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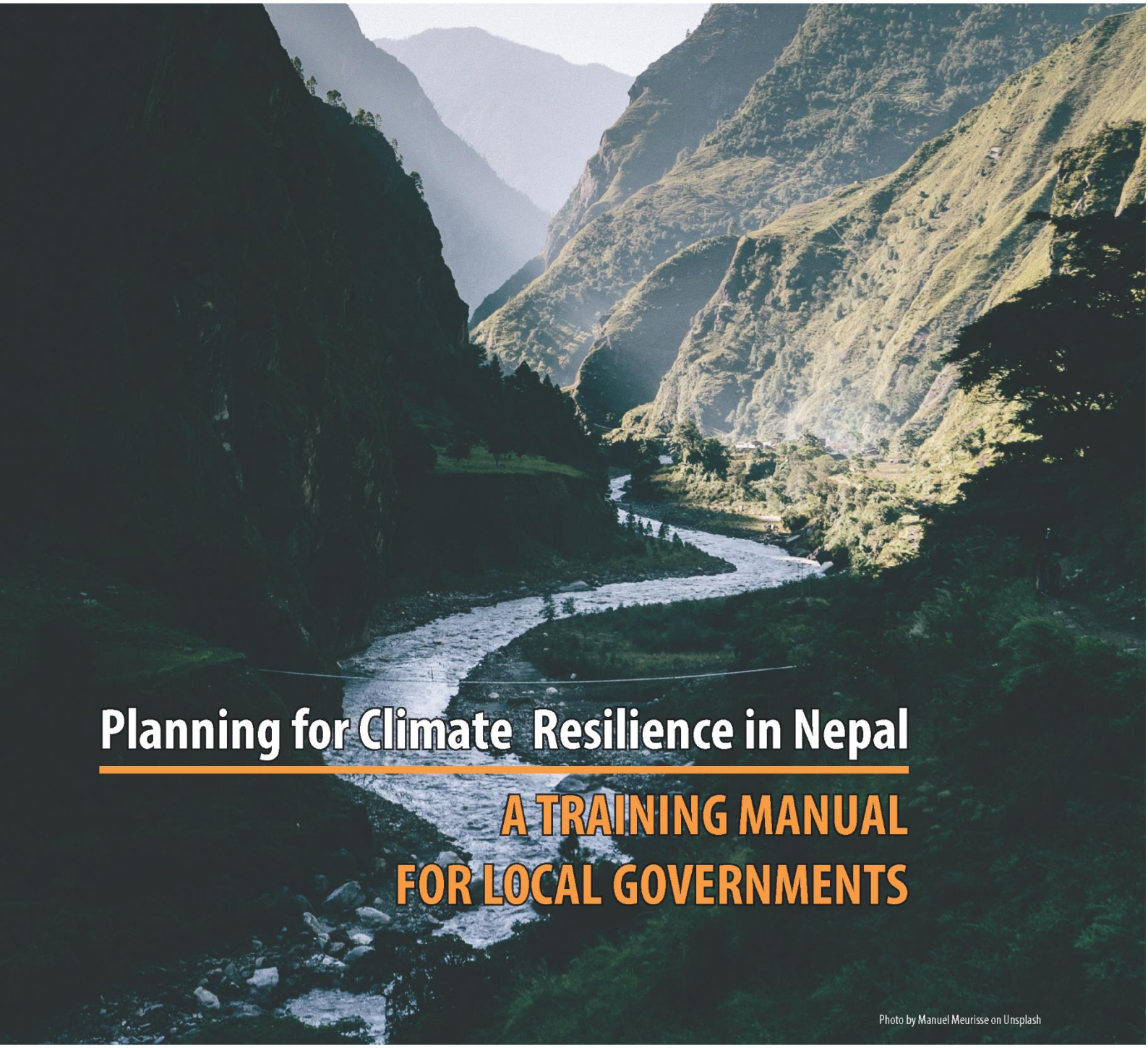

Planning for Climate Resilience in Nepal

A TRAINING MANUAL FOR LOCAL GOVERNMENTS

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Introduction

Climate change induced hazards, such as rising temperature, uncertain rainfall, heat stress, drought and floods are imposing significant stresses on the Himalayan region, leading to disruption of infrastructure and other socio-ecological systems in urban and rural areas. Improper developmental planning and insufficient preparedness in dealing with these hazards can lead to human fatalities and loss of property and infrastructure. Proactive and responsive actions to build resilience at the local level through an inclusive, participatory climate resilience strategy can help local governments deal with these challenges effectively.

This training manual has been developed to help local authorities in rural and urban areas, as well as decision-makers and practitioners to prepare a climate resilience strategy that can address climate mitigation and adaptation aspects through consultative participation of local stakeholders. ICLEI - Local Governments for Sustainability, South Asia – the Asia Coordinator for Climate and Development Knowledge Network (CDKN) – and the International Centre for Integrated Mountain Development (ICIMOD) have jointly developed this training manual under the CDKN's Knowledge Accelerator Programme.

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 and ICIMOD's Resilient Mountain Solutions (RMS) Framework. The CRCAP tool, developed as a part of the CapaCITIES project, provides local governments stepwise guidance in preparing climate resilience plans. The CapaCITIES project is being funded by the Swiss Agency for Development and Cooperation (SDC). The climate resilience action plan tries to tackle the issues of climate change mitigation and adaptation and their interconnections. 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. Under the RMS Initiative, ICIMOD and the National University of Singapore have jointly developed resilience markers, which take the systems thinking route to isolate causalities, and identify non-linear behaviour in structural components. This helps to pinpoint key components that influence the system's behaviour, which can be used to ensure its adaptability.

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 strategies for local governments of Nepal and other Himalayan countries.
- Enable local authorities to identify and engage with relevant stakeholders for collaborative planning and inclusive 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 of Nepal and other Himalayan countries for the implementation of resilience interventions.

The training manual is divided into separate modules, which are:

- **Module 1 – Introduction to Climate Resilience**: 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 and inclusive climate resilience strategies. It also gives a brief introduction to different global agreements on climate and disaster risk reduction.
- **Module 2A – Engagement Process:** It helps local authorities to map out the stakeholders in the region, to engage and consult with them effectively and collaboratively develop a climate resilience strategy. It outlines the benefits of engaging with different stakeholders, including marginalised groups, for climate planning.
- **Module 2B - Baseline Assessment with a Climate Lens:** The module outlines the need for and the means of conducting a baseline assessment of the existing scenario in the municipality, with respect to infrastructure, socio-ecological systems, ecosystem services, climate and emissions.
- **Module 2C – Climate Risk and Vulnerability Assessment:** The module provides a simple method of conducting a risk and vulnerability assessment at the local level, with minimal external assistance. It will help local authorities to identify the areas/sectors and populations/stakeholders that face the highest risk of adverse climate change impacts.
- **Module 3 - Development of Climate Resilience Strategy:** This module will help the participants bring the information collated in the previous steps and consolidate it to develop a resilience strategy with interventions for climate mitigation and adaptation and a plan to implement them.
- **Module 4 - Monitoring, Evaluation**, **and Upscaling:** This module outlines the method of monitoring and evaluating, and upscaling the implementation of the resilience strategy developed by the local government.
- **Module 5 - Financing Climate Resilience Initiatives:** This module gives some information on the available financial sources or tools to support the implementation of climate resilience actions locally.

Figure 1 shows the resilience planning methodology that is outlined in the modules in the training manual.

