IDRC · CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

Ministry of Foreign Affairs of the Netherlands

CDKN Climate & Development Knowledge Network

Planning for Climate Resilience in Bangladesh

A TRAINING MANUAL FOR LOCAL GOVERNMENTS

Photo by Niloy Biswas on Unsplash

SOUTH SOUTH NORTH

ICLEI Local Governments for Sustainability SOUTH ASIA

futuro latinoamericano
diálogo, capacidades y desarrollo sostenible

ODI

Contents

Introduction 5

Objective of the Training Programme 5

Modules in the Training Manual 6

Target Groups/Audience 6

Module 1: Introduction to Climate Resilience 8

Key Concepts 8

The Greenhouse Effect 8
Weather and Climate 9
Climate Variability 9
Climate Change 9
Hazard, Risk and Disaster 10
Climate Mitigation 11
Climate Adaptation 12
Disaster Risk Reduction 13
Climate Resilience 13
What is a Resilient City/Town/Village? 14

Climate Change in the Context of Cities 14

Cities as Drivers of Climate Change 14
Impacts of Climate Change on Urban and Rural Municipalities 15

Vulnerability 16

Global Agreements on Climate Change and Disaster Risk Reduction 18

The Paris Agreement 18
The 2030 Agenda for Sustainable Development 18
The Sendai Framework for Disaster Risk Reduction (2015-2030) 19
Bangladesh's National Policies on Climate Change 19

Module 2 (a): Engagement Process 21

Formulation of a Climate Core Team 21

Stakeholder Group 22

Communications Plan 26

Module 2 (b): Baseline Assessment with a Climate Lens . 27

Preparation of City/Village Profile 27

GHG Emission Inventory 27

Infrastructure and Socio-ecological System Analysis 30

Module 2 (c): Climate Risk and Vulnerability Assessment 36

Climate Change Trends, Projections and Scenarios 36

Climate Impact on Fragile Infrastructure and Socio-ecological Systems 39

Risk Analysis and Vulnerability Assessment 40

Vulnerability Assessment and Preparation of Vulnerability Maps 42

Identification of Actors and their Adaptive Capacity Assessment 45

Assessing Resilience Capacity of Infrastructure and Socio-ecological Systems 48

Module 3: Development of Climate Resilience Strategy ... 52

Identification of Interventions 52

Prioritisation of Interventions 54

Integration into the Municipality Plan 58

Module 4: Monitoring and Evaluation 59

Reporting 62

Module 5: Financing Climate Resilience Initiatives 63

Sources of Finance for Climate Resilience Initiatives 63

Various Platforms and Tools for Financing 65

List of Tables

Table 1: Members of the Climate Core Team – Example (based on CRCAP Toolkit) 21
Table 2: Identification of Stakeholder Groups (based on CRCAP Toolkit) 23
Table 3: Indicative Checklist of Core and Secondary Socio-ecological Systems (Adapted from ISET, 2011) 31
Table 4: Identifying Fragile Systems as per the CRCAP Methodology of ICLEI South Asia 33
Table 5: Climate Data Collection and Preparation of Scenario Statement as per the ICLEI ACCCRN Process 37
Table 6: Climate Impacts on Fragile Urban Systems or Socio-ecological Systems 39
Table 7: Likelihood Rating and Scoring as per the ICLEI ACCCRN Process 40
Table 8: Consequence Rating and Scoring as per the ICLEI ACCCRN Process 41
Table 9: Prioritisation of Climate Risks as per the ICLEI ACCCRN Process 41
Table 10: Summary of a Risk Matrix as per the ICLEI ACCCRN Process 42
Table 11: Actors' Capacities Rating and Scoring as per the ICLEI ACCCRN Process 45
Table 12: Levels of Adaptive Capacity of Actors as per the ICLEI ACCCRN Process 46
Table 13: Summary of Adaptive Capacity as per the ICLEI ACCCRN Process 47
Table 14: Reference Table for Compiling Information about the Resilience Capacity of the Fragile Urban Systems as per the ICLEI ACCCRN Process 49
Table 15: Climate Resilience Capacity of the Fragile Urban System - Example 51
Table 16: Identifying Resilience Interventions – Example and Work Exercise as per the ICLEI ACCCRN Process 53

Table 17: Prioritisation of Resilience Intervention – Example and Work Exercise 56
Table 18: Feasibility and Impact – Example and Exercise as per the CRCAP Methodology 57
Table 19: Linking Resilience Interventions to Ongoing Programmes – Example and Exercise 58
Table 20: Monitoring and Evaluation Framework and Working Exercise 61

List of Figures

Figure 1: Course Content and Methodology 7
Figure 2: The Greenhouse Effect 8
Figure 3: Weather and Climate 9
Figure 4: Schematic of the Interaction among the Physical Climate System, Exposure, and Vulnerability Producing Risk 11
Figure 5: Hazard and Disaster 11
Figure 6: Climate Mitigation Actions 12
Figure 7: Climate Adaptation 12
Figure 8: Building Climate Resilience (Source: ICLEI Canada) 13
Figure 9: Municipalities as Drivers of Climate Change 14
Figure 10: Climate Change Impact in Cities 16
Figure 11: Integrating Social Inclusion in Resilience Planning (adapted from CDKN Gender Toolkit) 17
Figure 12: Stakeholder Group Members 22
Figure 13: Community-scale GHG Emissions Inventory in City/Village 30
Figure 14: Vulnerability Hotspot Map for Mongla City in Bangladesh 44
Figure 15: Process of Monitoring of Implementation of Resilience Intervention 60

Introduction

Climate change-induced hazards, such as rising temperature, uncertain rainfall, sea-level rise, heat stress and floods are imposing significant stresses, leading to disruption of infrastructure and other socio-ecological systems in urban and rural areas. Bangladesh is highly vulnerable to climate change due to its low elevation and high population density. Moreover, improper planning, inadequate adaptive capacity, and insufficient preparedness of the coastal regions result in loss and damage to infrastructure as well as human lives. However, there is a growing awareness among national and local governments in Bangladesh about the need to initiate actions to build socially inclusive climate resilience at the local level. This is facilitated by the development of a climate resilience action plan that promotes collective action.

In this context, ICLEI - Local Governments for Sustainability, South Asia – the Asia Coordinator for the Climate& Development Knowledge Network (CDKN) –has developed a training manual under the CDKN's Knowledge Accelerator Programmeto assist local authorities, decision-makers and practitioners in preparing a gender-responsive climate-resilient strategy that can address climate mitigation and adaptation aspects.

The process followed in the training manual for developing a climate resilience strategy is based on ICLEI South Asia's Climate Resilient Cities Action Plan (CRCAP) Methodology. The CRCAP tool has been developed as a part of the CapaCITIES project, funded by the Swiss Agency for Development and Cooperation (SDC). It is tailored for local governments depending on a number of factors and provides step-by-step guidance for preparing an action plan on climate resilience. The action plan tries to address both climate change mitigation and adaptation, and the linkages therein while building resilience. The development of the CRCAP tool has been influenced by three key ICLEI toolkits/ programmes: the Asian Cities Climate Change Resilience Network (ACCCRN) Process toolkit, designed for preparing climate adaptation action plans; Cities for Climate Protection Campaign; and the Green Climate Cities Program.

Objective of the Training Programme

The training programme through the modules outlined in the manual aims to:

- Increase awareness on the need to develop local climate resilience strategy for local governments of Bangladesh
- Enable local authorities to identify and engage with relevant stakeholders for collaborative planning and decision making
- Enhance the capacities of local authorities, decision-makers, and practitioners to plan and implement mitigation and adaptation measures
- Assist local authorities in developing a robust monitoring and evaluation system to implement the measures and actions.
- Provide a glimpse of various financing opportunities available to local authorities for the implementation of resilience interventions.

Modules in the Training Manual

The training manual is divided into separate modules. The different modules are:

- **Module 1 – Introduction to Climate Resilience**: It introduces commonly used terms in climate change planning, the cause and effect of climate change with specific regard to local governments, and the need for developing local level climate resilience strategies. It also gives a brief introduction to different global agreements on climate and disaster risk reduction.
- **Module 2 (a) – Engagement Process:** It helps local authorities map out the stakeholders in the region, to engage and consult with them effectively and to collaboratively develop a climate resilience strategy. It outlines the benefits of engaging with different stakeholders for climate planning.
- **Module 2 (b) – Baseline Assessment with a Climate Lens:**It outlines the need for and the means of conducting a baseline assessment of the existing scenario in the municipalities, with respect to infrastructure, socio-economic conditions, climate and emissions.It also assesses ecosystem services of the area that can be impacted by climate change.
- **Module 2 (c) – Climate Risk and Vulnerability Assessment:**It provides a simple method of conducting a risk and vulnerability assessment at the local level, with minimal external assistance. It will help local authorities identify the most vulnerable areas/sectors and populations/stakeholders.
- **Module 3 – Development of Climate Resilience Strategy:**It will help the participants bring the information generated in the previous steps together and consolidate it to develop a resilience strategy with interventions for climate mitigation and adaptation, and a plan to implement them.
- **Module 4 – Monitoring and Evaluation:**It outlines the method of monitoring and evaluating the implementation of the resilience strategy developed by the local government.
- **Module 5 – Financing Climate Resilience Initiatives:**It provides information on the available financial sources or tools to support the implementation of climate resilience actions locally.

Target Groups/Audience

The training programme is developed especially for the following target groups:

(i) Senior to mid-level municipal officials, such as environmental engineers, health officers and urban planners from local authorities
(ii) Elected representatives and executives/professionals from local bodies/other government agencies
(iii) Practitioners and other decision-makers involved in climate resilience planning

The figure below shows the resilience planning methodology outlined through the modules in the training manual.

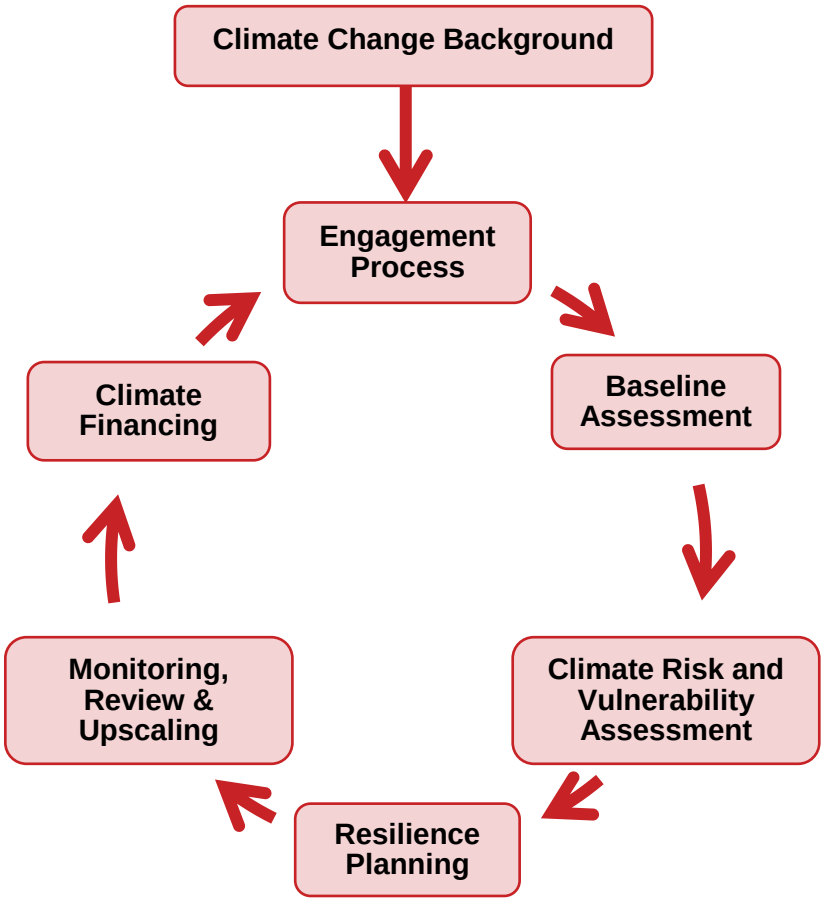


Figure 1: Course Content and Methodology

Module1: Introduction to Climate Resilience

Learning Objectives: This module outlines some of the key terminologies/concepts related to climate resilience that will be repeatedly used in the training programme. It gives an introduction to commonly used terms in climate change planning, the cause and effect of climate change with specific regard to local governments, and the need for developing local level climate resilience strategies. It also briefly introduces different global agreements on climate and disaster risk reduction.

Key Concepts

The Greenhouse Effect

When solar energy reaches the earth, some of it is absorbed by the atmosphere, oceans and land, and the remaining is radiated back into space. A greenhouse effect is created when the absorbed energy is converted into heat just like in a glass greenhouse, thus heating up the earth and its atmosphere.

The Greenhouse Gases (GHGs) largely responsible for the absorption of sun's energy and heating up the earth include water vapour, carbondioxide (CO_2), hydrofluorocarbon (HFC), perfluorocarbon(PFC),sulphurhexafluoride (SF_6), methane(CH_4), and nitrousoxide (N_2O)[1].

This is a natural process, important for the sustenance of life on the planet.However, anthropogenic activities such as the burning of fossil fuels, deforestation and waste generation producelarge quantities of GHGs that are released into the atmosphere. This is leading to an unprecedented rise in the average atmospheric temperature, causing global warming.

Figure 2: The Greenhouse Effect

Weather and Climate

Weather refers to short-term local atmospheric conditions, generally measured on the scale of hours, days and months[2]. Weather can change drastically in a shortperiod, due to sudden rainfall, windy days, or a rainy month.

Climate is the long-term average weather in a particular area, typically across decades, and can be assessed for a single location or a large area. For example, Bangladesh has a tropical monsoon climate.

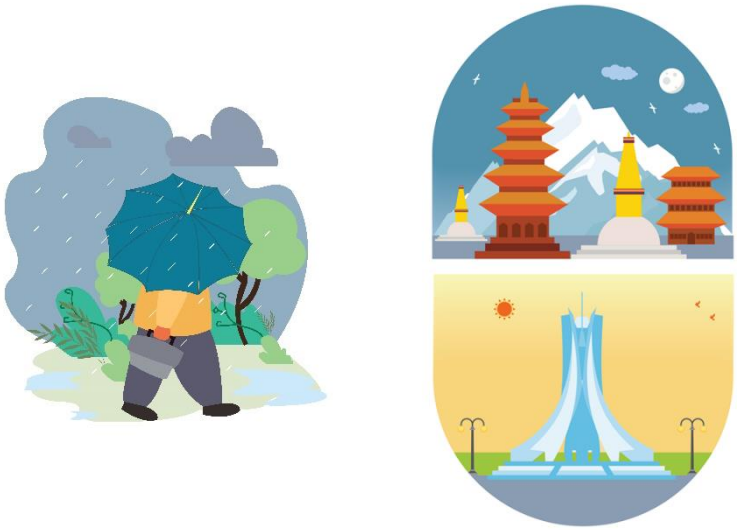


Figure 3: Weather and Climate

Climate Variability

Climate can show short-term seasonal fluctuations every year. For example, the summer temperatures of a region in a particular year can be above or below the average temperature of the region, or the monsoon rainfall can fluctuate from year to year.

Climate variability can be caused by natural processes, changes in climatic factors or by anthropogenic (human) activities.

Climate Change

When there is a significant change in weather conditions for a long period of time, typically decades or longer, it is called climate change. Natural phenomena such as volcanic activities, the EL Nino climate pattern, and changes in the Earth's orbit and the Sun's energy output can contribute to climate change. But anthropogenic activities such as the use of fossil fuels and deforestation can also significantly accelerate climate change.

According to the United Nations Framework Convention on Climate Change (UNFCCC 1999), Article 1, climate change is caused by direct or indirect human interventions/activities that

change “the composition of the global atmosphere, in addition to natural climate variability observed over comparable periods”[3].

Examples of climate change:

- **Increase in average temperature:**As per an IPCC Special Report released in 2018, in the decade 2006–2015, human-induced global warming had raised temperatures 0.87°C (±0.12°C) above pre-industrial (1850-1900) levels, and approximately 1°C by 2017. If the current warming rate continues, this number would reach 1.5°C around 2040”[4].
- **Sea level rise**: As per IPCC’s Special Report on the Ocean and Cryosphere in Changing Climate (SROCC),the global mean sea level will rise between 0.95 feet (0.29m) and 3.61 feet (1.1m) by the end of this century[5].

Hazard, Risk and Disaster

Hazard, risk and disaster are defined as follows by the IPCC’s fifth assessment report[6]:

Hazard: “Potential occurrence of a natural or human induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss of property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources”.

Risk: “The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as the probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard”.