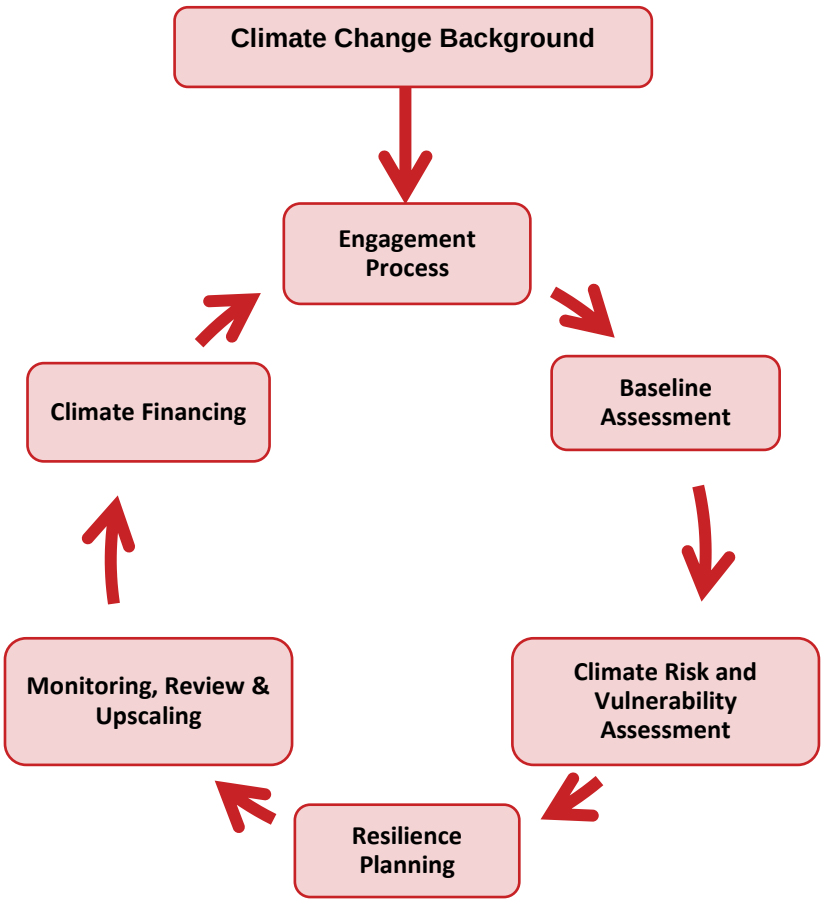


Figure 1: Course Content and Methodology

Target Groups/Audience

The training programme has been developed for the following participants:

(i) Senior to mid-level municipal officials, such as, environment officers, environmental engineers, health officers, planners and other decisions makers 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.

Module 1: 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 solar energy and heating up of the earth include water vapour, carbon dioxide (CO_2), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF_6), methane (CH_4), and nitrous oxide[1] (N_2O).

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 produce large 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 small period, for example, 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, Nepal has a sub-tropical and temperate climate**.**

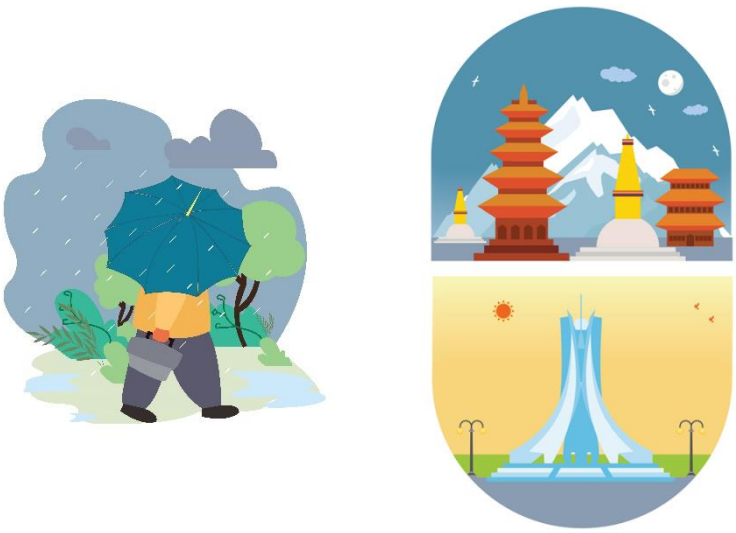


Figure 3 Weather and Climate

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[3].

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 directly or indirectly by anthropogenic actions that change the atmosphere's composition, besides the natural variations in climate that can be observed over comparable periods[4].

Example of climate change:

- **Increase in average temperature:** The rise in the atmospheric temperature caused by human activities reached approximately 1°C above pre-industrial (1850-1900) levels in 2017. During the 2006–2015 period, the temperature rise was 0.87°C (±0.12°C), as compared to the pre-industrial times. If this rate of warming persists, global temperatures would rise by 1.5°C by 2040. (IPCC Special Report on the impact of a 1.5°C rise in global temperature 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, 2018[5]).

Hazard, Disaster and Risk

Hazard, risk and disaster are defined as follows by the IPCC's fifth assessment report (IPCC, WGII AR5, Emergent Risks and Key Vulnerabilities, 2018)[6]:

Hazard:"*A natural or anthropogenic event, trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss of property, livelihoods, ecosystems, infrastructure, service provision and natural resources is called a hazard[7]".*

Disaster: If a hazardous event severely disrupts the normal functioning of a community or a society, causing widespread destruction to human lives, property, the economy and the environment, among others, leading to the need for an emergency response, it is termed a disaster.

Risk: "*Often represented as the probability of occurrence of hazardous incidents, trends multiplied by the impacts resulted from the interaction of vulnerability, exposure, and hazard"*[8].

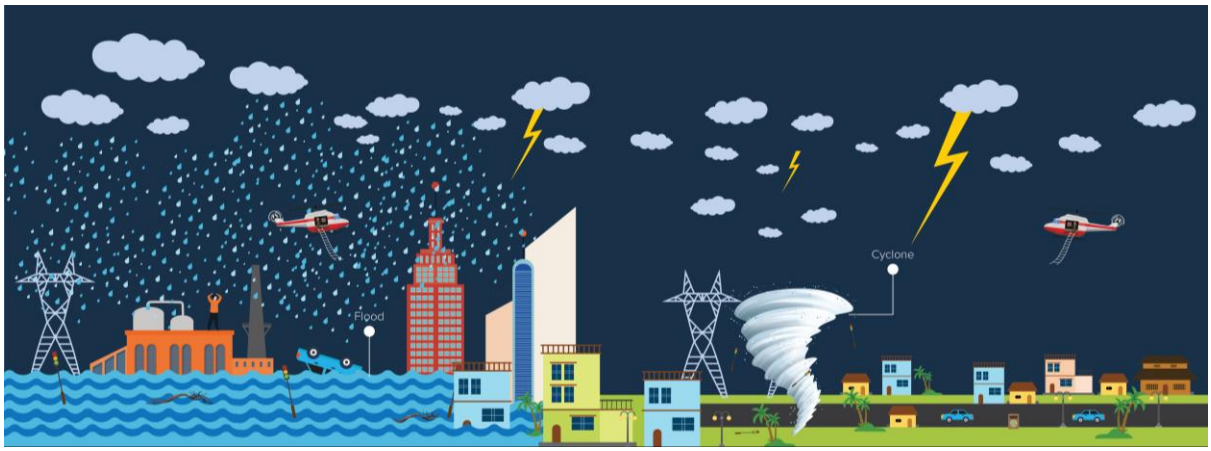


Figure 4: Hazard and Disaster

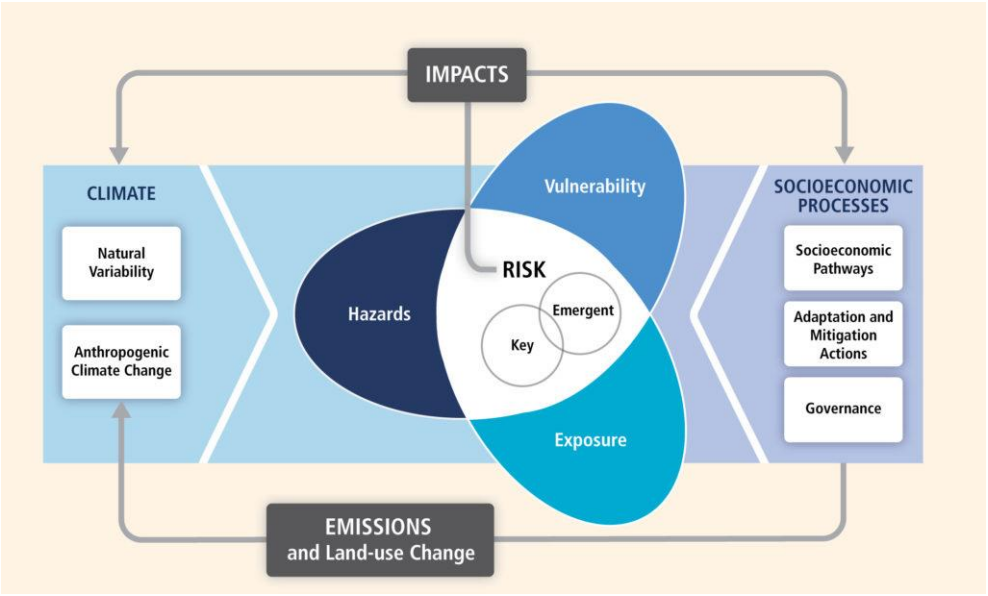


Figure 5: Schematic of the interaction between the physical climate system, exposure and vulnerability producing risk[9]

Climate Mitigation

Climate mitigation means the reduction of GHG emissions 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[10]. 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 Mitigation Measures

Climate Adaptation

Climate Adaptation means altering the natural or human systems in response to current or anticipated climatic change or its impact. Adaptation helps 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[11].

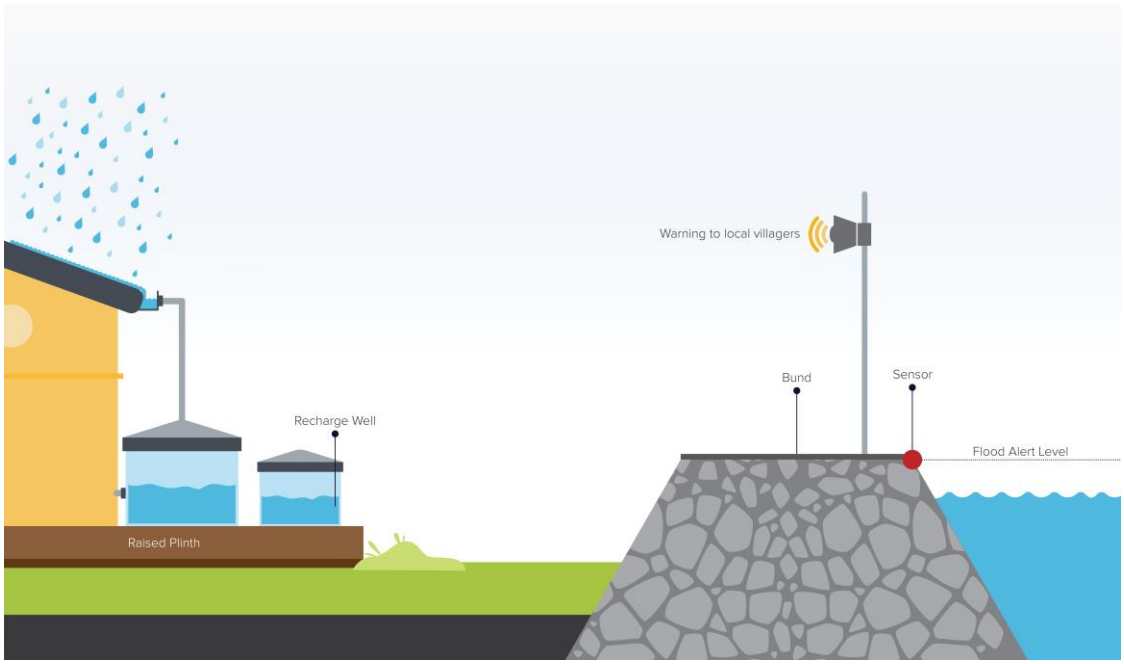


Figure 7: Adaptation Measures

Disaster Risk Reduction

Strategies that assist to reduce risks and vulnerability to disasters, and prevent or restrict adverse impacts of climatic hazards within the broad context of sustainable development come within the purview of disaster risk reduction.

Box 1: Mal-adaptation

Sometimes, when we undertake certain adaptation activities that focus on a sector or a group of stakeholders, it may inadvertently increase the vulnerability of a second sector or second group of people. It may also increase greenhouse gas emissions. This is known as mal-adaptation. For example, the embankments of rivers, built to prevent flooding, can be mal-adaptive if the river shifts its course.

Climate Resilience

Climate resilience is described as 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, as we will

be discussing in the training programme, is a combination of climate mitigation and climate adaptation interventions.

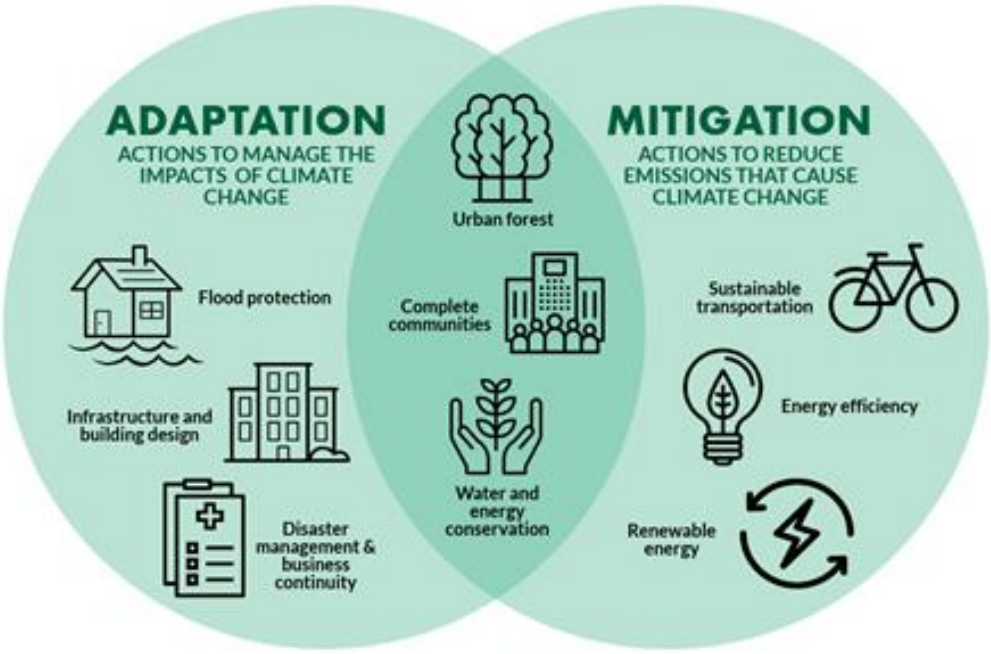


Figure 3: Building Climate Resilience (Source: ICLEI Canada)

What can be described as a Resilient City/Town/Village[12]?