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”.

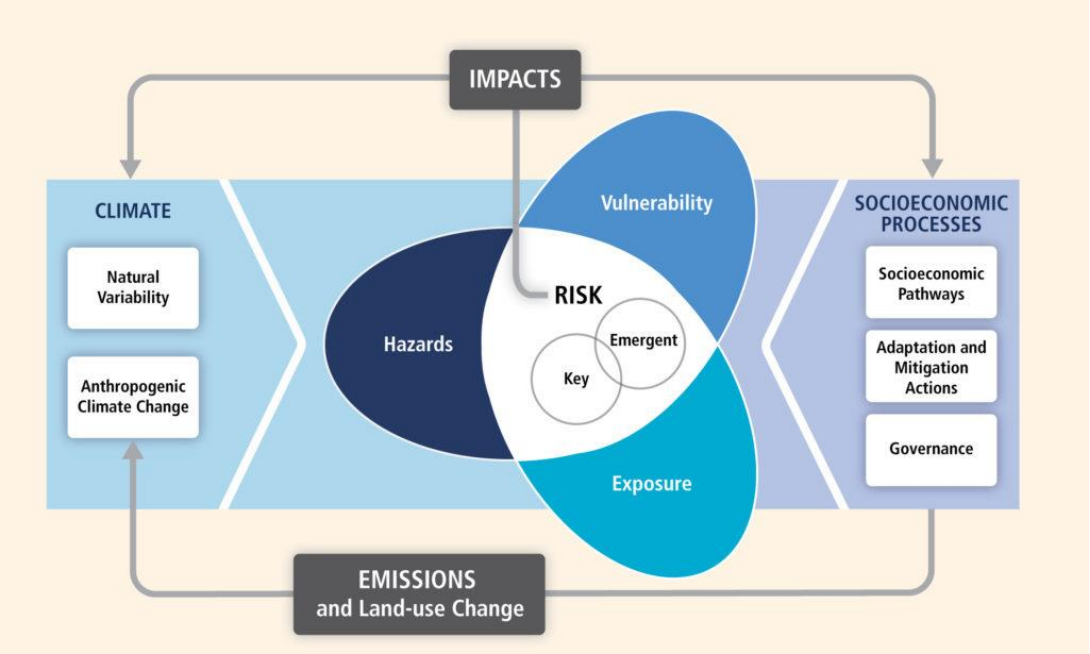


Figure 4: Schematic of the Interaction among the Physical Climate System, Exposure, and Vulnerability Producing Risk[7]

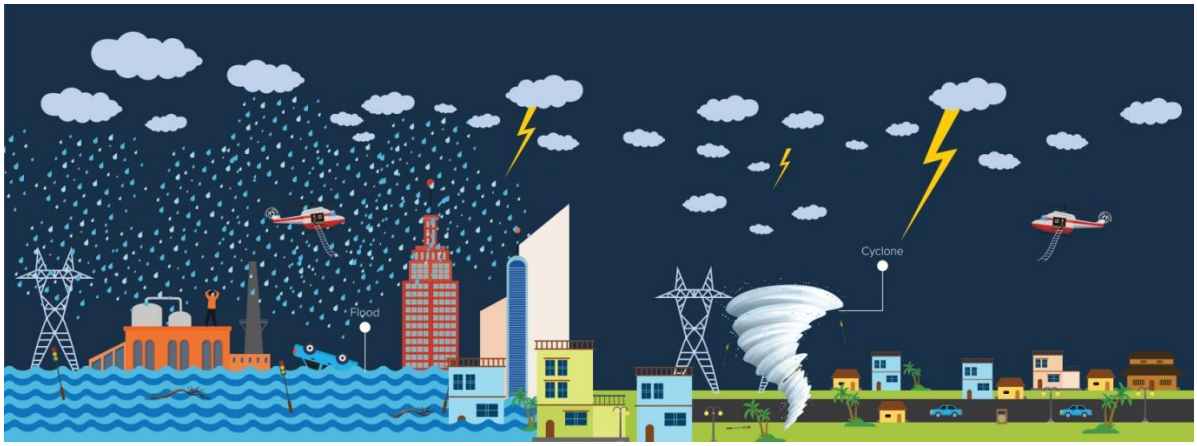


Figure 5: Hazard and Disaster

Climate Mitigation

Climate mitigation means the reduction of GHGemissions and their sources or the removal of carbon and GHG from the atmosphere by increasing their sinks, primarily by inceasing the green cover. It can be achieved by using new low-emission technologies and renewable energy, and changing management practices or consumer behaviour[8]. For example, an increase in green cover - carbon sinks - in a municipality can assist in carbon sequestration, whereas using non-fossil fuel energy sources (such as solar power) instead of fossil fuels – carbon sources - can reduce the emission of GHGs.

Figure 6: Climate Mitigation Actions

Climate Adaptation

Climate Adaptation means altering the natural or human systems in response to current oranticipatedclimatic change or itsimpact. Adaptationhelps to reduce adverse impacts or expand opportunities that are beneficial, such as building the capacity of communities and systems to cope with the effects of climate change[9].

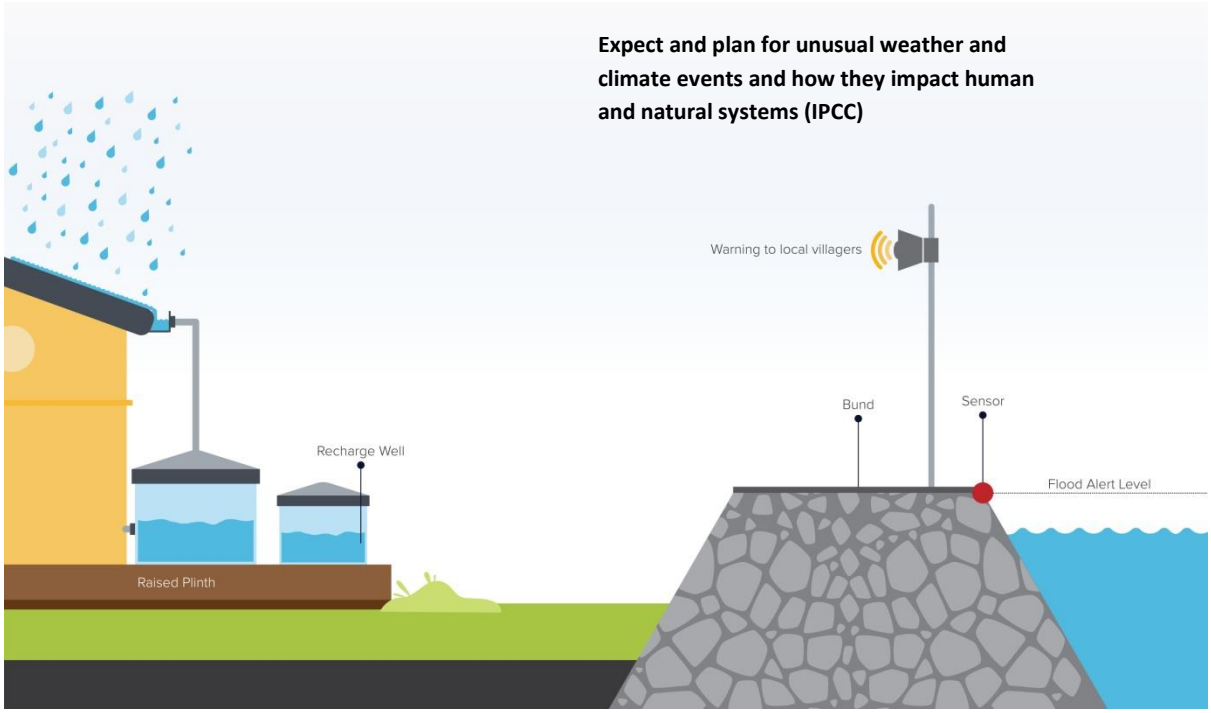


Figure 7: Climate Adaptation

Disaster Risk Reduction

Disaster risk reduction refers to aset of strategies to reduce risks and vulnerabilityto disasters, and prevent or restrict adverse impacts of climatic hazards within the broad context of sustainable developmentin a society, avoid (prevention) or limit (mitigation and preparedness) the adverse impact of hazards within the broad context of sustainable development.

Maladaptation

Maladaptation is when adaptation activities focusing on one sector or group of stakeholders inadvertently increase the vulnerability of another sector or group of stakeholders. For example, building a sea wall to avoid cyclonic flooding can provide a false sense of security and encourage people to build in the high risk areas, in turn increasing the risk. Embankments along rivers to prevent flooding can be maladaptive if the river shifts course.

Climate Resilience

Climate resilience is the ability “to anticipate, prevent, absorb and recover from shocks and stresses, in particular those brought about by rapid environmental, technological, social and demographic change, and to improve essential basic response structures and functions”(ICLEI Montréal Commitment and Strategic Vision). Climate resilience, discussed in detail in the training programme, is a combination of climate mitigation and climate adaptation interventions.

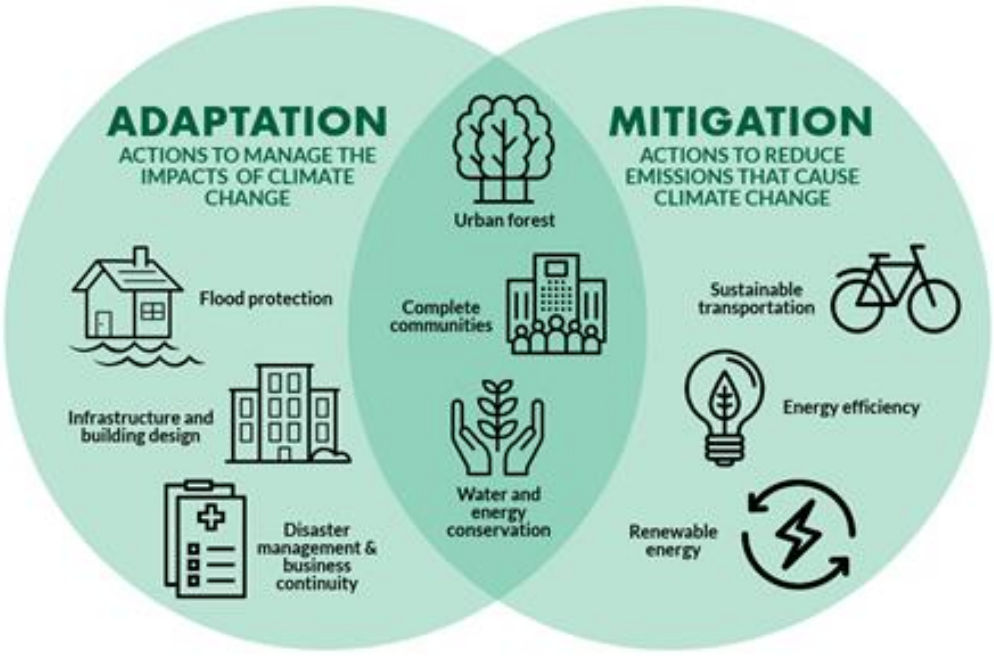


Figure 8: Building Climate Resilience (Source: ICLEI Canada)

What is a Resilient City/Town/Village?

- A city, town or village, which has the potential to reduce or minimise the impacts of changing climate on its population/ infrastructure and economy, develops the capacity to absorb future stresses and shocks, and become resilient[10].
- The resilient city/ town utilisesavailable information on past and future climate trends to prepare and implement interventions to reduce the vulnerability of the population and their systems.
- The resilient city/ town takes measures to adapt to climate change, prepare and respond to disasters, and toreduce GHG emissions.
- The resilient city/ town empowers its community to engage, discuss and plan in conjunction with local authorities, and values local and indigenous knowledge, capacities and resources.
- To become climate-resilient, the local authorities in cities, towns and villages need to strategise, choose and act on the right policies and decisions[11].

Climate Change in the Context of Cities

Cities as Drivers of Climate Change

On a global scale, cities occupy approximately 3% of the area, househalf of the population, consume about 75% of the energy resources and are responsible for 80% of the emissions[12].

According to World Bank[13], 55% of the global human population, i.e. 4.2 billion, lives in cities. This means that nearly sevenout of 10 people in the world live in cities[14]. Urbanisation leads to increased demand for housing and other urban services. Changes in the land-use pattern can exacerbate climate change impacts in cities. Uncontrolled construction and urbanisation cause deforestation, biodiversity loss and disruption in regulation of services, besides increased demand for energy and fossil fuels, which results in greater GHG emissions. Overconsumption of natural resources can lead to resource scarcity and pollution.

Urban municipalities can thus have a significant roleas drivers of climate change and also provide opportunities to mitigateits impact and adapt to it.

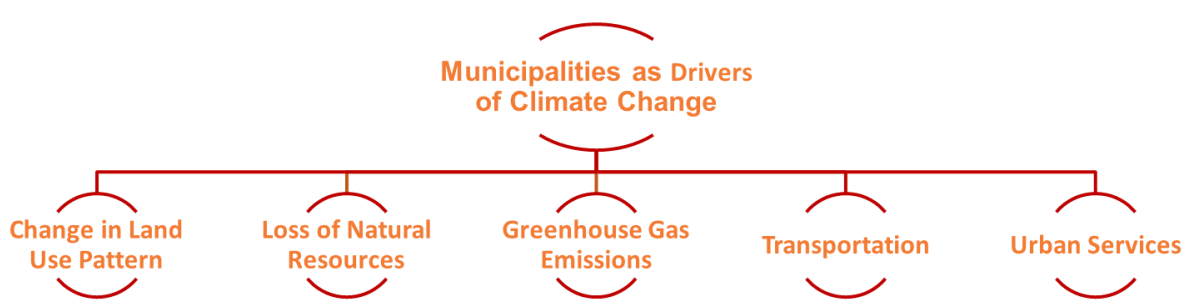


Figure 9: Municipalitiesas Drivers of Climate Change

Urban heat Island effect - Urban areas that havea dense concentration of infrastructure and limited greenery experience temperatures that are higher than their surrounding areas. Concrete structures like buildings, roads, bridges and flyovers absorb more solar heat than natural elements such as forests and water bodies. This elevated temperature in urban areas, as compared to other areas, is referred to as the urban heat island effect (EPA 2016).

Ecosystem services - The natural environment contributes to human well-being directly and indirectly, through services that impact our survival and quality of life.The four types of ecosystem services are provision, regulatory, cultural and supporting services (Earth.org).

UN has estimated that cities are responsible for 75% of global CO_2 emissions, with the transport and building sectors being among the largest contributors (Cities and Climate Change, n.d)[15].

Impacts of Climate Change on Urban and Rural Municipalities

Urban and rural municipalities of Bangladesh are vulnerable to climate change due to very high population density. Some of the major impacts of climate change felt in localities in this region are as follows:

- Risingtemperaturesy can result in heat stress and drought-like conditions, impacting health, water services, agriculture and food security in both rural and urban municipalities.
- Changes in precipitation or sudden intense rainfall can cause flooding and impact infrastructure and agriculture.
- Greater dependence on agriculture and natural resources makes rural areas highly sensitive to climate variability and climate change. Impacts on agriculture and infrastructure can result in severe impacts on food security, livelihoods, value of land, human lives, and economy.
- Climate change is considered one of the factors for rural to urban migration.
- Increase in temperature can create suitable conditions for the growth and spread of vector-borne diseases.
- Climate change can increase the intensity and frequency of cyclones that can damage infrastructure and cause loss of lives and livelihoods.