- 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.
- The resilient city/town utilises available 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 to reduce 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.

Climate Change in the Context of Cities

Cities as Drivers of Climate Change

On a global scale, cities occupy approximately 3% of the area, house half of the population, consume about 75% of the energy resources and are responsible for 80% of the emissions[13].

According to World Bank, 55% of the global human population, i.e. 4.2 billion, lives in cities. This means that nearly seven out 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.

The rate of urbanisation in Nepal is one of the fastest in South Asia, though it's mainly concentrated in a few medium and large cities, especially in and around Kathmandu valley[15].

Urban municipalities can thus have a significant role as drivers of climate change and also provide opportunities to mitigate its impact and adapt to it.

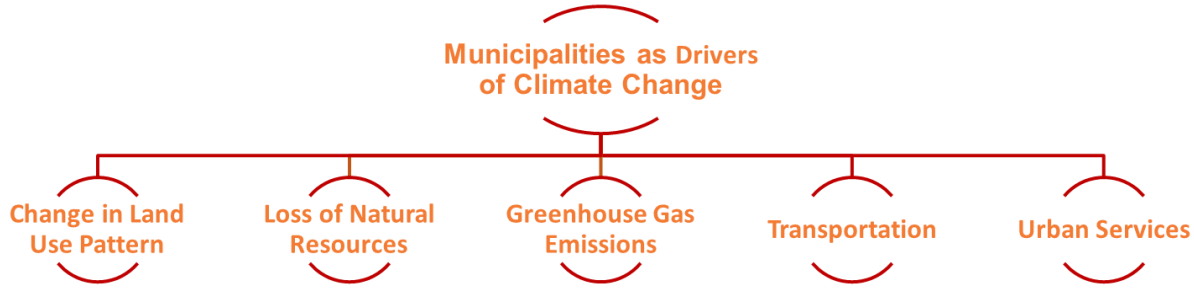


Figure 4: Municipalities as Drivers of Climate Change

Urban heat Island effect - Urban areas that have a 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 (Source: EPA).

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[16] (Earth.org).

UN has estimated that cities account for 75% of the global carbon emissions. The largest contributors of these emissions are the transport and building sectors [17](Cities and Climate Change, n.d.).

How Climate Change Impacts Himalayan Cities/Towns/Rural areas

Himalayan cities, towns, and villages support a large population and several economic activities while being highly vulnerable to climate change. Some of the climate change impacts in this region include:

- Rising temperature can result in heat stress and drought-like conditions, impacting health and water services, agriculture, and food security.

- Changes in precipitation or sudden intense rainfall can cause flooding and impact infrastructure, agriculture, and groundwater or spring recharge.
- A rise in temperature can create conditions that are conducive to the growth and spread of vector-borne diseases.
- Climate change can increase the intensity and recurrence of extreme events such as flash floods, landslides, droughts, and heat waves that can damage infrastructure and cause loss of lives and livelihoods.
- Impacts on agriculture and infrastructure can severely affect food security, nutritional security, livelihood, the value of land, human lives, and the economy.

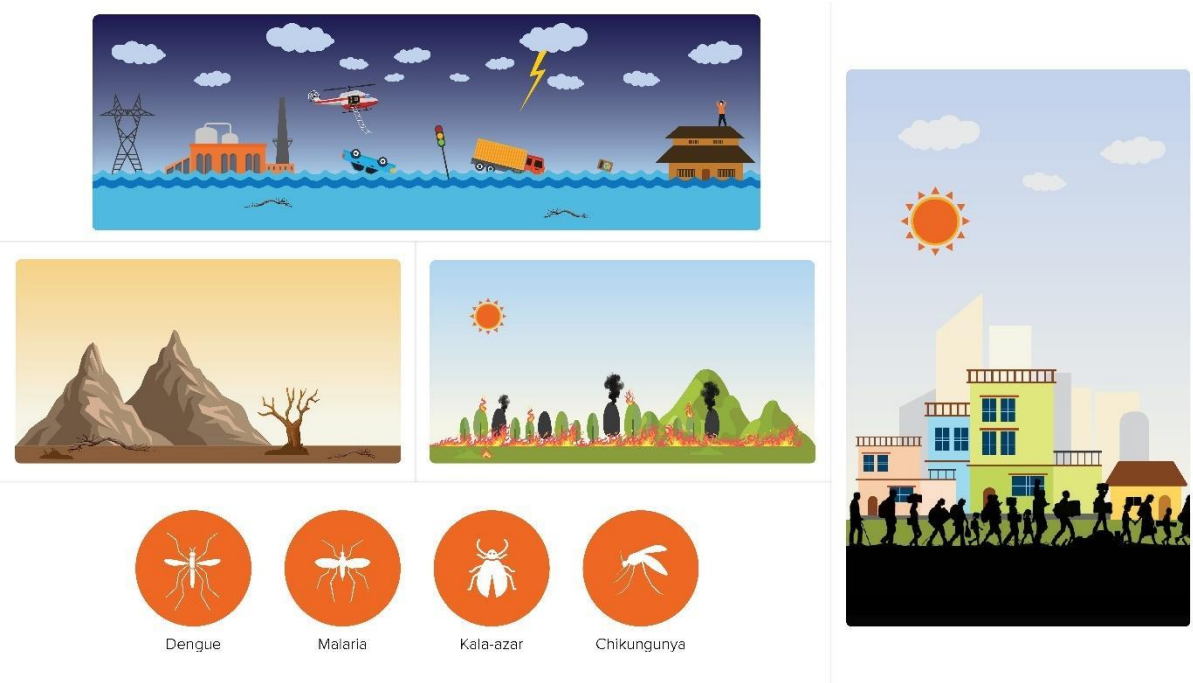
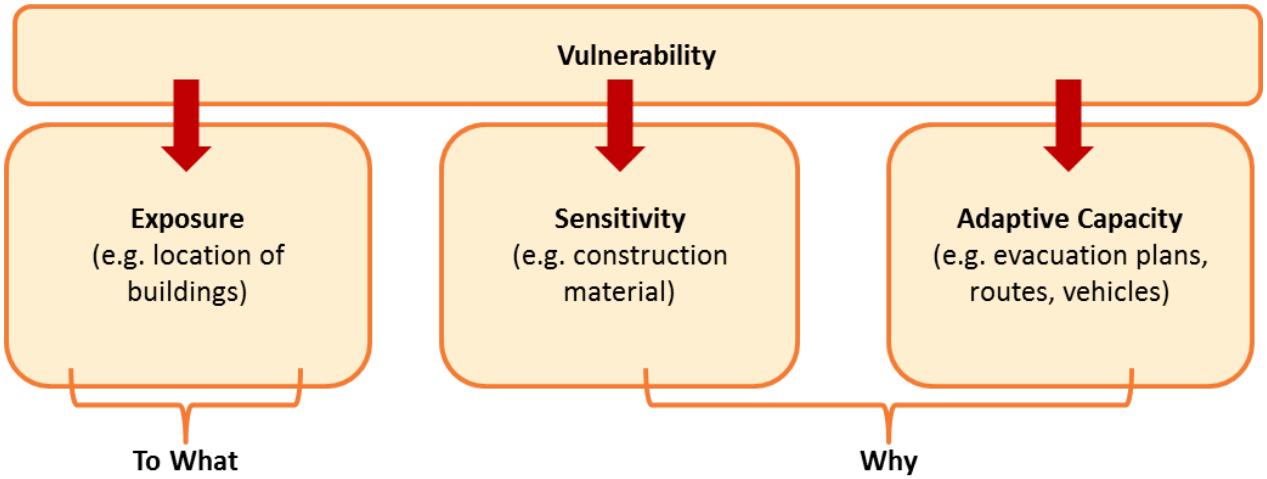


Figure 5: Climate Change Impact on Municipalities

Vulnerability

As per the IPCC's fifth assessment report (WGII AR5, 2018), "vulnerability is defined as the propensity or tendency to be adversely affected. Vulnerability depends upon a variety of factors such as the the sensitivity of a system to harm and its ability to respond to threats[18]".