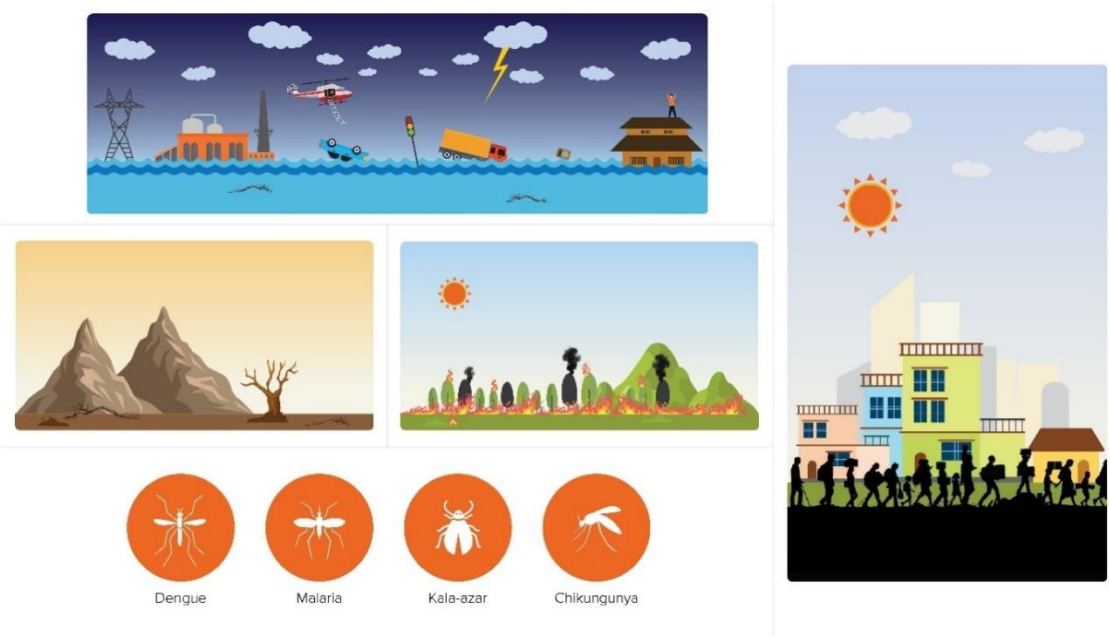
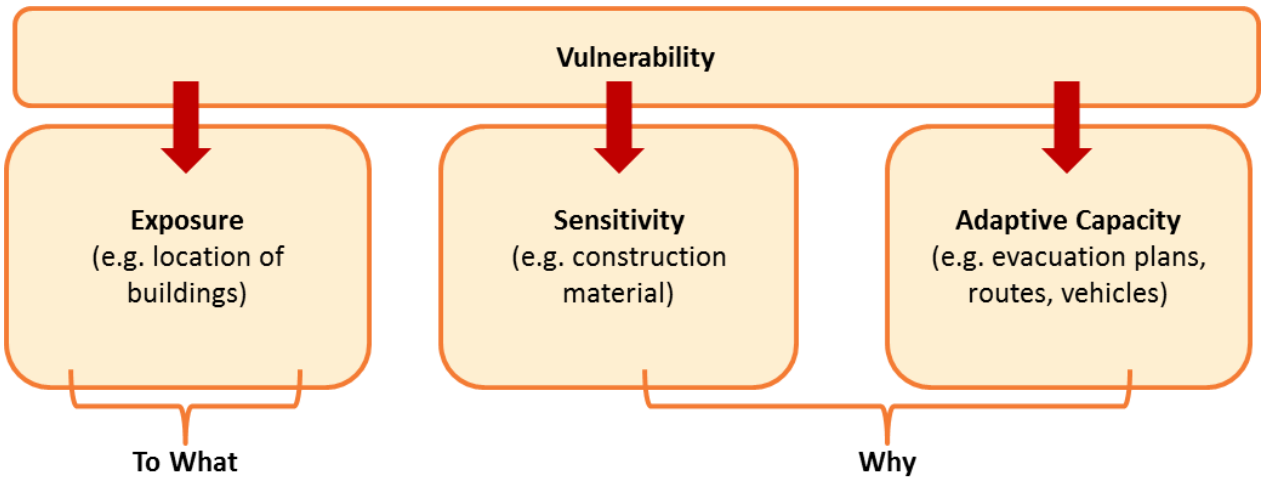


Figure 10:Climate Change Impact in Cities

Vulnerability

According to IPCC's fifth assessment report (2018), vulnerability is defined as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. A broad set of factors such as wealth, social status, and gender determine vulnerability and exposure to climate-related risk[16]".Vulnerability can be identified based on the sensitivity and adaptive capacity of the system, community, and human beings.



As per the ICLEI ACCCRN Process, vulnerability is assessed in terms of who or what is vulnerable to what and why.

Who/What: Population groups, zones/wards, and sectors (e.g. infrastructure for water supply and solid waste management)

To What: Impacts of climatic threats (e.g. water scarcity and spread of vector-borne diseases)

Why: Capacities and resources to deal with the impact of climatic hazards

For example, people in north-western Bangladesh are vulnerable to rising temperatures while those in coastal Bangladesh are more vulnerable to sea-level rise and cyclones.

Individual characteristics determine the climate vulnerability of people and may have a bearing on how exposed to climate hazards they would be. When local governments want to plan for resilience, they should look at resilient options that promote equality, equity and inclusive participation, which are decided by the differential impacts of climate change felt by different groups of populations.

Equality: Different behaviours, aspirations, and needs of women and men(and different social groups) are considered, valued and favoured equally.

Equity: Women and men (and different social groups) are treated fairly, according to their respective needs. This may include treatment that is different but considered equivalent concerning rights, benefits, obligations, and opportunities.

Equity is the process; equality is the goal.

Inclusive Participation: Participation is a way for women and men of all ages, backgrounds, and identities to voice their opinions, concerns and experiences resulting in meaningful action. Giving space to everyone for identifying problems and finding solutions ensures everyone shares equal power, respect and protection in the planning process.

A simple methodology of integrating social aspects into climate resilience planning is shown in the figure below:

Figure 11: Integrating Social Inclusion in Resilience Planning (adapted from CDKN Gender Toolkit)

Global Agreements on Climate Change and Disaster Risk Reduction

The Paris Agreement

The Paris Agreement is a treaty within the UNFCCC that aims to limit global warming to well below 2°C, as compared to pre-industrial levels, and to take efforts to curb the increase to 1.5°C. The agreement was signed by 196 parties at COP 21 in Paris in 2015 and was enforcedin 2016.As of January 2021, 190 parties have ratified the Paris Agreement.

The treatyprovides a framework for climate actions that includes mitigation of and adaptation to climate change, transparent reporting and strengthening of climate goals, andprovides a pathway for developed nations to extend financial assistance to developing nations. Every five years, countries submit their climate action plans, known as nationally determined contributions (NDCs), wherethey communicate the actions to be taken to bring down GHG emissions and build resilience.

The role of non-party stakeholders, such as cities and subnational governments, in addressing climate change by taking actions to cut emissions, strengthen resilience and reduce vulnerability,is also recognised in the Paris Agreement. To achieve the Sustainable Development Goals, it is important to implement the Agreement as it provides a guideline for taking actions to cut emissions and improve climate resilience.

The 2030 Agenda for Sustainable Development

The UN General Assembly adopted the Agenda 2030 for Sustainable Development - including the 17 Sustainable Development Goals (SDGs) and 169 targets – in September 2015, with an aim to streamline developmental actions for the achievement of human well-being, while leaving no one behind. The 17 SDGs are universal goals that cover the social, economic and ecological aspects of development, and are applicable to all nations, irrespective of their economic status. They are also interconnected and require to be dealt with in a comprehensive, inclusive and participatory manner.

The SDGs encompass all key sectors in the three dimensions of social justice, economic prosperity and environment protection, such as education, health, sanitation, employment, infrastructure, energy, and the environment with time-bound targets to achieve them. The Goals recognise that poverty must be eliminated in sync with plans that boost economic growth and address the challenges in the sectors of education, health, social protection and job opportunities, as well as climate change and environmental protection.

The two SDGs that relate directly to climate resilience include:

- Goal 11, which promotes actions to develop urban centres and communities that are safe, inclusive, sustainable and resilient, and
- Goal 13, which promotes necessary actions to tackle the impacts of climate change.

In addition, there are several other SDGs – such as those on health, education, gender, water, sanitation, ecosystems, that are also very relevant to local governments and their role in basic service provision.

The Sendai Framework for Disaster Risk Reduction (2015-2030)[17]

The Sendai Framework for Disaster Risk Reduction was adopted at the 3rd United Nations World Conference on Disaster Risk Reduction in 2015, in Sendai, Miyagi, Japan.

It is a 15-year, voluntary, non-binding agreement with the goal to prevent and reduce the risks of disastersby implementing integrated and inclusive socio- economic, cultural, health, educational, structural, political, environmental, technological, legal and institutional measures that prevent and reduce vulnerability to disasters andexposure to hazards, and improve preparedness for response and recovery.

The framework also states that while it is the State that has the key role to cut disaster risks, other stakeholders such as local governments and the private sector must also bear responsibility.

In addition to seven targets, the Sendai Framework outlines four priorities for actions to prevent new and reduce existing disaster risks, and these are:

i. understanding disaster risk;
ii. strengthening disaster risk governance to manage disaster risk;
iii. investing in disaster reduction for resilience and;
iv. enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

The aim is to reduce substantially disaster risks and losses in livelihoods and lives and in the physical, environmental, socio- economic and cultural assets of people, communities, businesses and countries.

The Sendai Framework also recognises clearly the role of local authorities to develop disaster risk reduction plans and to take initiatives to reduce and alleviate the impacts of all natural and man-made induced disasters.

Bangladesh's National Policies on Climate Change

Bangladesh has responded to climate risks through a number of policies, programmes and institutional initiatives, including preparing the National Adaptation Programme of Action (NAPA) in 2005 and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2009 (currently under revision), establishing the Climate Change Unit, creating the Climate Trust Fund, and designating high-level committees with specific functions to facilitate adaptation actions.

The adaptation priorities from NAPA were embedded in the BCCSAP in 2009. The BCCSAP includes 44 immediate, short-, medium- and long-term programmes for both climate adaptation and low-carbon development based on six pillars:

1. Food security, social protection and health
2. Comprehensive disaster management
3. Infrastructure
4. Research and knowledge management
5. Mitigation and low-carbon development
6. Capacity building and institutional strengthening

Bangladesh signed the Paris Agreement in 2015. In its NDC submitted in 2016, Bangladesh focuses on both climate change mitigation through developing a resilient low-carbon economy and climate change adaptation through building resilience against the negative impacts of food insecurity, erratic rainfall, drought, extreme temperature, sea-level rise, ocean acidification and salinity intrusion. In its NDC, Bangladesh pledged:

- an unconditional 5% reduction in GHG emissions from the 2011 level by 2030[18] in the power, transport and industry sectors, and
- a conditional 15% reduction in GHG emissions by 2030[19] in the power, transport and industry sectors, depending on international support through investments, financing, capacity building, and technology transfer.

The NDC also identifies 14 adaptation priorities for the country. Bangladesh has prepared a roadmap towards formulating a comprehensive National Adaptation Plan (NAP), with a focus on investing in long-term adaptation and enhancing national capacity for integrating climate change adaptation in planning, budgeting and financial monitoring.

The Government of Bangladesh (GoB) has formulated the Bangladesh Delta Plan 2100 (BDP 2100) which is a strategic and comprehensive planning document covering 50-100 years and identifies sectors for investments to reduce climate risks and environmental losses in the delta region. The current investment plan for BDP 2100 consists of 65 infrastructure projects and 15 institutional and knowledge-development projects in six hotspots countrywide for the next 10 years.

The Bangladesh Country Investment Plan for Environment, Forests and Climate Change (CIP-EFCC 2016-2021)[20] is a five-year framework for planning and coordination of national and international investments for environment, forestry and climate change sectors in the country. It aims to increase the contribution of the EFCC sectors to the country's sustainable development, help reduce poverty, improve environmental and human health, and increase resilience to climate change.

Module 2(a): Engagement Process

Learning Objectives: The key learning objective of Module 2(a) is to understand the stakeholder landscape for climate resilience planning and the different ways to engage them. The section helps understand the need for stakeholder engagement and provides means of engaging with them systematically.

The engagement process provides an opportunity to bring all relevant stakeholders on the same platform for the development of an inclusive and collaborative resilience strategy to build climate resilience in a municipality. Climate change is a cross-sectoral issue. Therefore, identifying stakeholders (both internal and external to the local body administration) and regularly coordinating with them are key steps for local authorities to be able to engage with them.

Formulation of a Climate Core Team

Engaging stakeholders from different departments of local body operations, with different vantage points and areas of expertise is an important early step.

- The Climate Core Team may consist of representatives from various departments with responsibility for, or who have an impact on, development planning, energy use, pollution, waste, food security, water security, agriculuture, public health, local economic development, infrastructure, and transportation.

  In order to ensure equal space and resources for women in climate change decision making, the Climate Core Team must have equal representation (preferably 50%) of women. It is critical to recruita gender expert to the team to ensure that gender is integrated into data collection, workshop processes and final implementation.

- The Climate Core Team will appoint a project nodal officer to be the focal point for the process. The Core Team members with their position and responsibilities should be listed clearly and updated as and when necessary.

Table 1: Members of the Climate Core Team –Example(based on CRCAP Toolkit)

Name	Position	Responsibility
Ms. W	Chairperson	Supervising the working of the Core Team and providing management support
Mr. X	Project Nodal Officer	Coordinating the activities of the Core Team and ensuring its smooth functioning
Ms.Y	Member	Coordinating activities with the Water Resources department
Mr. Z	Member	Coordinating activities with the Forest department

Stakeholder Group

It is difficult to prepare a comprehensive, practical, unbiased, and data-driven climate resilient strategy without the involvement of stakeholders. Representatives from different sectors/communities help with thelatest data and by highlighting challenges related to their sectors in the discussion**.**

Stakeholders involved indifferent sectors and issues that need to be considered when developing a climate resilience strategy (energy use, pollution, waste, food security, water security, public health, local economic development, infrastructure, transportation, and development planning) should be invited. Stakeholders may be individuals, government agencies, NGOs, research institutions, private sector and community leaders, among others. They are to be identified on the basis of their sphere of influence.

For a comprehensive understanding of climate vulnerability, risk and adaptive capacity of all municipality dwellers,stakeholder consultations should include equal number of men and women. Preferably, separate consultations should be held with men's groups and women's groups to ensure women can voice their opinion and experiences in the consultation process.

The stakeholder group should be representative of a varied set of interests and groups in the municipality. The core team must ensure representation of women and men from different social, cultural, and economic backgrounds including women'sorganisations to ensure inclusivity.

Figure 12: Stakeholder Group Members

Developing the following table while identifying the stakeholder group in a municipality will help ensure that the identified stakeholders are not a homogenous group but represent different socioeconomic and cultural backgrounds.

Table 2: Identification of Stakeholder Groups(based on CRCAP Toolkit)

Category/Sectors	**Government (local, national)**	**Local NGOs**	**Research Institutions**	**Community Representatives**	**Private Sector**	**National and International Funding Agencies**
Can potentially provide information contributing to development of resilience strategy						
Can be involved in the implementation of resilience strategy						
Their support will be essential to implement resilience strategy						
They are most affected by the implementation of resilience strategy actions developed						

Although climate change and urbanization affect everyone, the vulnerability to climate change and the ability to deal with or adapt to the impacts of climate change varies between and among women and men of different social groups. Globally, women are disproportionally vulnerable to the impacts of climate change due to their socially constructed roles and responsibilities and relatively poor economic and social positions (IPCC, 2007). The livelihood of Bangladeshi women in rural areasisdependent on natural resources that are threatened by climate change. Women in urban areas in Bangladesh lack resources and opportunities, and climate change-related hazards worsen their situation. There are significant differences in adaptive capacity among men and women from various urban and rural communities depending economic and social status. In addition, different communities and stakeholders differ in voice and power so that everyone's priorities may not be recognised in local

development planning processes. Inequality in rights, resources and voice, unequal legal status, property rights, access to education and literacy, access to health, and access to assets all contribute to the differences in the impacts felt due to climate change on different communities and stakeholders.

Women form one of the vulnerable groups that need to be integrated into the resilience strategy development to reduce the overall vulnerability of amunicipality. They feel the impacts of climate change very differently thanmen for a number of reasons, including gendered roles and responsibilities in households and communities and gender-based differences in economic opportunity. Causes and consequences of climate change are deeply intertwined with patterns of inequality which is a multiplier of existing vulnerabilities. Women's role as primary caregivers of their families andconservatorsof biodiversity and natural resource management gives them enough experience and local knowledge which can be leveraged for climate adaptation and resource management strategies. Hence, despite their vulnerability, women can play an important role in leading the fight against climate change.

The key to ensuring equity and participation in climate change planning is to understand the differentiated impacts of climate change in a community and make sure all voices are heard at every step of the planning process so that everyone wouldbenefit equally. The first step to achieving this is to understand the key concepts of gender and differences between 'sex-related roles' and 'gender-related roles'. Concepts of gender and social inclusion can help frame our work on vulnerability and make us more alert to the types of challenges people face, and be more sensitive to the range of perspectives that shape people's experiences.

Sex	Gender
• The term sex refers to biological characteristics, namely chromosomes, internal and external sex organs, and hormonal activities within the body. • The sex of an individual is based on genetics, making it much more difficult to change.	• Gender denotes the social and cultural role of each sex within a given society. • People often develop their gender roles in response to their environment, including family interactions, the media, peers, and education. It refers to learned behaviour that determines the specific roles, responsibilities, attributes, activities, behaviour expectations and even appearance of being male or female. Gender identity determines how we are perceived, how we are expected to think and act as a woman and man. Gendered identities are influenced by class, caste, culture, religion, place as well as family dynamics. As a result, gender can be a sensitive, complex issue, and it is important to understand how that affects the climate vulnerability assessment process.