As per the ICLEI ACCCRN Process, vulnerability is assessed in terms of who or what is vulnerable to what and why[19].

Who or What: Population groups, zones/wards, and sectors (e.g. infrastructure for drinking 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, all people of Nepal are vulnerable to rising temperatures and changes in precipitation. However, farmers whose livelihood is highly dependent on climate are more vulnerable to sudden climate shocks or stresses as are the urban poor with limited financial resources.

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: The idea of equality gives equal consideration and value to the behaviour of men, women and different social groups, as well as their aspirations and needs.

Equity*:* This concept means extending fair treatment to women, men and different social groups, as per their respective needs, and could include benefits, opportunities, rights and obligations that are different but implied to be equivalent.

Equity is the process and Equality is the goal.

Inclusive participation: This is a way of engaging women and men of all ages, backgrounds and identities that allows them to voice their opinions, concerns and experiences, resulting in meaningful action. This means giving space to everyone for identifying problems and finding solutions, and ensures that each one has equal respect, power and protection during the planning process.

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

Figure 6: Integrating Social Inclusion in Resilience Planning (adapted from CDKN Gender Toolkit)

Global Agreements

The Paris Agreement[20]

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 enforced in 2016. As of January 2021, 190 parties have ratified the Paris Agreement.

The treaty provides a framework for "climate actions that include mitigation of and adaptation to climate change, transparent reporting, and strengthening of climate goals[21]", and provides 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), where they 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.

Key Highlights of Nepal NDC

Nepal's NDCs consist of targets based on sectoral activities[22].

- '*Increase clean energy generation by 2030 from approximately 1400 MW to 15,000 MW; 5-10% of this will be powered by solar and wind energy, and mini- and micro-hydro power sources'.*
- *Ensure that clean energy sources provide 15% of the total energy demand by 2030.*
- *'Increase the sale of electric vehicles by 2025; with 25% of all private passenger vehicles being sold, including two-wheelers, and 20% of all four-wheeler public passenger vehicles being sold being electric. Meeting these targets would reduce the dependency on fossil fuels by 2% by 2025'.*
- *'Treat 380 million litres/day of wastewater before their discharge into natural courses, and manage 60,000 cubic metres/year of faecal sludge by 2025. These two activities together will reduce 258 Gg of carbon emissions'.*

Agenda 2030 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, promotes actions to develop urban centres and communities that are safe, inclusive, sustainable and resilient, and
- Goal 13, 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.

Sendai Framework for Disaster Risk Reduction (2015-2030)[23]

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 disasters by implementing integrated and inclusive socio-economic, cultural, health, educational, structural, political, environmental, technological, legal and institutional measures that prevent and reduce vulnerability to disasters and exposure 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.

i. In addition to seven targets, the Sendai Framework outlines four priority areas for action on disaster risk reduction. These action areas include assessing, recognising, and appreciating disaster risks, enhancing governance mechanisms for better management of risks, financial investments for increasing resilience to disasters and improving preparedness and early action to better respond to disasters, and supporting “Build Back Better” in the post-disaster situation.

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

Module 2 (a): Engagement Process

Learning objectives: The key learning objective of Module 2 (a) is to identify the stakeholder landscape for climate resilience planning and the different ways of involving them. The section helps in understanding the need for stakeholder engagement and provides means of engaging with stakeholders systematically.

The engagement process provides an opportunity to bring all relevant and important stakeholders on a single platform for the development of an inclusive and collaborative Climate Resilience Strategy. Climate change is a cross-sectoral issue. Therefore, identification of stakeholders (both inside and outside of the local body administration) and regular coordination with them are key steps for engagement with local authorities. This section helps municipalities to form an institutional mechanism to help in coordinating or implementing the Climate Resilient process. It will assist in identifying and work effectively with stakeholders to define and implement the climate action plan process.

Formulation of a Climate Core Team

Engaging municipal officials from different departments, with different areas of expertise and vantage points, is an important early step.

- The Climate Core Team could include representatives of various departments, who are responsible for or have an impact on, pollution, development planning, waste, energy use, food security, ecosystem services conservation, water security, agriculture, transportation, public health, infrastructure and local economic development.
- 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.
- The team should have a gender expert who can lead the process of mainstreaming gender and ensure that gender is integrated into the data that is collected, analysed and processed for final implementation.
- The presence of a Project Nodal Officer in the core team – to act as a focal point - is important. The core team members, with their positions and responsibilities, should be listed clearly and the information updated as and when necessary.

Existing committees with similar roles and responsibilities within the municipality can be considered to be the ‘Climate Core Team’ as long as they agree to take part in the preparation and implementation of climate-resilience strategies in the development plan. The climate core team needs to synchronise the required cooperation and communication with all relevant departments of the municipality as well as other important stakeholders.

Table 1: Members of the Climate Core Team[24] – Example (based on CRCAP Toolkit)

Name	Position	Responsibility
Ms. W	Chairperson/CAO	Supervise the core team's work and provide management support
Mr. X	Project Nodal Officer	Coordinate the core team's activities and ensure its smooth functioning
Ms. Y	Member	Coordinate activities with the Water Resources department
Ms. Z	Member	Coordinate activities with the Forest department

Stakeholder Group

It is difficult to prepare a comprehensive, practical, unbiased, and data-driven resilient strategy without the involvement of stakeholders. Representatives from different sectors/communities generally bring the latest data and challenges related to their sectors in the discussion**.**

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

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

The stakeholder group should represent the different interests of various sections of society in the municipality. The core team must ensure gender and social inclusion in the stakeholder group.

Figure 8: Stakeholder Group Member

The following table can be completed to develop the stakeholder group in the municipality making sure that the identified stakeholders are not a homogenous group but from different socio, economic and cultural backgrounds.

Table 2 Identification of Stakeholder Groups[25] (based on CRCAP Toolkit)

Category/Sectors	Government (local, provincial national)	Local NGOs	Research Institutions	Community Representatives	Private Sector	National and International Funding Agencies
Can potentially provide information contributing to the development of the CRS						
Can be involved in the implementation of the CRS						
Their support will be essential for implementing the CRS						
They are most affected by the implementation of CRS actions developed or supported by other groups						

Climate change and urbanisation affects everyone, but the ability to cope with its impacts varies between and among women and men of different social groups. Women worldwide are disproportionately at risk of being impacted by climate change because of limited decision making power. This is also true for women living in the Hindukush Himalayan (HKH) region, whose livelihoods are often directly dependent on natural resources. This is particularly true for informal urban communities where women face the double burden of lack of resources along with climatic hazards. There are significant differences in adaptive capacity among men and women from various urban communities depending on their economic and social status, gendered roles and responsibilities in households and communities, and gender-based differences in economic opportunities. In addition, different communities and stakeholders have differences 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, access to assets all contribute to the differences in the impacts felt due to climate change on different communities and stakeholders.