Differences in gender roles and identities determine the access and control over important resources like economic resources. More often than not, these roles, responsibilities, and behaviour expectations provide better access and control over resources to men than women making the relationship between women and men unequal. Unequal access and control over resources results in the differential ability of women and men to respond to a crisis like disasters or climate change.

Climate change indicator	Impact of climate change	Impact on women	Impact on men
Increase in temperature	Extreme drought/heat stress leading to water scarcity among slum dwellers	Increased burden of collecting water for their family by spending several hours each day to line up for free water; allocating much of their income to buy clean water	Allocating extra resources for the purchase of water
	Heat wave leading to heat stress and increasing demand for electricity	Women-headed households may not have access to electricity or pay for increased prices.	Men working outside in the open are more prone to heat stress.
Increase in precipitation or sudden rainfall	Cyclones or flooding leading to destruction of livelihoods and homes	Living in temporary shelters causes concern for security and safety. Increase in domestic burden for women, such as clearing their homes andaccessing clean water. Women have to let go of professional work to look after the house and family.	Additional burden of repair of homes; loss of income opportunities and loss of jobs; migration

Women-led forums enhance livelihoods and reduce risks of climate hazards

Women in Bangladesh are more vulnerable to climate hazards than men. They are often left out of community decisions and their views are not incorporated into climate change adaptation planning or disaster-risk reduction activities. However, women-led forums play a vital role in escalating climate change adaptation of women and the community in general.

Different genders are affected in different ways during a disaster induced by climate change. In Bangladesh, men often migrate in search of work after a disaster, while women are left behind to care for the children and elderly, depending on activities such as home gardening, raising poultry and cattle and small-scale trading to earn an income.

The Christian Commission for Development in Bangladesh (CCDB) has been instrumental in forming many women-led forums in the country. Women from these forums have actively participated in Participatory Vulnerability Assessments (PVAs), adaptation planning and training in climate change and gender-sensitive adaptation. The 148-member Basundhara forum in Gopalganj district has been recognised as the best cooperative by GoB. It is registered as a cooperative and is a community business, recognised by the Women's Affairs Department of GoB. The forum, spearheaded by women, works on livelihoods, disaster risk reduction and social protection. The Gopalganj district is particularly prone to floods and cyclones that result in loss and damage for agriculture, infrastructure and fisheries.

Based on the vulnerability of households in the district, the CCDB has identified resilience indicators for forum members:

1. Education: Members' children are going to schools and colleges.
2. Health: Members have access to health centres.
3. Access to markets: Established Small and Medium Enterprise (SME) businesses have linkages to markets.
4. Social dignity in society and institutions, and a raised voice
5. Food security: Financial ability to access better quality food
6. Improved economic stability and capacity to quickly respond to disasters

Forum members use loans from the forum's fund to engage in income-generating activities like rearing of poultry, ducks and cattle, environment-friendly agriculture, fishing and tailoring.

The Basundhara Forum has been a catalyst in promoting women's livelihoods and reducing poverty. Mobilising women through cooperatives and enhancing their skills to generate their own incomes not only boosts their confidence, but can also increase their unity and cohesiveness. Women in the Basundhara Forum felt empowered to work with government officials and other organisations and to seek support for livelihood and disaster-risk reduction activities.

Communications Plan

Once the core team and stakeholder groups are set up, it is recommended to develop a communications plan to convey common messages about the vision and ambitions for climate resilient development, and to effectively communicate information about different stages to the stakeholders and get regularinputs from them.

Communication being a two-way process, when developing a communication plan, the focus should not be only on conveying messages to the stakeholders but also on consultative feedback to make sure that the planning process is responsive, transparent and accountable.

- It is important to understand that one is working with people with varying levels of education and understanding (from government officials to community members, slum dwellers to small business owners, children and elderly). The medium of communication (one to one verbal communication, or communication through print or visual media), as well as the language of communication, is as important as the message itself.
- It is important to convey **complex science** in easily understandable formats/language, and to not just inform about numbers and targets, but also about the impact on day to day life.

The Communications Plan may contain the following:

- Target audience
- Key messages and steps of communication
- Communication medium
- Resources and coordination
- Timeline

Module 2(b):Baseline Assessment with a Climate Lens

Learning Objective: Baseline assessment helps municipal officials to understand the existing situation in the municipality regarding GHG emissions, infrastructure and socio-economic conditions, and examine different socio-economic and infrastructure systems through a climate lens.

The climate core team with the support of stakeholder groups should collect baseline information to understand the existing situation of different socio-ecological systems and services. This is to identify the data already available to assist the climate change resilience analysis.

The baseline assessment of a city/village involves three overarching steps:

- Preparation of City/Village Profile
- Greenhouse Gas Inventory
- Infrastructure and Socio-ecological Systems Analysis

Preparation of City/Village Profile

The city/village profile includes a brief description of the nature of the area, its location with a map, and socio-economic and demographic details.

The profile should include the details of the local government body: area, number of wards, other agencies involved, the role of agencies and municipal corporation structure – administrative divisions, governance structure, and main responsibilities.

The profile should also briefly describe the service performance of all major urban systems or socio-ecological systems (water supply, sewerage, solid waste management, drainage, transportation, housing, health, electricity and energy). It should collate information related to ecosystem services provided by the ecosystem of the area and agriculture practices of the local community. Additional information, such as sex-disaggregated data for different sectors (including water, waste, and energy) can also be collected.

The profile will include the major initiatives undertaken on sustainability, energy, climate, resource management, and any major projects on water supply, sewerage, drainage, solid waste, transportation, public health and housing with details of activities, funding and beneficiaries.

GHG Emission Inventory

Carbon footprint or GHG inventory is the accounting of GHG emissions, resulting directly or indirectly from consumption of fossil fuels in various sectors such as fuel combustion for industrial or residential purposes, electricity use, transport, and degradation of municipal solid

waste. Developing the GHG emissions inventory is the first step in developing a plan to reduce energy use and GHG emissions. The inventory provides the necessary baseline data to understand current trends of energy consumption and GHG emissions across sectors and to identify priority sectors where mitigation actions are required to lower the overall GHG emissions from the city/village. The baseline GHG emissions inventory provides a basis to set targets, and assesses progress in achieving set mitigation targets.

Broadly, the preparation of GHG emissions inventory involves the following steps:

- The Global Protocol for Community-scale Greenhouse Emission (GPC) framework provides information regarding the type and amount of data to be collected for preparing a GHG emission inventory. Since the information has to be collected from different departments, the core team can request these departments for the information with a supporting letter from the head of administration.
- The nodal officer and core team can collect and collate the data for the GHG emission inventory based on the GPC framework. Rigorous follow up and consultation with the respective departments may be required to verify and collect accurate data and fill in missing data gaps.
- The data collected and collated can be used to develop the GHG emission inventory using different availablesoftwares. Harmonized Emissions Analysis Tool plus (HEAT+), developed by ICLEI, is one such software available at a nominal price to local governments interested in preparing their GHG emission inventories. HEAT plus contains numerous countries' emission factors and energy density values mapped already. Once all the collected data is populated into HEAT plus, the software automatically estimates the GHG emission inventory report. ICLEI South Asia provides in-depth training to local and sub-national authorities on accounting and reporting GHG emission using HEAT plus based on demand.

Calculating GHG Emissions

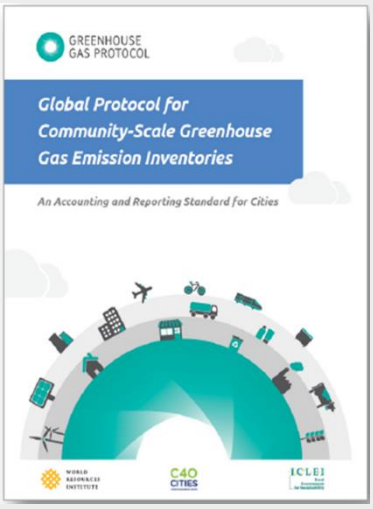
Box 2:GHG emissions are (relatively) simple to calculate:

Activity data x emissions factor = GHG emissions

- Activity data: Amount of energy used (e.g., litres of petrol used) OR amount of other GHG emissions generating activity (e.g. mass of solid waste sent to landfill)
- Emissions factor: Mass of GHG emitted per unit of activity data (E.g. kg of CO2 per litre of petrol used) OR (e.g. kg of CH4 per tonne of waste disposed in landfill)

The Global Protocol of Community-Scale GHG Emission Inventories

The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) provides globally accepted guidelines and methodologies to help local authorities quantify GHG emissions from activities taking place within the administrative boundaries of cities.



The GPC has the most exhaustive GHG accounting and reporting framework for cities. Local governments make use of this standard to: set emission reduction targets, respond to regulations and requirements of local GHG programmes, track performance and build and report GHG inventories in accordance with global standards. For more details:https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

The GPC aims to:

- Help cities to formulate a comprehensive and robust GHG inventory that supports**climate action planning**
- Ensure consistent and transparent measurement and reporting of GHG emissions between cities
- Empower cities to report their mitigation performance in **national or international frameworks**
- Showcase the important roles of cities in dealing with climate change, and promote insights through **benchmarking** and **aggregation** of **comparable data**

The Harmonized Emissions Analysis Tool plus (HEAT+)

The HEAT+ or the Harmonized Emissions Analysis Tool plus is a multilingual online emissions inventory tool, developed by ICLEI to help local authoritiescalculateemissions such as GHGs, Common Air Pollutants (CAP) and other Volatile Organic Compounds (VOC). Key functionalities of HEAT+ include:

- Develop an emissions inventory of transportation demand, local energy useand waste practices
- Make the introduction of additional sectors and gases flexible.
- Accounting and reporting in terms of Scope-1 Scope-2 and Scope-3 local GHG emissions
- Develop a simple emissions forecast
- Identify a target/goal for reducing emissions
- Work out planned measures for reduction of GHG emissions and air pollutants
- Prepare reports and track progress

The HEAT+ toll is compliant with the IPCC 2006 guidelines and with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). HEAT+ also enables cities

to report directly to the ICLEI CDP Unified Reporting System. – the online reporting platform for GHG emissions and climate actions undertaken by cities. This tool is useful for electrical engineers, executive engineers, town planners, environment officers, city resilience officers and urban practioners. For more information, please visit: http://heat.iclei.org/

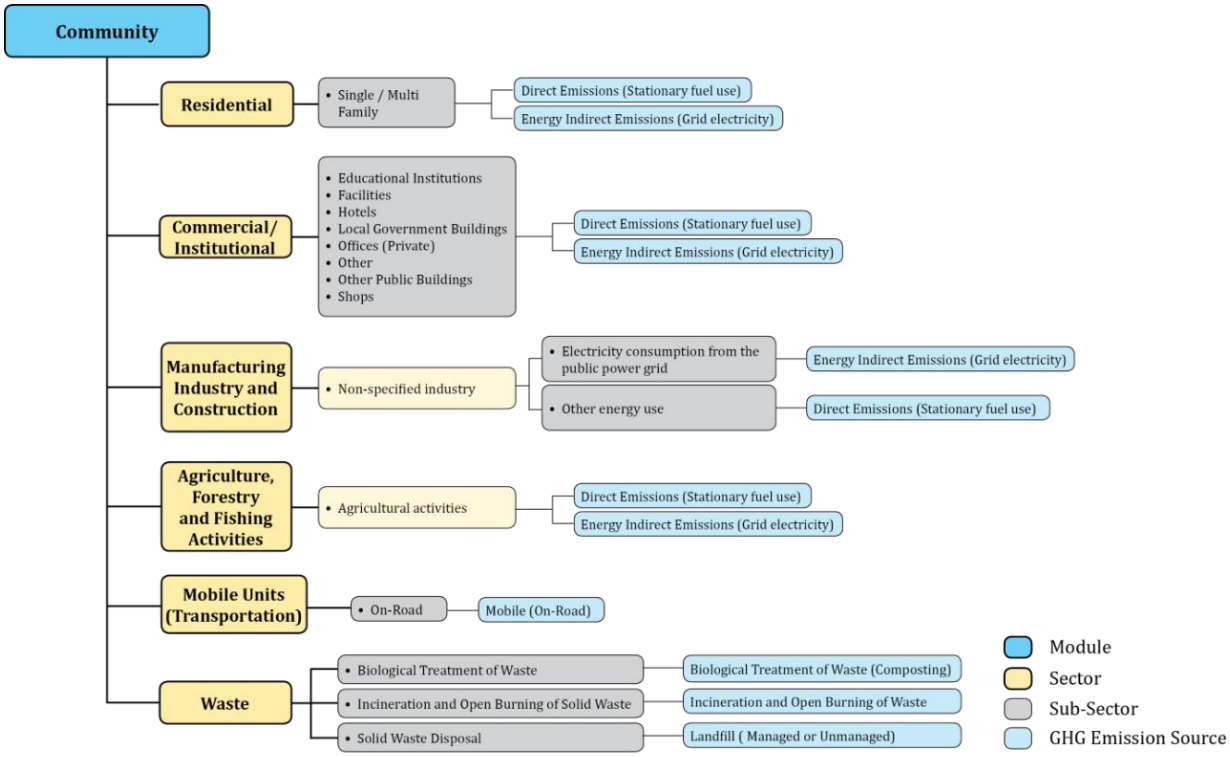


Figure 13: Community-scale GHG Emissions Inventory in City/Village

Infrastructure and Socio-ecological System Analysis

The infrastructure and socio-ecological systems are service delivery mechanisms of the local government. A baseline assessment of these systems is conducted to understand their existing status and identify if any of themis already weak or under stress. The table below provides an indicative menu of core and secondary systems. This list is not exhaustive, and each local government should prepare their own list, as relevant.

Socio-ecological Systems

The socio-ecological system is one in which there are strong links among its political, social, cultural, ecological and technological and other components.(I Petrosillo, R Aretano, and G Zurlini, 2015[21])

Table 3: Indicative Checklist of Core and Secondary Socio-ecological Systems (Adapted from ISET, 2011)

Core Systems	Secondary Systems
• Ecosystems • Land • Energy • Water • Food • Shelter • Transport • Communications	• Healthcare • Tourism • Education • Finance • Markets • Sanitation • Community services • Public security • Taxation

Local governments have to identify municipal systems or services that are under stress or consume a significant amount of the total energy consumption and contribute to GHG emissions. To help identify fragile systems, the municipalities should consider:

- The sectors that could be seen as being impacted by climate change
- Sectors in which the energy consumption is high
- The highest priorities in your municipality's development/master plan/ disaster management plan
- The main concerns that are raised by the city administration, the community and the private sector

The fragility of these systems is identified on the basis of four resilience parameters according to the Climate Resilient City Action Plan (CRCAP) Methodology of ICLEI South Asia: flexibility and diversity; redundancy; safe failure and energy consumption and GHG emissions.

Flexibility and diversity – whether the sector can provide multiple options to help distribute or decentralise key assets and functions, and that not all are affected by a single event, and can function under diverse conditions. *Example: Instead of depending on the centralised water treatment plant, a water supply system depended on multiple sources such as spring water used by mountain people, groundwater, lakes and reservoirs is considered as 'flexible and diverse'.*

Redundancy – whether a system has back-up systems/contingency plans, capacity for contingency situations, multiple pathways and options for service delivery in case one or several options fail. *Example: In case of a failure in the centralised water treatment facility, the municipality has a backup plan such as providing water through tankers in the city/village. In the mountainous region, tankers may not provide water to the entire city/village due to the difficult terrain.*

Safe failure – If the system can absorb sudden shocks or slow onset stress in order to avoid catastrophic failure. *Example: Dikes are designed to fail in predictable ways in case their capacity is exceeded, by channelling flooding away from populated areas.*

Energy consumption and GHG emission – whether the system **c**onsumes less energy than traditional means and leads to GHG emission mitigation.

The systems should also be examined in terms of their impacts on other systems and services, and on the responsibility of these systems on the whole. Local governments should also check the impact of the fragile systems on women and other vulnerable groups such as urban poor and indigenous populationsto introduce a gender-sensitive and inclusive approach to resilience planning. The information is then used to develop a Fragility Statement to define briefly why the system is considered to be fragile in the catchment.