Reducing the vulnerability of women an reduce the overall vulnerability of the city. Women's roles as primary caregivers of their families as well as protectors and managers of mountain biodiversity and natural resources gives them enough experience and traditional knowledge, to enable them to play a vital role in carrying out climate actions.

To ensure that equity and participation in planning and designing climate actions, it is first necessary to understand the differentiated impacts of climate change in a community and to make sure that everyone benefits equally by having their voices heard at every step of the planning process. 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 alert us towards the challenges faced by individuals, and develop strategies that are 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 the hormonal activities within the body[26]. • 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[27]. • 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 the way individuals are perceived and are expected to think and act. Gendered identities are influenced by class, caste, culture, religion, place as well as family dynamics. Gender is a complex and sensitive issue, making it important to understand the way it could affect the climate vulnerability assessment process.

Differences in gender-specific roles and identities determine the access and control over important resources. More often than not, these roles, responsibilities and behaviour expectations allow men to have better control over resources, leading to an unequal relationship between women and men. Unequal control over and access to resources result 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 low income group	Increased burden of collecting water for their families by spending many hours daily in lining up for free water Utilising more funds/money from their income to buy clean water	Providing extra resources for the purchase of water
Increase in precipitation or sudden rainfall	Flooding leading to the destruction of livelihoods and homes	Living in temporary shelters causes concern for security and safety Women are burdened with extra domestic work such as collecting safe water and cleaning their homes Women have to let go of productive work to look after the house and family	Additional burden of repair of homes. Impact on livelihood Loss of income opportunities and loss of jobs Migration

Communications Plan

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

It is important to note that communication is a two-way process. While developing a communication plan, the focus should not be on just conveying messages to the stakeholders but it should be on consultative feedback to make sure that the planning process is responsive, transparent, inclusive, and accountable.

- It is important to understand that one is working with people that have varying levels of education and understanding (from government officials to community members, slum dwellers to small business owners, children, and the 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.
- Conveying **complex science** in easily understandable formats/language is important, and it is important to not just inform about the numbers and targets, but also about the relationship to day-to-day life.

The Communications Plan may contain the following:

- Target audience
- Key messages and steps of communicating
- 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 group, should collect the baseline information to understand the existing situations of different infrastructure and socio-ecological systems and services. The objective is to identify the availability of required data to assist the climate change resilience analysis.

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

- Preparation of City/Town/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 city/village/town and local authority: 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 basic service systems or socio-ecological systems. It should also collate information related to service 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.

It will also include the major initiatives undertaken on sustainability, energy, climate, resource management, and any major projects on municipality 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 “quantity of CO2 and other 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[28]”. The first step taken in preparing a plan to cut GHG emissions and reduce energy use is the development of a GHG inventory. The inventory provides the

necessary baseline data to understand current patterns of energy consumption and GHG emissions in different sectors. It helps to identify the sectors where climate mitigation actions should be undertaken to reduce the GHG emission levels from the city/village. It helps to set city/village specific targets for emission reduction and monitors the achievement of these targets[29].

Broadly, the development of a GHG emissions inventory involves the following steps:

- The Global Protocol for Community-scale Greenhouse Emission (GPC) framework supplies information regarding the type and amount of data that needs to be collected to prepare 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 software that are available. The HEAT plus software[1] developed by ICLEI is one such software that is available for a nominal price to the local governments who are interested in preparing their GHG emission inventories. The HEAT plus has numerous countries' emission factors and energy density values mapped already. Once all data is collected and populated into the HEAT plus, the software can estimate the GHG emission inventory report automatically. ICLEI South Asia provides in-depth training to local and subnational authorities on accounting and reporting GHG emission using HEAT plus based on demand.

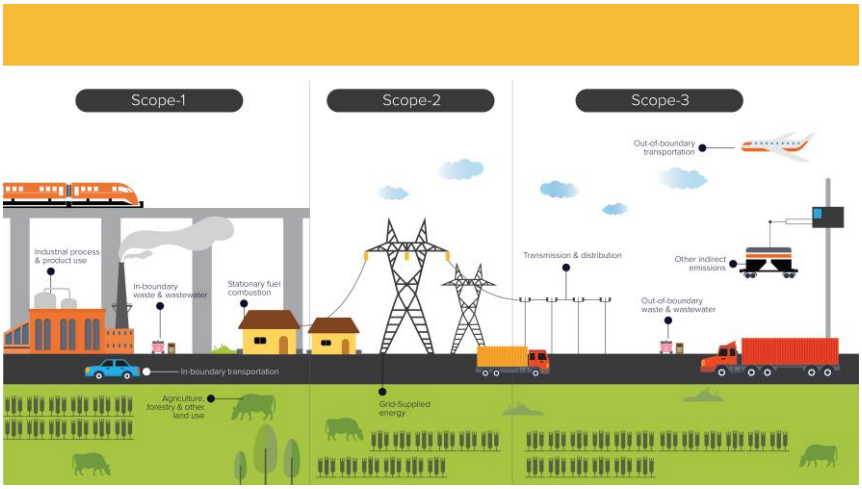


Figure 9: Scopes distinguish GHGs emissions based on where they physically occur (Within or Outside the municipal boundary)

[1] Source: HEAT plus is an online GHG emissions inventory tool, which helps local governments account for GHG emissions, Common Air Pollutants (CAP) and other Volatile Organic Compounds (VOC). More details: http://heat.iclei.org/

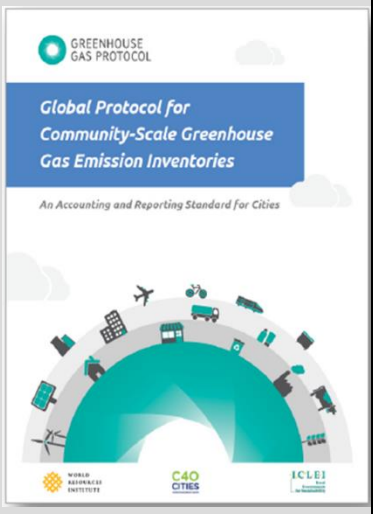
Box 2: GHG emissions are (relatively) simple to calculate[30]:

Activity data x emissions factor = GHG emissions

- **Activity data:** Amount of energy used in a sector (e.g., volume of fuel used) OR measurement of GHG emissions generating activity (e.g. mass of municipal waste)
- **Emissions factor:** Mass of GHG emitted per unit of activity data (E.g. kg of CO2 released for a unit volume of fuel) OR (e.g. kg of CH4 per unit mass of municipal waste in landfill)

Box 3: The Global Protocol of Community-Scale GHG Emission [31]

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 local governments develop a complete GHG inventory to plan for climate action..
- Ensure regular monitoring and reporting of GHG emissions.
- Assist local governments to internationally report on their climate actions.
- Showcase the role of local governments in dealing with climate change.

Box 4: The Harmonized Emissions Analysis Tool plus [32](HEAT+)

- The HEAT+ or the Harmonized Emissions Analysis Tool plus is a online emissions inventory tool, developed by ICLEI to help local governments calculate emissions such as GHGs, Common Air Pollutants (CAP) and other Volatile Organic Compounds (VOC). The software helps to develop an emissions inventory, support the reporting of Scope-1 Scope-2 and Scope-3 local GHG emissions, prepare a forecast of the emissions, identify locally relevant targets, undertake emission reduction actions, and monitor progress.

The HEAT+ tool 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 CDP – ICLEI Track – 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/

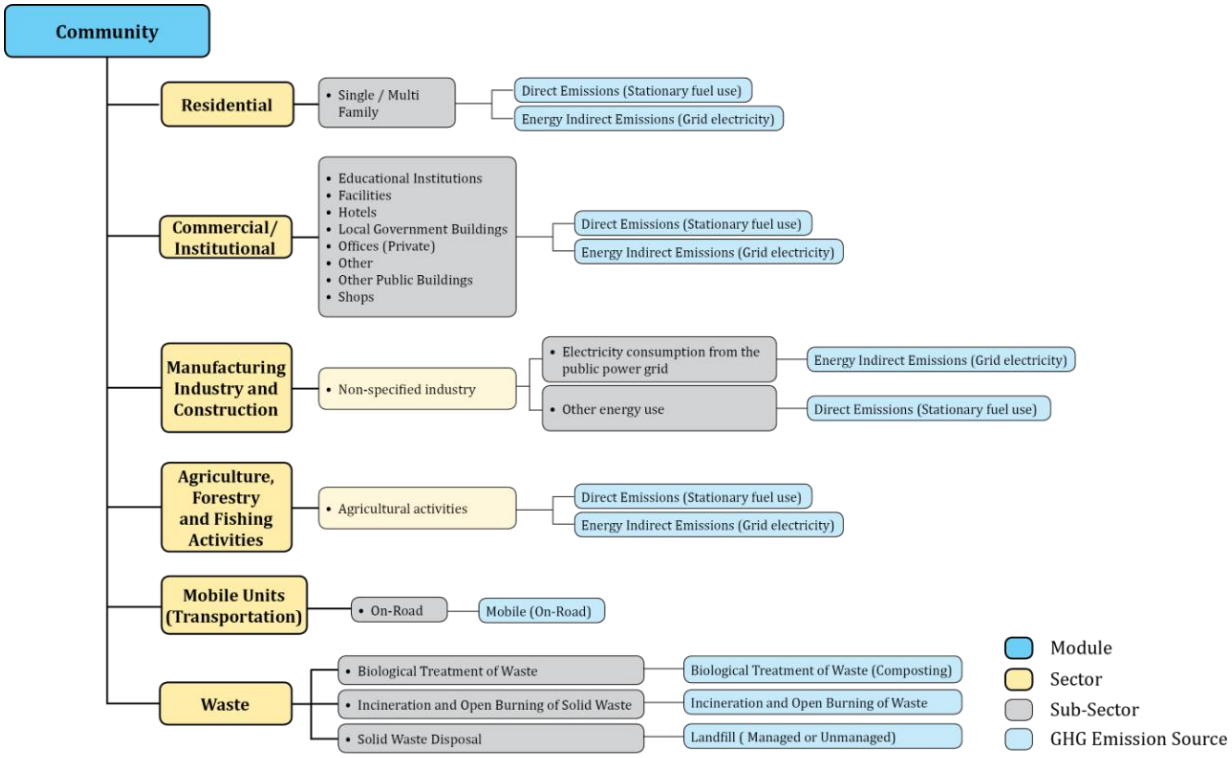


Figure 7: Community-scale GHG Emissions Inventory in City/Village

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 should be conducted to understand their existing status and identify if any of these are already weak or under stress. The table below gives an indicative list of the primary and secondary socio-ecological systems. It is not an exhaustive list, and each local government should prepare its own list as is relevant to it.

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[33]. (I Petrosillo, R Aretano, and G Zurlini, 2015)

Table 3 Indicative Checklist of Core and Secondary Socio-Ecological Systems as per the CRCAP process [34]

Some Core/primary Systems	Secondary Systems
• Ecosystems • Land • Energy • Water • Food and Agriculture • Shelter • Transport • Communications	• Health care • 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 energy 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/village administration, local community, the private players and other stakeholders.

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[35].

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[36]". *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[37]." *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[38]." *Example: A water treatment plant can be built in such a way that in case of a diaster, if the plant fails, it does not flood the city, but the water moves away from habitation.*

Energy consumption and GHG emission – whether the system **c**onsumes less energy than traditional means and leads to GHG emission mitigation[39].

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 populations to 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.

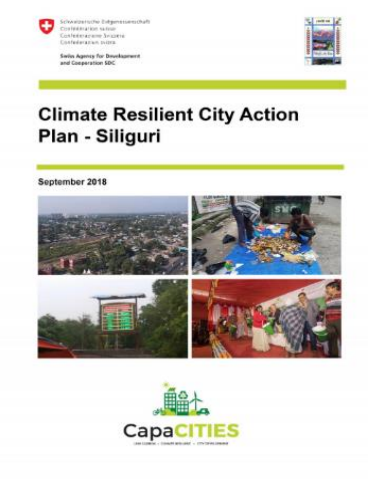
Table 4 Identifying Fragile Systems as per the IADAPT Framework for Development of Catchment Management plans[40]

Infrastructure and socio-ecological system	**Why is it critical or fragile?**	**What are the existing and anticipated problems caused by the fragility of this system?**	**Part of city/village function (Wholly /Shared /No)**	**Fragility statement**
Water supply	**Flexibility & Diversity:** Loss of natural water sources due to rapid urbanisation and encroachments; complete dependence on centralised water pumping systems; existing water supply system is old and cannot meet the growing water demand of the municipality. **High energy consumption & GHG emission:** the transportation of water over large distances to the municipal area with old pumping stations consumes around 143 million kWh, which leads to 117,540 tCO_2e of GHG emissions. **Redundancy:** Water supply trucks (tankers)	Disruption of water supply to citizens Extra financial burden on individual households that are forced to pay tankers for transporting water Water scarcity adversely impacts the tourism and hospitality industry Water shortages impact agricultural activities. Water tankers cause more pollution and GHG emissions.	Department of water supply and sewerage management, Nepal Local Authority	The municipal water supply system is old and largely depends on water transported over large distances, which leads to significant energy consumptions and GHG emissions. Even a small impact within the distribution network can lead to significant water shortage in the municipality due to an ever-growing demand. Alternative solutions are either not financially viable or sustainable. Further, a shortage of water will have an impact on both genders.

Infrastructure and socio-ecological system	Why is it critical or fragile?	What are the existing and anticipated problems caused by the fragility of this system?	Part of city/village function (Wholly /Shared /No)	Fragility statement
	are used as an alternatives to supply water during any disruption The mountainous terrain limits their access, in addition to the tankers being an expensive and polluting option. **Safe failure:** Individual households have to fend for themselves in case the water supply is disrupted. One of the systems is more than 100 years old			
Food and Agriculture Sector	**Flexibility & Diversity:** Most local farmers are dependent on one type of crop. They do not practice rotation and mutifarming. **High energy consumption & GHG emission:** The agriculture sector generates GHG emissions by using inputs such as water, pesticides and fertilisers, as well as machinery, irrigation and soil disturbance, and residue management. **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.	Complete dependency on one type of crop and framing technique. The proportion of women and the elderly in agriculture has increased because of outmigration by young men. This has led to increased workload for women, negatively impacting their lives. Due to lack of understanding of farmers on GHG emission, the agriculture sector contributing a good amount of Greenhouse gases.	Ministry of Agriculture and Livestock Nepal 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 emissions from the agriculture sector.