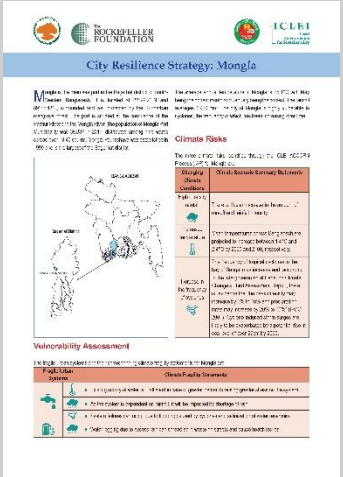
Table 4: Identifying Fragile Systemsas per the CRCAP Methodology of ICLEI South Asia

Infrastructure and socio-ecological system	Why is it critical or fragile?	What are the existing and expected problems caused by the fragility of this system?	Part of city / village function (Wholly / Shared / No)	Fragility statement
Water supply	**Flexibility anddiversity:** Traditional water sources have been lost to urbanisation and the city depends on centralised pumping systems that transport water from significant distances to the city. Supply cannot meet the growing demand. **High energy consumption andGHG emissions:**Transportation of water from significant distances to the city with old pumping stations leads to GHG emissions in the city. **Redundancy:** Alternatives usually include water supplied by tankers (trucks). This maynot enough to provide water to the entire municipal area. **Safe failure:** In case of a disruption in water supply, individual households have to fend for themselves.	Disruption of water supply to citizens Additional financial burden on individual households that are forced to pay for tankers for transporting water Water shortage adversely impacts the tourism industry. Increased pollution and emissions from the plying of water tankers	Ministry of Irrigation, Water Development and Flood Control, Bangladesh Local Authorities	The water supply system in the city is old and largely dependent on transporting water over large distances, which consumes significant energy and leads to GHG emissions. Even minor disruptions within the distribution network cause significant shortages in the city in the face of ever-growing demand; alternatives are not cost-effective or sustainable. Further, shortage of water will have an impact on both genders.
Agriculture	**Flexibility anddiversity:** Most local farmers are dependent on one type of crop. They do not practice rotation and mutifarming. **High energy consumption andGHG emissions:** Agriculture sector generates GHG emissions through the production and use of agricultural inputs (mainly water, fertilizers, and pesticides)	Complete dependency on conventional farming techniques Migration of people Lack of farmers' understanding of GHG emissions leads to the agriculture sector contributingsubstantialGHG emissions.	Ministry of Agriculture, Bangladesh Local Authority	Local communities are using conventional farming techniques. The outmigration of young men increases the pressure on local women. Lack of knowledge on technical sustainable alternatives results in high GHG

Infrastructure and socio-ecological system	Why is it critical or fragile?	What are the existing and expected problems caused by the fragility of this system?	Part of city / village function (Wholly / Shared / No)	Fragility statement
	farm machinery, soil disturbance, residue management, and irrigation. **Redundancy:** Local farmers are completely dependent on conventional farming techniques and have very few options for farming. **Safe failure:** Government has not provided any insurance scheme for crops. Municipality does not have any early warning system and weather forecasting mechanism.			emissions from the agriculture sector.

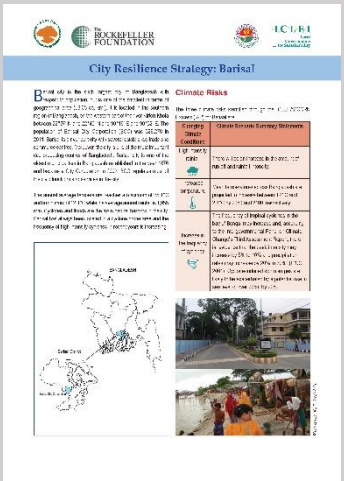
Case Studies: Climate Resilience Strategies of Mongla and Barisal

City Resilience Strategy: Mongla



Mongla is the main sea port in the Bagerhat district of South-Western Bangladesh, surrounded and well protected by the Sundarban mangrove forest. It is situated at the confluence of the Pashur and Mongla Rivers. Though not heavily populated, the port brings in sufficient revenue for the municipality's various developmental activities. The major climate risks to the city are floods and salinity ingress. The City Resilience Strategy for Mongla was developed under the Asian Cities Climate Change Resilience Network (ACCCRN) project funded by the Rockefeller Foundation, with technical support from ICLEI South Asia. The municipality conducted series of Shared Learning Dialogues (SLD) to understand the city profile, its climate risks and urban vulnerability, and identified a number of interventions to improve its resilience. One of the interventions to construct a rain water harvesting pond, was immediately implemented by the municipality. The city that barely had sufficient clean drinking water due to salinity ingress, in spite of its proximity to two large rivers, met its citizens' drinking water requirement fully, using rain water harvesting systems.

Climate Resilience Strategy: Barisal



Barisal is the sixth-largest city in Bangladesh. Located in the country's southern region, on the western part of the Kirton Khola River, it is a river port city with several established trade and commerce centres. Cyclones and floods are the main natural hazards in Barisal as it is located in a cyclone prone area and the frequency of high intensity cyclones has been increasing in recent years. Under the Asian Cities Climate Change Resilience Network (ACCCRN) project, the Barisal Municipal Corporation prepared the city resilience strategy with technical support from ICLEI South Asia. ICLEI South Asia collected baseline data to develop a city profile providing details of socio-economic scenarios, service delivery status, and the general governance systems in the city. Climate change impact on the fragile socio-ecological system and vulnerability was assessed, based on which, several measures such as rain water harvesting, community based disaster management measures, plantation, and emergency health care facilities were identified to improve the city's resilience.

Module 2(c): Climate Risk and Vulnerability Assessment

Learning Objective: The key learning objective of the module is to identify the climate risks and its impacts on fragile infrastructure and socio-ecological systems. The module will help local governments identify specifically who or what is vulnerable to what and why. This will help identify the vulnerability hotspots and assess the adaptive capacity of the local community and other important actors.

The next step is to understand climate change trends, patterns, and projections of climate change at the regional and local levels. The analysis will be used to gauge the vulnerability and risk of the critical systems (identified in module 2.B). Finally, maps that show the distribution of high-priority climate risks in the municipal area will be produced.

Climate Change Trends, Projections and Scenarios

It is important to collate and analyse past climate data to understand climate exposure scenarios and projections. Local authorities should first seek out local-level climate data and any other data sets or recent studies on climate phenomena and projections for the area. If local level climate data or studiesare not available, regional or national data or studieson climate change and its impact should be sought.

Although this analysis can be substantiated with inputs from an expert, stakeholder group, and the local community, the preliminary results alone will help provide a broad understanding of climate and if there have been any significant changes in weather/climate patterns. Local governments can consult different secondary data for conducting climate analysis. If the local authorities, universities or research institutes, NGOs, or other bodies have access to recent local studies on climate trends and projections, these can be used. In the absence of local-level assessment, a regional assessment study may be used.

Temperature and rainfall data for the past 30 or 40 years can be collected from the meteorological department to develop climate trend maps, after discussing the data with the local stakeholder group to verify the past trends.

The secondary projection data can be summarised to form climate scenario statements that give a general idea of the climate risks faced by the local government. The climate scenario statements can be developed as per the following table (from the ICLEI ACCCRN Process):

Table 5: Climate Data Collection and Preparation of Scenario Statementas per the ICLEI ACCCRN Process

Changing Climate Condition	Assessments	Amount of Expected Change (baseline and planning horizon years included)	GHG Emissions Scenario	Extent of Variability	Source	Level of Confidence	Climate Scenario Statement
Temperature change	Regional Assessments	By 2050, the mean annual temperature in the country is projected to increase by 0.54°C, 1.23°C, and 2.16°C for the 10th, 50th, and 90th percentiles for the RCP4.5 model ensemble runsrespectively and 0.91°C, 1.69°C, and 2.76°C for the 10th, 50th, and 90th percentiles for the RCP8.5 model ensemble runs respectively[22].	RCP4.5 &RCP8.5	Annually, projections indicate that "hot" days will occur on 17-39% of days by the 2060s	Climate change information fact sheet - Bangladesh	High	e.g. There is a high level of confidence inan increase of 0.54 to 2.76°C in the temperature of Bangladesh by 2050.
	Supplementary Local Assessments						
Precipitation change	Regional Assessments	By 2050, the projections of mean annual rainfall range from -13.79%, 3.40%, and 23.40% for the RCP4.5 10th, 50th, and 90th percentile ensemble runs respectively and -14.97%, 3.64%, and 24.58% for the RCP8.5 10th, 50th, and 90th percentile ensembleruns respectively[23].	RCP4.5 &RCP8.5	The median ensemble runs for RCP4.5 and 8.5 indicate an average annual rainfall increase of 0.2 mm/day and 0.4mm/day, respectively by around 2060 [USGS]. The models broadly	Climate change information fact sheet - Bangladesh		e.g. There is a high level of confidence in an increase of 0.2 to 0.4mm rainfall in Bangladesh by 2050.

Changing Climate Condition	Assessments	Amount of Expected Change (baseline and planning horizon years included)	GHG Emissions Scenario	Extent of Variability	Source	Level of Confidence	Climate Scenario Statement
				suggest increases in the magnitude of five-day maxima rainfall.			
	Supplementary Local Assessments						
Sea Level Rise and StromSurge	Regional Assessments	Cyclone-induced storm surges are likely to be exacerbated by a potential rise in sea level of over 27cm by 2050[24]. Sea level rise is projected for Bangladesh, although there is disagreement on the degree. One study suggests an increase of 30 to 100 cm by 2100, while the IPCC Fourth Assessment gives a global average range with slightly lower values of 26 to 98 cm [IPCC WG1 AR5, Ch13].		Bangladesh could lose 10% of its area due to a sea level rise of 45 cm.	Climate change information fact sheet - Bangladesh	High	e.g. The country will face an increase in sea level rise that leads to high frequency of cyclone-induced storm surges.
	Supplementary Local Assessments						

Climate Impact on Fragile Infrastructure and Socio-ecological Systems

On the basis of the information from the earlier section, a climate fragility statement identifying the characteristics of the vulnerable systems and potential climate impacts on them should be prepared.

In most cases, climate change could threaten or weaken a system (e.g. drainage systems that are already in poor condition may be impacted further in case of increased precipitation), but in some others, it may be beneficial (for instance, water supply systems facing water shortage could benefit from increased precipitation).

The question to be asked in each fragility statement is: 'What could be the impact of the projected climate change on systems that are identified as fragile/ critical?'Further, how is it going to impact different genders and age groups and other vulnerable sector?

Finally, by assessing the impacts of climate risks on the fragility of a system, write a 'climate fragility statement' that points out its features and the potential climate impacts on it.

Table 6: Climate Impacts on Fragile Urban Systems or Socio-ecological Systems

Fragile system	**Fragility statement**	**Climate fragility statement**	**Climate fragility statement**
		Climate risk 1: e.g. Increased precipitation	**Climate risk 2: e.g. Increased temperatures**
e.g. Water Supply	The water supply system in the city is old and largely dependent on water transported over large distances, which leads to significant energy consumption and GHG emissions. Even minor disruptions within the distribution network cause significant shortages in the city in the face of ever-growing demand. Alternatives are neither cost-effective nor sustainable.	Increased precipitation disrupts/damages water supply infrastructure.	Rising temperatures will lead to increased demand for water, thereby putting additional stress on the supply system which will put extra burden on local women to collect free drinking water.
			Rising temperatures will lead to increased demand for water, thereby putting additional stress on the water pumping sector, which in turn will contribute to higher GHG emissions.
Agriculture Sector	Local communities are using conventional farming techniques. The outmigration of young men increases the pressure on local	Heavy rainfall events leading to flooding can wipe out entire crops over wide	Increase in temperature can provide a suitable environment for some weeds, pests, and

Fragile system	Fragility statement	Climate fragility statement Climate risk 1: e.g. Increased precipitation	Climate fragility statement Climate risk 2: e.g. Increased temperatures
	women. Lack of technical knowledge on GHGs results in high GHG emissions from the agriculture sector.	areas, and excess water can cause other impacts including soil water logging, anaerobicity and reduced plant growth.	fungiwhich subsequently impacts the yield of the crop.

Risk Analysis and Vulnerability Assessment

Once the Climate Fragility Statements for the fragile infrastructure and socio-ecological systems are identified, it is important to prioritise the risks using a risk assessment methodology in consultation with the stakeholder group in the local government. As it depends on the opinions and experiences of the participants/ stakeholders, this exercise can be subjective. Therefore, the risk assessment should be preferably conducted with a broad group of city/ village representatives and stakeholder group to validate the priorities. This will lead to discussions and build consensus on the final risk prioritisation.

Local governments can assess the likelihood and consequence of each climate fragility statement of each system to assess the climate risks. The level of exposure to the risk will decide the likelihood, while the consequence depends on the vulnerability of the system or population group.

The likelihood of each risk can be assigned a score from 1 to 5 as per the table below. The 'Level of Confidence' assigned to each of the identified climate change conditions in the climate scenario table (see Table 5), which indicates whether the likelihood of occurrence is higher or lower, should be referred to.

Table 7: Likelihood Rating and Scoringas per the ICLEI ACCCRN Process

Likelihood rating	Description	Score
Almost certain	Highly likely to occur, could occur several times per year Likelihood: probably greater than 50%	5
Likely	Reasonable likelihood, may arise once per year Likelihood: 50/50 chance	4
Possible	May occur, perhaps once in 10 years Likelihood: less than 50% but quite high	3
Unlikely	Unlikely but should be considered, may arise once in 10 to 25 years Likelihood: probability significantly greater than zero	2
Rare	Unlikely in foreseeable future Likelihood:negligible probability	1

Next, assess the consequence or impactfor each climate risk to gauge if the risk does occur. The consequences can range from Catastrophic to Moderate to Insignificant. Assign a score from 1 to 5 for each risk, where 5 is Catastrophic and 1 is Insignificant. Table 9 shows one way of assessing the different consequence ratings, using “Impact on the System” and “Impact on the local Government” as measures.

Table 8: Consequence Rating and Scoringas per the ICLEI ACCCRN Process

Consequence rating	Impact on system	Impact on poor and other vulnerable groups such as women	Score
Catastrophic	System fails completely and is unable to deliver critical services;may lead to failure of other connected systems.	Severe impacts on poor and vulnerable groups (including women)in the city/village, leading to extreme destitution	5
Major	Serious impact on the system’s ability to deliver critical services; however, not a complete system failure	Loss of confidence and criticism in local government; ability to achieve city/village vision and mission seriously affected; significant impacts on poor and vulnerable groups in the city/village that seriously affect their lives and livelihoods	4
Moderate	System experiences significant problems, but is able to deliver some degree of service.	Moderate impacts on the lives and livelihoods of the poor and vulnerable groups (including women) in the city/village	3
Minor	Some minor problems experienced, reducing effective service delivery, possibly affecting certain other systems or groups	Minor impacts on the lives and livelihoods of the poor and vulnerable groups (including women)in the city/village	2
Insignificant	Minimal impact on system; may require review or repair, but able to function	Minimal impacts on the lives and livelihoods of the poor and vulnerablegroups (including women) in the city/village	1

After assigning a ‘Likelihood’ and ‘Consequence’ score to each of the identified climate risks, these values are multiplied to arrive at the ‘Risk Score’ for each fragile system (see Table 9).

Table 9: Prioritisation of Climate Risksas per the ICLEI ACCCRN Process

Climate Fragility Statements	Likelihood	Consequence	Risk Score (Likelihood x Consequence)	Risk Status
Increased precipitation disrupts/damages water supply infrastructure.	4	4	16	High
Increased temperatures will lead to increased demand for water, thereby putting additional stress on the supply system.	3	3	9	Medium

Climate Fragility Statements	Likelihood	Consequence	Risk Score (Likelihood x Consequence)	Risk Status
Increased temperatures will lead to increased water demand, thereby putting additionalpressure on local women to collect free drinking water.	4	4	16	High

Finally, for each of the climate fragility statements, assess their Risk Status based on their respective Risk Scores. Please refer to the 'Summary of Risk Matrix' in Table 10 for assessing the risk status.

Table 10:Summary of a Risk Matrixas per the ICLEI ACCCRN Process

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium (RS* = 5)	Medium (RS = 10)	High (RS = 15)	Extreme (RS = 20)	Extreme (RS = 25)
Likely	Low (RS = 4)	Medium (RS = 8)	High (RS = 12)	High (RS = 16)	Extreme (RS = 20)
Possible	Low (RS = 3)	Medium (RS = 6)	Medium (RS = 9)	High (RS = 12)	High (RS = 15)
Unlikely	Low (RS = 2)	Low (RS = 4)	Medium (RS = 6)	Medium (RS = 8)	Medium (RS = 10)
Rare	Low (RS = 1)	Low (RS = 2)	Low (RS = 3)	Low (RS = 4)	Medium (RS = 5)

*RS: Risk Score

Vulnerability Assessment and Preparation of Vulnerability Maps

As per the new IPCC framework for risk and vulnerability assessment, vulnerability is generally assessed in terms of two indicators, i.e. sensitivity, and adaptive capacity. Local governments, supported by the climate core team and stakeholder group, can prepare GIS (Geographic Information System) maps showing the distribution of vulnerable areas in the context of climate risk (by using climate fragility statement) across the municipal areas/ wards based on sensitivity and adaptive capacity.

The climate core team and stakeholder group can identify the vulnerable area and actors. Subsequently, they should assess the adaptive capacity of different actors/ social groups (including women) and fragile systems that are most at riskfrom climate impacts.

Definition of the terminology used in Risk and Vulnerability Assessment Framework of IPCC Fifth Assessment Report

Vulnerability = Sensitivity and Adaptive capacity

Sensitivity: If society and its ecosystems are predisposed to suffer damage as a consequence of intrinsic and context conditions, then such systems are likely to collapse or experience major harm and damage due to the impact of a hazard event.

Adaptive Capacity: The capacity of systems, human beings and other organisms and institutions to adjust to potential harm, and to take advantage of opportunities, or to respond to the impact of climate change.

Source: Vulnerability and Risk Assessment Framework and Indicator for National Adaptation Plan Formulation Process Nepal

Special emphasis should be given to local women (especially, those belonging to marginalised groups) to understand the impact of climate risk and fragile infrastructure and socio-ecological systems on their daily lives.

For each fragile infrastructure and socio-ecological system, local governments should identify the areas/ wards of the city/ village that will be most affected/sensitive and mark them with a particular colour. While identifying the vulnerable area, local authorities should have enough information about the population distribution, slum areas, public service distribution and topography of the ward or area. Municipal officials can also look into the women's perspective, while identifying the vulnerable areas, to understand gender-specific vulnerability.

After all the systems are identified and mapped, local governments can mark out the areas of cities that are affected by the largest number of extreme climate risks by overlaying the maps. These areas will represent the Vulnerability of Hotspots in the city/ village.

Figure 14 shows a map of vulnerable hotspots of the Mongla Port Municipality prepared using the ICLEI ACCRN Process. The climate core team identified seven fragile urban systems for Mongla through Shared Learning Dialogues, including water supply, drainage, solid waste management, transport, health among others. The vulnerability hot spots map indicates the wards of the city which are impacted by more than one fragile urban system. Yellow colour shows the wards which are impacted by three fragile urban systems while green colour indicates wards that are impacted by five fragile urban systems. The orange colour indicates the wards which are impacted by six fragile urban systems, while the red colour indicates the wards which are impacted by all fragile urban systems.

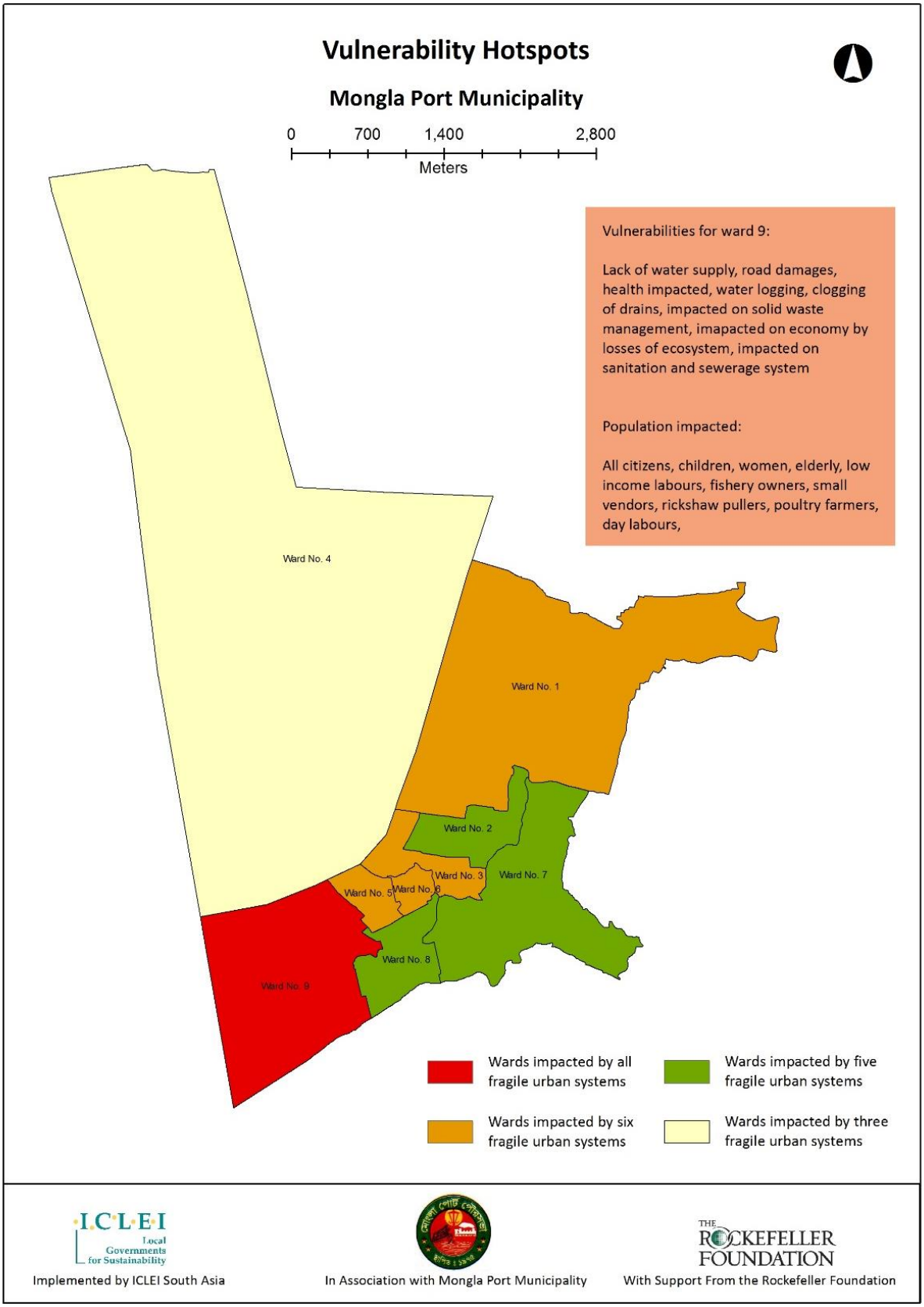


Figure 14:Vulnerability Hotspot Map forMonglaCity in Bangladesh

Identification of Actors and their Adaptive Capacity Assessment

The local government should identify the actors (i.e. individuals, households and public/private sector organisations) that can play a key role in improving urban resilience.As per the ICLEI ACCCRN Process,their capacity to contribute to resilience and adaptation is broadly dependent on their:

Capacity to organise and respond – whether they have the ability to organise and re-organise in response to threat or disruption.

Access to Resources – whether they have access to the resources necessary to respond to stress (such as technology, human resources and funds).

Access to information – whether they can use data and other information necessary to develop effective plans and actions and to improve responses to disruptions.

The combination of these three features would help to determine the adaptive capacity of these actors.

Adaptive Capacity Score = Capacity to organise and respond x Access to Resources x Access to Information

Table 11: Actors' Capacities Rating and Scoringas per the ICLEI ACCCRN Process

Key Capacities of Actors	Score
Capacity to Organise and Respond	
Low capacity to organise and re-organise in response to threat or disruption	1
Medium capacity to organise and re-organise in response to threat or disruption	2
High capacity to organise and re-organise in response to threat or disruption	3
Resources	
Low access to the resources necessary to respond (human resource, technology, funds)	1
Medium access to the resources necessary to respond (human resource, technology, funds)	2
High access to the resources necessary to respond (human resource, technology, funds)	3
Access to Information	
Low availability of data and information necessary to develop effective plans and actions and to improve responses to disruptions	1
Medium availability of data and information necessary to develop effective plans and actions and to improve responses to disruptions	2
High availability of data and information necessary to develop effective plans and actions and to improve responses to disruptions	3

Based on the Adaptive Capacity Scores mentioned in Table 11, it can be determined which actors have a high, medium or low adaptive capacity in a particular fragile system. Table 12 shows the level of adaptive capacity of the actors.

Table 12: Levels of Adaptive Capacity of Actorsas per the ICLEI ACCCRN Process

Adaptive Capacity Score	Level of Adaptive Capacity
1 – 8	Low
9 – 17	Medium
18 – 27	High

Actors with a 'low' level of adaptive capacity need to be specifically targeted in the actions (or resilience strategies) that will be taken to reduce the fragility of the particular infrastructure and socio-ecological system. Those with a high ormedium level of adaptive capacity can be involved in the proposed actions as they can effectively deal with the effects on the fragile systems. It is observed that women generally lack resources and information (especially in South Asian countries). Therefore, local authorities should assess the adaptive capacity of the local women by considering them as important actors. The information can be summarised as below:

Table 13:Summary of Adaptive Capacityas per the ICLEI ACCCRN Process

Climate Fragility Statements	Area/Ward	Actors	Capacity to Organise andRespond (A)	Access to Resources (B)	Access to Information (C)	Adaptive Capacity Score (A)*(B)*(C)	Supporting Notes
Increased precipitation may lead to more runoff and sedimentation thereby disrupting/damaging water supply systems.	Ward 5	Local Authorities	3	2	2	12 (Medium)	
		Private Sector	2	3	2	12 (Medium)	
		Residents Welfare Association	2	2	1	4 (Low)	
Heavy rainfall eventsleading to flooding can wipeout entire crops over wide areas, and excess water can lead to other impacts including soil waterlogging, anaerobicity, and reduced plant growth.	Ward 2	Agriculture Department	3	2	2	12 (Medium)	
		Women Farmer	2	1	1	2 (Low)	
		Local Authorities	3	2	2	12 (Medium)	

Assessing Resilience Capacity of Infrastructure and Socio-ecological Systems

In this section, the resilience capacity of the infrastructure and socio-ecological systems and service of the municipality will be ascertained in terms of climate adaptation and mitigation. Resilience capacity is based on five categories of economic, technology/ infrastructure, governance, social, and ecosystem servicesas per the ICLEI ACCCRN Process. Each of the five categories of adaptive capacity can be rated as high/medium/low for each fragile system.

A Few Guiding Questions

Economic – does the system have the funds required for undertaking the necessary actions to manage climate change, such as budget allocation, tax base, ability to charge fees, any other identified sources including state and national schemes? What is the ratio: cost of intervention versus benefits in terms of climate resilience impact? Is it able to operate as a “business” or does it follow the traditional model of public service?

Technology/ Infrastructure – does the system have the requiredresources and technical knowledge? Can the existing infrastructure cope with additional stresses from climate change? Are major technology changes needed? Does the system have the capacity to introduce the required changes? What is the potential for the improvement of urban services?

GHG Emissions – Is it possible for the municipality to reduce sectoral GHG emissions?

Governance – Have the responsibilities in the system been clearly outlined? Do the responsible entities have the required authority to effect changes? Is there enough support from higher levels of government? Is there enough coordination among the stakeholders, and are they supportive of necessary change?

Social– Does the community have enough understanding and resources to do its share of responsibilities in this system? Does the system have the requisite mechanisms to involve the community and accept their feedback? Does it give due recognition to the needs of poor and vulnerable groups in the community?

Ecosystems – Can this system protect or restore the ecosystem adequately? Is there enough understanding and data about the condition of the different ecosystems in the city, as well as their strengths and weaknesses?

Table 14: Reference Table for Compiling Information about the Resilience Capacity of the Fragile Urban Systemsas per the ICLEI ACCCRN Process

Examples of Level of Climate Resilience Capacity						
	Economic	**Technology/Infrastructure**	**GHG Emissions**	**Governance**	**Social**	**Ecosystem Services/Natural Environment**
Low	Limited inherent economic ability to adapt to impacts (e.g.very high finance required compared to benefits, no legal authority to raise funds,no strong tax base to call upon)	Limited inherent technology/infrastructure to adapt to impacts (e.g. use of out dated materials in building codes,no system for integrating new knowledge into changes, very low potential for improvement of urban services, low/no possibility for replication, very low energy saving and GHG emission reduction potential)	Contribution of the sector to GHG emissions is less than 5% and mitigation interventions are limited.	Limited governance structure in place to adapt to impacts (e.g. no interagency collaboration,no support from higher levels) i.e. inadequate rules and practices	Limited societal structure in place to adapt to impacts (e.g. disenfranchised or uninvolved citizenry,lack of community involvement)	Limited ecosystem services/natural environmental ability to adapt to impacts (e.g. no marsh or dune system to provide storm protection, all habitat isolated and disconnected from other natural areas)
Medium	Economic ability to adapt to impacts can be developed (e.g. required finance comparable to benefits, mechanism for raising funds exists,tax base available to call upon)	Technology/infrastructure to adapt to impacts can be accessed (e.g. structures can be renovated and retrofitted,new knowledge can be regularly integrated into purchasing agreements, potential to improve urban services)	Contribution of the sector to overall city GHG emissions is less than 10% and mitigation interventions are possible.	Governance structure in place to adapt to impacts (e.g. possibility of interagency collaborative processes,work closely with higher levels) i.e. some rules and practices are in place.	Societal structure in place to adapt to impacts (e.g. citizens are heavily involved in their communities,active and effective community involvement)	Ecosystem services/natural environmental ability to adapt to impacts (e.g. municipality takes into account ecosystem services while planning for developmental projects)
High	Robust inherent economic ability to adapt to impacts	Robust inherent technology/infrastructure to adapt to impacts (e.g. most	Contribution of the sector to overall city GHG	Robust governance structure in place to adapt to impacts	Robust societal structure in place to adapt to impacts	Robust ecosystem services/natural environmental ability to

Examples of Level of Climate Resilience Capacity						
	Economic	**Technology/Infrastructure**	**GHG Emissions**	**Governance**	**Social**	**Ecosystem Services/Natural Environment**
	(e.g.required finance is less as compared to benefits, mechanism for raising funds exist,very strong tax base to call upon)	structures are new and have used the latest materials andbuilding codes,new knowledge is regularly integrated into purchasing agreements, very high potential to improve urban services, replication at larger scale possible, very high energy saving and GHG emission reduction potential)	emissions is more than 15% and significant reduction of GHG emissions is possible through mitigation interventions	(e.g. good interagency collaborative processes,work closely with higher levels) i.e. good rules and practices	(e.g. citizens are heavily involved in their communities,active and effective community involvement)	adapt to impacts (e.g. highly functioning dune or marsh system provides storm protection,habitat systems are connected allowing for species and sediment movement)

Table 15: Climate Resilience Capacity of the Fragile Urban System- Example

Fragile Urban System	Economic/Source of Finance	Technology/Infrastructure	GHG Emissions	Governance	Social	Ecosystem Services
Water Supply	Low (funds not available for new infrastructure)	Medium (improved technology can be accessed through engagement of private companies)	High (50% of GHG emissions from electricity use for government facilities is from	Medium (good coordination with departmentsof water supply and sewerage management)	High (increasing demand from citizens for improved water supply systems, high energy consumption for water pumping and resultant GHG emissions)	Low (water bodies being lost in the municipality)
Agriculture	Low (funds not available for new infrastructure)	Low (lack of access to improved technology)	Medium (various farming activities generate GHG)	Medium (Good Coordination among local authority and department of agriculture and livestock	Medium (societalstructure in place to adapt to impactse.g. citizens are heavily involved in their communities,active and effective community and aid)	Medium (localcommunity has a good understanding of ecosystem services and they do farming accordingly)

Module 3: Development of Climate Resilience Strategy

Learning Objective: The key learning objective of the module is to consolidate analysis and results of previous modules and to identify adaptation and mitigation actions that are needed to deal with climate change and related disasters. The module will help participants to understand the need to prioritise and integrate these measures to existing municipal plans.

This section will help develop a list of possible “interventions” to address the climate risks and vulnerabilities identified in previous phases, and subsequently develop a climate resilience strategy.

Resilience strategy helps expect, prevent, absorb and recover from shocks and stresses, especially those brought about by rapid environmental technological, social and demographic change. Once the climate risks havebeen identified and the fragile infrastructure and socio-ecological systems assessed for their impacts particularly on vulnerable populations, the local government should identify solutions that will help them build their resilience.

Identification of Interventions

The local government should develop a list of possible actions or interventions that can help with adaptation and mitigation of the identified climate risks and vulnerability, according to the Climate Resilient Action Plan Methodology. The interventions should be identified based on participatory and gender-inclusive stakeholder group discussions exploring traditional local knowledge or best practices from other areas with a similar situation.

It can have hard (i.e. infrastructure-related) as well as soft (i.e. not or minor infrastructure-related e.g. policy changes, capacity building) measures. The interventions must concentrate on improving the resilience of the most vulnerable groups (especially women and children) and vulnerable areas identified before. Each intervention must be analysed for its mitigation and adaptation potential, along with the financial aspect, should be analysed. The interventions with co-benefits of adaptation and mitigation should be selected to get more benefits with the same investment.

Table 16: Identifying Resilience Interventions – Example and Work Exerciseas per the ICLEI ACCCRN Process

Climate Fragility Statement	**Vulnerable Areas**	**Actors**		**Resilience Capacity of the System**			**Potential Climate Resilience Interventions**
		Vulnerable Actors	**Potential Supporting Actor**	**Low**	**Medium**	**High**	
Increased precipitation may lead to more runoff and sedimentation thereby disrupting/damaging water supply systems.	*Ward 5*	*NGOs*	*Private Sector Water Authority*	*Economic/source of finance Ecosystem Services*	*Technology/infrastructure Governance*	*Social GHG Emissions*	Roof-top water harvesting to be made mandatory to deal with water stress due to anticipated increase in temperatures and decrease in precipitation Watershedmanagement measures to conserve the ground and surface water
Heavy rainfall events leading to flooding can wipe out entire crops over wide areas, and excess water can lead to other impacts including soil water logging, anaerobicity and reduced plant growth.	*Ward 2*	*Women Farmers*	*Local Authority Agriculture Department*	*Economic/source of finance Technology/infrastructure*	*Social Governance GHG Emissions*		Climate-smart farming to be introduced to deal with increasing temperature and precipitation Training and capacity building of local farmers

Prioritisation of Interventions

In this section, the proposed resilience interventions should be evaluated against a set of resilience indicatorsviz.redundancy, flexibility, responsiveness, GHG emission reduction and access to information, to understand the resilience potential of each intervention. Based on the resilience potential, local governments can prioritise their investments. The higher scoring interventions are then assessed for feasibility and impact. Lower scoring interventions can also be assessed for feasibility and impact if the municipality feels that these are important from the city development perspective.

Redundancy: A resilient system can function and achieve results through multiple paths or nodes when one fails and when performance is critical. In contrast, a “single best solution” is not resilient because if it fails, the system collapses. Backup systems, or decentralised nodes for service delivery in a linked network, are preferable.

Example: If the water treatment facility fails, tankers are available in the city to be deployed to provide water for essential services.

Flexibility: Essential systems should be able to work under a variety of conditions; they should not be rigid or designed only for one specific situation. Any system will fail if overloaded beyond its capacity, but it should be designed to fail under stress safely and predictably, rather than suddenly and catastrophically.

Example: The water treatment facility is designed such that minor fluctuations in temperature and rainfall will not affect is overall efficacy.

Responsiveness/Re-organisation[25]: Under extreme conditions, systems should be able to respond and change to meet unexpected shocks. This requires flexible organisations and access to different kinds of resources (information, skills, equipment, knowledge and experience). It also means a high level of coordination and flexible organisational structures capable of adjusting to new conditions.

Example: Houses in flood-prone areas are designed to have flat roofs that can be emergency refuges for family members and possessions above floodwater level.

Access to information: Resilient systems have mechanisms to learn from and build on experience, so that past mistakes are not repeated and lessons from other cities can be integrated into planning. This requires procedures for monitoring and evaluating performance under stress, and multiple sources of knowledge and documentation (strengthening “corporate memory”).

Example: Different government agencies share a common monitoring and reporting system to trackgroundwater quality and extraction in the face of more frequent droughts or sea-level rise.

Energy-saving and GHG emission mitigation potential: Resilient systems have the potential to reduce energy consumption and mitigate GHG emissions, which may be integrated into their regular planning. This requires procedures for periodic monitoring and evaluating performance, and multiple sources of knowledge and documentation.

Example: Biomethanation of organic waste to produce energy can divert waste from landfills while also generating energy that can be used to reduce power demand, and reduce GHG emissions from waste.

Social resilience: A resilient system should also have the potential to improve the social resilience of marginalised groups by providing the ability to cope with social risks.

Example: Providing agricultural equipment to women that reduce their drudgery can help save time and energy for other activities, while also empowering them economically.

Table 17: Prioritisation of Resilience Intervention – Example andWork Exercise

Potential Climate Resilience Interventions	**Resilience Indicators**						**Overall Resilience** **6/6: Very high** **5/5: Very high** **4/5: High** **3/5: Medium** **2/5: Average** **1/5: Low**
	Redundancy (Yes/No)	**Flexibility (Yes/No)**	**Responsiveness/ Re-organisation (Yes/No)**	**Access to Information (Yes/No)**	**Energy Saving and GHG Emission Mitigation Potential (Yes/No)**	**Potential to improve social resilience (especially women/marginalised sections/poor)**	
Roof-top water harvesting to be made mandatory to deal with water stress due to anticipated increase in temperatures and decrease in precipitation	Yes, Supports a higher degree of self sufficiency at the household level	Yes, System allows for water to be channelized towards recharging groundwater.	Yes, In case of a shutdown of the city's water supply system, households have stored rainwater for use.	No, City helplines exist, but responsibility lies with individual household.	Yes, Reduction in electricity consumption and GHG emission mitigation potential due to reduced pumping requirement	Yes, Can improve women's livelihood by providing decentralised access to drinking water	Very High
Climate-smart farming to be introduced to deal with increasing temperature and precipitation	Yes, Supports conventional as well as new farming system	Yes, Provides farmers a good yield even in changing climate	Yes, Farmers can get an yield even in the case of an extreme event.	Yes, It will increase access to information among farmers. They can learn new techniques of climate smart farming.	Yes, Farmers will have a better understanding of GHG emissions from the agriculture sector and take steps to reduceemissions.	Yes, Can improve women's livelihood	Very High

According to the Climate Resilient Action Plan Methodology, interventions should be checked for their **feasibility** and **expected impact,** besides **their** resilience potential.

Feasibility can be assessed on the basis of the following criteria:

Technical – the local government has the necessary expertise to implement the project, or can access the required skills; the project is implementable, realistic and suitable to the local conditions and is not mal-adaptive.

Political – the intervention would be acceptable to city leaders and the community, and is consistent with their values and vision.

Financial –the local government can meet the cost, or can access the required funds from the state or the central government; the anticipated benefits of the action will justify the cost; any low hanging fruits that can be implemented quickly with minimal effort and costs.

The impact of the intervention can be assessed using:

- Timeframe – most actions should be completed within a short or medium timeframe.
- Criticality or overall impact - the proposed intervention should have a significant and measurable impact on the targeted climate risk

Table 18: Feasibility and Impact – Example and Exerciseas per the CRCAP Methodology

Potential Climate Resilience Interventions	**Feasibility**			**Time required for the intervention to show impacts on climate change (short/medium/ long term)**	**Overall Impact**
	Technically (high/medium/low)	**Politically (high/medium/ low)**	**Financially (high/medium/low)**		
Roof-top water harvesting to be mademandatory to deal with water stress due toanticipatedincreasing temperaturesanddecreasingprecipitation	High (technology easily available)	Medium(would require achange in building by-laws and building codes)	High (not an expensive option to implement withsubstantial results)	Short Term	High
Climate-smart farming to be introduced to deal with increasing temperature and precipitation	Medium (technology not easily available)	Medium (New policies describes fund available for climate-smart farming)	Medium ()	Medium Term	High

Dynamic Adaptation Model
The Dynamic Adaptation Model (DAM) is developed by the Institute of Water and Flood Management, Bangladesh University of Engineering and Technology (IWFM, BUET). The DAM Tool assists in computingadaptation deficiencies at different vulnerability hotspot areas at the local level and generates a dynamic risk map that can identify priority areas for immediate actions and need for investments for the local authorities. The DAM follows a systematic approach by applying nonlinear programming that computes adaptation deficiencies to minimize future climate risk in selected hotspots and map the changed condition if investment is made for implementation of the selected interventions. This helps policy makers understand the benefits of different interventions and plan and invest effectively to get the maximum benefits from minimum investment. The adaptation model can be used as a tool for risk based planning to decide on appropriate investment options that will minimize future risk including storm surge, salinity, flood, and erosion in the identified hotspots of coastal regions. For more information about the tool, its use and implementation, local authorities can contact the IWFM at BUET.

Integration into the Municipality Plan

The shortlisted interventions and actions should be aligned with existing development plans or programmes. This will help to implement the interventions by using already allocated resources with little or no additional resources.

The stakeholder group and climate core team should identify the appropriate plans and programmes of the local government in which the identified interventions can be included. They should also check the time-frame of the existing programme to ensure it is consistent with the proposed interventions.

Table 19: Linking Resilience Interventions to Ongoing Programmes – Example and Exercise

Resilience Interventions	**Relevant Programmes**	**Ongoing/Upcoming/Planned**	**Can the programme be leveraged? Yes/No If Yes, how?**
e.g. Roof-top water harvesting to be made mandatory to deal with water stress due to anticipated increasingtemperaturesand decreasingprecipitation	Schemes for housing for urban poor	Upcoming (following financial year)	Yes,Design of buildings can be modified to include a roof-top water harvesting and safe storage system.

Module 4: Monitoringand Evaluation

Learning Objectives: The main objective of the moduleis to encourage municipalities to conduct a systematic and comprehensive assessment of targets/interventions/actions through a monitoring and evaluation process and to encourage local bodies to collaborate with other municipalities and agencies.

Local governments must regularly review and report the implementation of resilience interventions against a set time frame. Monitoring and evaluation should always be integrated into the programme to enhance the implementation and achievement of results (UNDP Programme Manual, 2000). The M&E framework can help municipalities keep track of the activities that are scheduled for implementation periodically.

According to the Climate Resilient Cities Action Plan Methodology, the M&E framework should include:

- **An institutional framework for monitoring and evaluation:** The Climate Core Team, led by the senior officials of the Local Authority (Mayor or Commissioner), will act as a task force for the preparation and implementation of the monitoring and evaluation framework of the climate resilience strategy.
- **Performance indicator to measure the achievement of the objective:** It is important to define certain milestones and indicators that will enable consistent monitoring of the annual plans and assessment of results.
- **Periodicity of Review:** The Climate Core Team would meet once in a quarter to monitor the implementation of the annual action plans of the CRS and ensure that the project implementation is on track as per the annual plan. The team would assess project learnings, challenges, and successes that can be fed back into future implementation. Quarterly reviews would allow for mid-course correction, where needed, and allocation of appropriate resources.
- **Process for review of the annual plan of implementation:** The Climate Core Team should monitor the implementation of the overall Climate Resilience Strategy.
- The mechanism for collating and reporting results from project-specific implementation and impact monitoring.

The Climate Core Team can form a framework for monitoring, reporting, and evaluation processes for the execution of each activity. The resilience actions can be differentiated by the departments and the department heads can be responsible for the implementation of all actions assigned to them. The department heads can provide their feedback to the Climate Core Team and the project nodal officer, who can be responsible for the reporting and monitoring of the project. The report should contain key information so that it can be used for decision-making. The Climate Core Team will inform the stakeholder group about challenges and inadequacies in the implementation of activities and submit the status report on the progress. As shown in the figure, the following process can be adopted for the monitoring framework. As

shown in the figure below, the following process can be adopted for the monitoring framework.

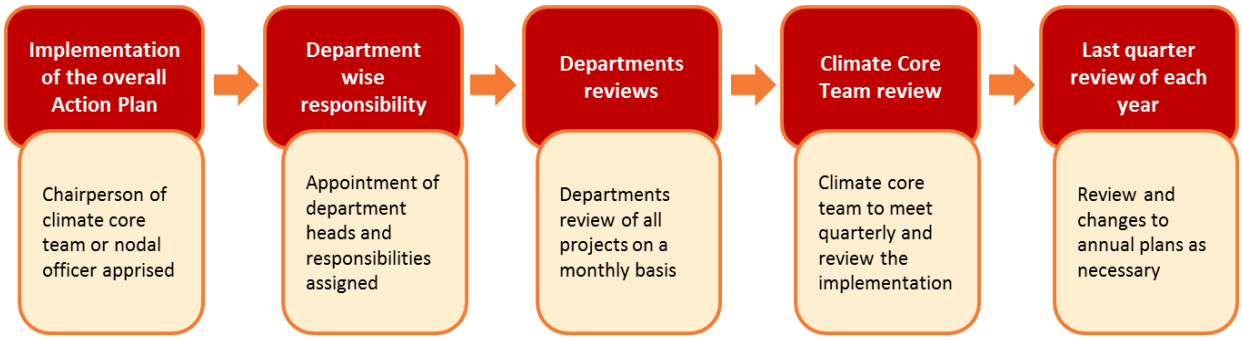


Figure 15: Process of Monitoring of Implementation of Resilience Intervention

The table below providesa draft M&E framework that can be adopted by local governments to suit their needs.

Table 20: Monitoring and Evaluation Framework and Working Exercise

Sector	Resilience Intervention	Timeline	Allocated Budget	Milestones for the Implementation Process	Status of Implementation Process	Climate Change Impact: Annual Mitigation Potential			Climate Change Impact: Annual Mitigation – Reported based on actual implementation		
						Potential energy saving (Million kWh)	Potential fuel saving (unit)	Potential emission reduction (tCO_2e)	Reported energy saving (Million KWh)	Potential fuel-saving	Potential emission reduction (tCO_2e)
Water Supply	Reduce NRW from 30% to 20% by replacing existing old water supply pipeline with ductile iron (DI) pipeline	October 2018 to December 2021	BDT----	Water and energy audit of water supply system Identify most critical areas where water losses are high. Feasibility and detailed project report for replacing old network with new DI network Implementation completed Monitoring impact	The consultant is identified, water audit and energy audit is completed, critical areas are identified Preparation of prefeasibility is in progress.						

Reporting

The ICLEI and CDP Unified Reporting System was jointly launched by CDP Cities and ICLEI - Local Governments for Sustainability in 2019. Local and regional governments can use the tool to report their climate data, keep track of their climate mitigation and adaptation commitments, and monitor plans, actions and performance. It is very important to track climate action and to report it consistently in order to meeting local, regional, national and global climate targets. Reporting helps in getting a clear picture of climate action at the local level, as a way to inform more targeted policy and action. In 2020, 812 cities from 85 countries reported their climate and environmental data through the CDP-ICLEI Unified Reporting System.

ICLEI and CDP support cities, towns and regions with the development of robust reporting practices that enhance transparency, accountability and credibility, encouraging measurable, reportable and verifiable (MRV) local climate action. Data from the Unified Reporting System shows the impact of local climate action and how it can contribute to the NDCs – national climate action plans submitted under the Paris Agreement – and to global climate targets.

By reporting to CDP and ICLEI's Unified Reporting System, local and regional governments can:

- Use its integrated reporting system to make peer-to-peer comparisons.
- Coordinate climate action planning and tracking across levels of government.
- Track mitigation performance over time by reporting greenhouse gas inventories.
- Examine climate hazards through risk analyses.
- Report comprehensive, high quality data to gain visibility and recognition as local climate action leaders.

For more information, please visit https://carbonn.org/pages/about

Module 5: Financing Climate Resilience Initiatives

Learning Objectives: This module serves as a brief guide to the various sources of finance for climate-resilient initiatives. It also provides information on the potential opportunities available for cities and sub-national authorities to mobilise technical and financial resources for implementation of climate resilience initiatives.

Sources of Finance for Climate Resilience Initiatives

TheUNFCCC defines climate finance as “finance that aims at reducing emissions, and enhancing sinks of GHGs and aims at reducing the vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts”.

The global landscape of climate finance has been always evolving. The target of mobilising USD 100 billion a year by 2020 by developed countries for developing countries was first agreed in the Copenhagen Accord in 2009, and confirmed in the Cancun Agreements in 2010 and Durban Platform. In 2015, developed countries agreed to continue mobilising USD 100 billion a year until 2025, and governments agreed to set a new collective mobilisation goal beyond 2025, taking into account the needs and priorities of developing countries.

Climate finance can be mobilised through multiple channelsboth within and outside of the UNFCCC financial mechanism, through bilateral, regional and national funds. Climate finance can be both public and private. **Public sources** include financial resources from multilateral organisations, governments, aid agencies and multilateral development banks. The magnitude of the costs required for transitioning to a low-carbon economy implies that in all circumstances, public budgets will be insufficient to address the financing challenge; therefore, the full strength of the financial sector is needed, inclusive of public and private finance. **Private sources** such as project developers, commercial financial institutions, philanthropies and corporate actors are also explored to leverage funding. In order to identify more funding opportunities, **blended financing** is also being explored, where public and private sources contribute to one fund, reducing the investment risks for the private sector. The types of climate finance available vary from grants and concessional loans, to guarantees and private equity.

Some of the major public channels for climate funds include:

- Funds operating under the UNFCCC umbrella:the two largest are the Green Climate Fund (GCF) and the Global Environmental Facility (GEF), with budgets of USD 10.3 and USD4.43 billion respectively, for the period 2014-2018. While GCF finances both adaptation and mitigation projects, GEF is dedicated largely to mitigation.
- A substantial volume of climate finance is also mobilised through institutions that are not directly under the guidance of the UNFCCC, such as the UN REDD Programme (United Nations Programme on Reducing Emissions from Deforestation and Forest

Degradation) which provides funding to reduce emissions from deforestation and forest degradation in developing countries.

- Development banks at the multilateral, regional, and national level play an important role in financing climate-related projects. Within this framework, the USD 8 billion Climate Investment Funds (CIF) play a crucial role in fostering climate change mitigation and adaptation projects. In 2017, climate financing from the main Multilateral Development Banks (MDB) alone reached USD35.2 billion.

The economy of Bangladesh is based primarily on agriculture, forestry and fishing. It is expected that climate change will lead to a reduction in agricultural gross domestic product (GDP) by 3.1% every year with almost USD 36 billion being lost for the period of 2005-2050. The World Bank (2010) estimates that the costs of adapting to tropical cyclones, storm surges and inland flooding could amount to USD 8.2 billion in Bangladesh, in addition to recurring annual costs of USD 160 million. Approximately USD 40 billion from 2015-2030 will be required for implementing key adaptation measures. As per the NDC of Bangladesh, climate change can lead to an annual loss of 2% of GDP by 2050 and 9.4% of GDP by 2100.

Bangladesh has been successful in mobilizing international climate funds both multilateral and bilateral for implementing climate actions. The major international funds accessed by the GoB include GEF, Least Developed Countries Fund (LDCF), Adaptation for Smallholder Agriculture Program (ASAP), Global Climate Change Alliance (GCCA), CIF, UN REDD Readiness Program and the GCF.

The GEF has funded 43 projects in Bangladesh, with USD 160 million as grant and USD 1,037 million as additional co-financing. The country utilized these funds to combat desertification in the drought prone part of the country and to support an ADB funded sustainable urban transport project. The GEF is managing the UNFCCC funds including the LDCF, SCCF and the ASAP.

Bangladesh accessed funds through three programmes i.e. Pilot Programme for Climate Resilience (PPCR), Scaling up Renewable Energy in Low Income Countries and Forest Investment Programme (FIP) under the CIF. At present, nineprojects are being supported through CIF in Bangladesh.

- Bangladesh accessed USD 110 million through PPCR in 2010. 45% of the fund was provided as grant (USD 50 million) and 55% as highly concessional loan support (USD 60 million) forimproving climate resilient agriculture and food security; strengthening the security and reliability of fresh water supply, sanitation, and infrastructure; and enhancing the resilience of coastal communities and infrastructure in the country.
- Bangladesh accessed USD 75 million in 2015 for scaling up renewable energy in the country through the SREP51. Up to USD 35.75 million from the funds will be provided as grants.
- Bangladesh has been selected among 15 countries to receive funds from the FIP. Bangladesh, with support from World Bank, is preparing an investment plan with a list of projects for consideration under the FIP.

The country has also accessed funds through the GCF and has received USD 351.1 million as grant for five projects out of total project value of USD 517.3 million. The rest of the project cost is co-financed by the country's public and private sectors.

Apart from the above-mentioned funds, some of the multilateral and bilateral development assistance agencies active in Bangladesh include World Bank and Asian Development Bank (ADB) and UN agencies such as UNDP, UNEP, DFID, USAID, SIDA, USAID and GIZ among others.

Considering the uncertainties and inadequacies of international finance support, the GoBtook several measures including adopting a Climate Fiscal Framework in 2014 (updated in 2019) to ensure that the country's public financial management system is climate inclusive, promotes green financing, fosters green banking and establishes dedicated funds.

At present, the GoBspends USD 1 billion annually which is around 6-7% of its annual budget on climate adaptation. Over the last five years (2016-2020), the budget allocation for climate activities increased from BDT 14,323.06 Cr. (USD 1,685.88 million) to BDT 24,225.68 Cr. (USD 2,851.45 million) amounting to 0.8%of the country's GDP for the financial year 2020-21.

Various Platforms and Tools for Financing

Local governments and subnational government entities require significant technical and financial support for the implementation of climate-resilient and sustainability initiatives. While it is important to mobilise financial resources, it is also necessary to ensure the requisite finance reaches cities where it is needed the most. In this regard, there are various platforms and tools that can assist cities with financial resources for identifying and implementing climate-resilient development projects. Some of the important platform and resources available for cities are:

1. Transformative Actions Programme (TAP)

It is often difficult to access climate finance at the local and subnational levels, and where available, the process can be highly complex. The demand for investment-ready projects also calls for expertise and capacity development so that a solid pipeline of transformative local climate projects is built.

TAP – a project pipeline and project preparation facility developed by ICLEI and partners – acts as an incubator that supports local and regional governments by catalysing capital flows for low-to-no emission and climate-resilient development. TAP helps local and regional governments to developclimate project concepts into low-risk, high-feasibility, and high-impact sustainable infrastructure projects. The facility enables linkages between local climate actors, technical experts and financial institutions. For more details, please visit https://tap-potential.org.

2. Global Climate City Challenge (GCCC)

The Global Climate City Challenge is a joint initiative of the European Investment Bank (EIB) and the Global Covenant of Mayors (GCoM), representing over 9000 cities from six continents, to provide technical assistance that helps prepare and fast-track financing of urban climate action projects. The GCoM and the EIB collaborate on this Challenge with global and local city networks, including ICLEI, the C40 Cities Climate Leadership Group as

well as the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). TheGCCC is part of a new partnership under the umbrella of Global Urbis, an ambitious global initiative announced during the One Planet Summit in Paris in December 2017, which provides cities and local governments around the globe with technical assistance and financing for climate action. The GCCC is aimed at municipal and local authorities or entities such as municipal companies, utilities and local banks that are interested in addressing climate change. The basic eligibility criteria is to have project/ programme investment volume of over EUR 30 million or an engagement in a facility, including smaller projects in different municipalities totalling EUR 30 million. For more information, please visit https://www.eib.org/en/projects/sectors/urban-development/city-call-for-proposal/index.htm

3. The Leadership for Urban Climate Investment (LUCI)

The Leadership for Urban Climate Investment (LUCI) is an initiative under the Infrastructure, Cities and Local Action (ICLA) track of the Climate Action Summit. It offers a comprehensive and transformative approach in sealing gaps in the investment value chain by establishing a global financing framework through synergies between countries, international and national financial institutions, international organisations, climate institutions and funds, and other partners. The initiative also seeks to achieve subnational financing by supporting bankable projects, capacity building of national and subnational development banks, and improving financing options. The goals of LUCI are: (a) 2000 cities have strengthened their capacities in project preparation by 2030; (b) 1000 climate-smart urban projects are bankable by 2030; (c) 1000 climate-smart urban projects are linked to finance by 2030; and (d) 100 climate-smart urban projects successfully utilised new financing mechanisms by 2025. For more details, please visit https://climateaction.unfccc.int/views/cooperative-initiative-details.html.

4. Global Covenant of Mayors for Climate & Energy (GCoM)

GCoM is the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and local governments from six continents and 138 countries. In total, they represent more than 800 million people. GCOM is supported by the former New York City Mayor and philanthropist Mr Michael Bloomberg. By 2030, GCoM member cities could account for 2.3 billion tons CO2e of annual emissions reduction, matching annual passenger road emissions from the US, France, Russia, China, Mexicoand Argentina combined. The cities and partners of the GCoMshare a long-term vision of supporting voluntary action to combat climate change, and to work towards a resilient and low-emission society. For more details, please visit https://www.globalcovenantofmayors.org.

5. SouthSouth Triangular Cooperation (SSTrC):

SouthSouth Cooperation is a broad framework of collaboration among developing countries for sharing knowledge, skills, expertise and resources to meet their development goals. While Triangular cooperation promotes collaboration between traditional donor countries and multilateral organisations to facilitate South-South initiatives. SouthSouth Triangular Cooperation has been acknowledged as one of the innovative platform to bring together key stakeholders including public and private sectors, various coalitions and the cooperation of several other key actors for sharing knowledge and enhancing skills, promoting and facilitating technology development and transfer of climate actions. Fifteen developing countries referred directly to SSC in their NDCs, while eight mentioned that they consider SSC to be a complement to North–South cooperation for climate actions, in particular regarding technology transfer and innovation and capacity-building. South-South and Triangular Cooperation (SSTrC) has indeed became an important modality of international

cooperation for development that is contributing to the achievement of the 2030 Agenda for Sustainable Development. For more information: https://www.unsouthsouth.org/about/about-sstc/

Adaptation Fund: The Adaptation Fund was established under the Kyoto Protocol of the UNFCCC, and since 2010 has committed $783 million to support climate adaptation and resilience activities, including 115 adaptation projects that have helped over 27 million total direct and indirect beneficiaries. Since 2019, the Adaptation Fund has also served the Paris Agreement. It is financed largely by government and private donors, and from a 2% share of proceeds of Certified Emission Reductions issued under the Protocol's Clean Development Mechanism projects[26].

Climate Finance Compendium

According to UN Environment, adapting to climate change in developing countries alone will require $280 billion to $500 billion per year by 2050. Also, the Global Commission on Adaptation finds that investing $1.8 trillion globally in priority areas from 2020-2030 could generate $7.1 trillion in net benefits, while minimising the impacts of natural disasters – which could apply to the current pandemic. However, current estimates show that approximately $30 billion was made available in 2017-2018, indicating that there was a huge gap in the funds required for mobilising climate adaptation actions. Most of the dedicated climate funds, such as the Green Climate Fund ($10 billion), the Climate Investment Funds ($8 billion), the Adaptation Fund ($0.75 billion), the Global Environment Facility ($4 billion) and the Least Developed Countries Fund (LDCF) ($1.6 billion) among others, can also be tapped for building the resilience of the urban system so that cities are more ready to deal with both climate-related impacts and pandemics.

In this regard, ICLEI South Asia through the Climate Development Knowledge Network (CDKN) has prepared the Climate Finance Compendium after assessing various climate finance instruments available to South Asian countries, particularly, India, Bangladesh and Nepal. This compendium provides detailed information about specific funds, including the eligibility criteria, focus and application procedure.

Green Climate Fund – Bangladesh
Bangladesh has received support from GCF amounting to USD 94.7 million for four projects. The projects are as follows: • Increasing the resilience of poor, marginalized, and climate-vulnerable communities in flood-prone areas of Bangladesh:The project was approved in 2019 with an overall cost of USD 13.3 million. GCF funds 72.7% of the project i.e. approximately USD 9.7 million. • Removing barriers in the development of a sustainable market for the adoption of improved cook stoves in Bangladesh:The project was approved in 2018 with an overall project cost of USD 40 million. GCF funds 50% of the project. • Enhancing adaptive capacities of coastal communities, especially women, to cope with climate change-induced salinity:The project was approved in 2018 with an overall project cost of USD 33 million. GCF funds 75.7% of the project. • Climate resilient infrastructure mainstreaming:The project was approved in 2015 with an overall cost of USD 81 million. GCF funded 49.4% of the project.

- Promoting private sector investment through large scale adoption of energy saving technologies and equipment for textile and readymade garment (RMG) sectors of Bangladesh:The project was approved in 2020, with total value of USD 350 million. Out of this, GCF funds USD 250 million as loan and USD 6.48 million as grant while the remaining amount is co-financed by IDCOL and other private sector entities.

Endnotes

[1] Department of Agriculture, Water and Environment, Australian Government.'Understanding climate change'. *Australian Government – Department of Agriculture, Water and the Environment website*.Retrieved from:https://www.awe.gov.au/science-research/climate-change/climate-science/understanding-climate-change

[2] American Geosciences Institute. 'What is the difference between Weather and Climate?' *American Geosciences Institute website.* Retrieved from: https://www.americangeosciences.org/critical-issues/faq/difference-between-weather-and-climate

[3] United Nations. (1992). *United Nations Framework Convention on Climate Change*. United Nations Climate Change (UNFCCC).Retrieved from: https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

[4]Allen, M.R., O.P. Dube, W. Solecki, F. Aragón-Durand, W. Cramer, S. Humphreys, M. Kainuma, J. Kala, N. Mahowald, Y. Mulugetta, R. Perez, M.Wairiu, and K. Zickfeld, 2018: Framing and Context. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter1_Low_Res.pdf

[5] Moore, R. (2019). *IPCC Report: Sea level Rise is a Present and Future Danger.* The Natural Resources Defense Council. Retrieved from: https://www.nrdc.org/experts/rob-moore/new-ipcc-report-sea-level-rise-challenges-are-growing

[6] Oppenheimer, M., M. Op. cit

[7] Oppenheimer, M., M. Op. cit

[8]United Nations Environment Programme. 'Mitigation'. *UNEP Website*. Retrieved from: https://www.unep.org/explore-topics/climate-action/what-we-do/mitigation

[9]Sustainability For all. 'Mitigation and Adaptation to Climate Change'. Sustainability For all. Retrieved from: https://www.activesustainability.com/climate-change/mitigation-adaptation-climate-change/?_adin=11551547647

[10]Gawler, S. and Tiwari, S. (2014).*ICLEI ACCCRN Process*. ICLEI South Asia. Retrieved from: https://southasia.iclei.org/wp-content/uploads/2021/08/ICLEI-ACCCRN-Process-IAP-A-toolkit-for-Local-Governments.pdf

[11]Denton, F., T.J.Wilbanks, A.C. Abeysinghe, I. Burton, Q. Gao, M.C. Lemos, T. Masui, K.L. O'Brien, and K.Warner, 2014: Climate-resilient pathways: adaptation, mitigation, and sustainable development. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental P?anel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1101-1131. Retrieved from:https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap20_FINAL.pdf

[12]World Economic Forum; These four numbers define the importance of our cities: 2, 50, 75 and 80 (2016); Retrived from: https://www.weforum.org/agenda/2016/12/technology-and-the-future-of-our-cities/

[13] The World Bank; Urban Development (2020); Retrieved from: https://www.worldbank.org/en/topic/urbandevelopment/overview#1

[14] The World Bank; Urban Development (2020); Retrieved from: https://www.worldbank.org/en/topic/urbandevelopment/overview#1

[15] United Nations Environment Programme. 'Cities and Climate Change'. *UNEP website*. Retrieved from: https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/cities-and-climate-change

[16] Oppenheimer, M., M. Op. cit.

[17] United Nations. (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030.* United Nations Office for Disaster Risk Reduction website. Retrieved from: https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

[18] Ministry of Environment and Forest, Government of the People's Republic of Bangladesh. (2015). *Intended Nationally Determined Contribution*. UNFCCC website. Retrieved from:https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf

[19] Ibid.

[20] Ministry of Finance, Government of the People's Republic of Bangladesh. (2020). *Climate Finance for Sustainable Development.* Ministry of Finance website. Retrieved from: https://mof.portal.gov.bd/sites/default/files/files/mof.portal.gov.bd/page/6e496a5b_f5c1_447b_bbb4_257a2d8a97a1/2020-2021_Climate_BR_English.pdf

[21] Petrosillo I., Aretano R. and Zurlini G. (2015). 'Socioecological Systems'. *Reference Module in Earth Systems and Environmental Sciences*. Elsevier. Retrieved from: https://www.researchgate.net/publication/281630887_Socioecological_Systems/link/59f6f009458515547c232baa/download

[22] USAID. (2015). *Climate Change Information Fact Sheet Bangladesh*. Climate Links website. Retrieved from:https://www.climatelinks.org/sites/default/files/asset/document/Bangladesh%20Climate%20Info%20Fact%20Sheet_FINAL.pdf

[23] Ibid.

[24] Ibid.

[25] Gawler, Tiwari, op.cit.

[26] ICIMOD. (2021). 'ICIMOD's Adaptation Fund accreditation paves the way for strengthened regional cooperation on climate change adaptation in the HKH'. ICIMOD website. 22 Feb. Retrieved from: https://www.icimod.org/icimods-adaptation-fund-accreditation-paves-the-way-for-strengthened-regional-cooperation-on-climate-change-adaptation-in-the-hkh/

This work was carried out with the aid of a grant from the Ministry of Foreign Affairs of the Netherlands and the International Development Research Centre (IDRC), Canada, as part of the Climate and Development Knowledge Network (CDKN) Programme. The views expressed herein do not necessarily represent those of the Ministry of Foreign Affairs of the Netherlands, or of the International Development Research Centre (IDRC) or its Board of Governors, or of the entities managing CDKN.