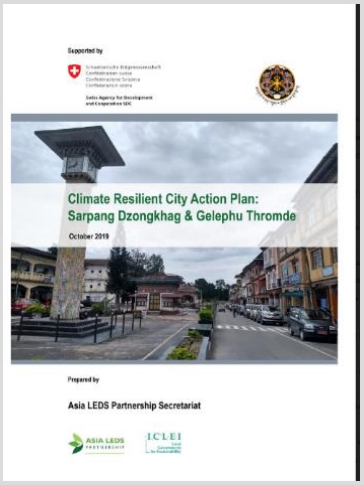
Box 5: Case Studies: Baseline assessment in Gelephu-Sarpang and Siliguri CRCAP

Siliguri CRCAP



The Siliguri Municipal Corporation (SMC) initiated the process of developing the CRCAP for Siliguri, prepared by using the Climate Resilient Cities Methodology, under the CapaCITIES Project, supported by SDC. A GHG emissions inventory of the SMC and the community-level activities in the city was developed by using the HEAT+ tool. The areas and communities within the city that are impacted by climate risks were identified with the help of a vulnerability assessment. Resilience interventions were identified and prioritised for each fragile system with a second shared learning dialogue, in order to form an action plan for the city. Through the interventions proposed in the CRCAP, the city of Siliguri is committed to cutting its annual GHG emissions by 14.6 % by 2022-23, compared to the baseline GHG emissions in 2015-16.

Gelephu- Sarpang CRCAP



The Asia LEDS Partnership Secretariat, hosted by ICLEI South Asia, has used the CRCAP methodology to prepare the CRCAPs of Sarpang and Gelephu. A GHG emission inventory was prepared for the city using the internationally recognized Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC). ICLEI South Asia gathered baseline data to prepare a profile for the city, which covers its socio-economic situation, emissions, service delivery status and governance systems. The HEAT+ software was used to identify and assess possible sectors where measures can be taken to reduce GHG emissions. It was calculated that in 2018, the total GHG emissions of Sarpang Dzongkhag and Gelephu Thromde were 63,023 and 55,794 tonnes of carbon dioxide equivalent (tCO2e), respectively.

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 to identify specifically who or what is vulnerable to what and why. This will help to identify the vulnerability hotspots and assess the adaptive capacity of the community and other important actors.

The next step is to understand the trends, patterns, and projections of climate change at the local and regional levels. The analysis will be used to gauge the vulnerability and risk of the critical systems (identified in module 2.B). Finally, GIS 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 data to understand climate exposure scenarios and projections. It is best to use local-level climate data or recent studies on climate phenomena from the region. In case this is not available, regional or national data or study on climate change can be used.

This analysis can be supported by inputs from stakeholder groups, an expert and the local community, but even the initial results will help give a general understanding whether there have been any major changes in weather patterns. Local governments can consult different secondary data for this climate analysis. If there are recent local studies on climate trends and projections available with local authorities, NGOs, universities and research institutes, or other bodies, then those can also be used. A regional assessment study may be used in case a local-level assessment is not available.

Temperature and rainfall data for the past 30 or 40 years can be collected from the meteorological department to develop climate trend maps. This information can be discussed 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 that are faced by the local government. The climate scenario statements can be written up as per the following table (from the ICLEI ACCCRN Process):

Table 5: Climate Data Collection and Preparation of Scenario Statement as per the CRCAP tool[41]

Changing Climate Condition	Assessments	Amount of Expected Change (include baseline and planning horizon years)	GHG Emissions Scenario	Extent of Variability	Level of Confidence	Climate Scenario Statement
Precipitation change	Regional Assessments	'Average annual precipitation is likely to increase in both the medium-term and long-term periods'[42]. 'Average annual precipitation is likely to increase by 2.1–7.9% for RCP 4.5 in the medium-term (2016–2045) and long term period (2036-2065)'[43]. 'Average annual precipitation is likely to increase 6.4–12.1% for RCP8.5 in the medium-term (2016–2045) and long term period (2036-2065)'[44].	(RCP 4.5 and RCP 8.5)	'Precipitation will increase in all seasons, except the pre-monsoon season, when there is likely to be a decrease of 4–5% in the medium-term period. The post-monsoon season might see the highest increase in precipitation as compared to the reference period, possibly going up by 6–19% in the medium term and 19–20% in the long term'[45]. The high mountain region will experience more precipitation change than other region of the country	*High*	There is a high level of confidence that the annual precipitation of Nepal is likely to increase by 2.1-7.9% for RCP4.5 and 6.4-12.1% for RCP8.5 for the reference periods for all seasons, except the pre-monsoon season.
	Supplementary Local Assessments					

Changing Climate Condition	Assessments	Amount of Expected Change (include baseline and planning horizon years)	GHG Emissions Scenario	Extent of Variability	Level of Confidence	Climate Scenario Statement
Temperature change	Regional Assessments	The average annual mean temperature is likely to rise. 'The mean temperature could increase by 0.9–1.3 degrees Celsius (°C) for RCP 4.5 in the medium-term period (2016–2045) and the long-term period (2036- 2065) respectively. It will increase by 1.3–1.8 °C for RCP 8.5 in the medium-term period (2016–2045) and the long-term period (2036- 2065) respectively'[46].	(RCP 4.5 and RCP 8.5)	'The projections show that regional temperature is rising in all seasons, with the highest rates of mean temperature increase being expected for the post-monsoon season[47].	High	There is a high level of confidence that the annual temperature of Nepal is projected to rise by 0.92-1.3ºC for RCP4.5 and 1.07-1.82ºC for RCP8.5 with respect to the reference period. The eastern part of the country may be impacted more by an increase in temperature.
	Supplementary Local Assessments					

The main climate impacts in the city/village can be listed from the table in terms of changes in temperature, changes in rainfall, extreme events and/or sea level rise.

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 (Based on IADAPT framework)[48]

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 municipality is old and largely dependent on water transported over large distances, which leads to significant energy consumption and GHG emissions. Even minor disruptions in the distribution network cause significant shortages in the face of an ever-growing demand; alternatives are neither financially viable nor sustainable.	Increased precipitation may lead to more runoff and sedimentation thereby disrupting/damaging water supply systems.	Rising temperatures will lead to increased demand for water, thereby putting additional stress on the supply system. This will eventually lead to high GHG emissions from the water pumping sector. It will put extra burden on the local women to collect free drinking water.
Agriculture Sector	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 emissions from the agriculture sector.	Heavy rainfall followed by flooding can destroy entire crops over wide areas. Excess water can also cause water logging of the soil, reduced plant growth and anaerobicity.	Increased temperature can provide a suitable environment for some of the weeds, pests, and fungi, that can subsequently impact crop yield.

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 7 below. The 'Level of Confidence' assigned to each of the identified climate change conditions in the climate scenario table (see Table 8), which indicates whether the likelihood of occurrence is higher or lower, should be referred to.

Table 7: Likelihood Rating and Scoring as per the CRCAP Process[49]

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

Next, assess the consequence or impact for 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 8 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 Scoring as per the CRCAP tool[50]

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 impacted; Significant impacts on poor and vulnerable groups in the city/village that seriously affect their lives and livelihoods.	4
Moderate	System experiences major problems, but is still 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 reduce 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 some review or repair, but still able to function.	Minimal impacts on the lives and livelihoods of the poor and vulnerable (Including women) groups in the city/village.	1

To get a risk score for each fragile system, multiple values of 'Likelihood' and 'Consequence' score for each of the identified climate risks (see Table 9).

Table 9: Prioritisation of Climate Risks as per the CRCAP tool[51]

Climate Fragility Statements	Likelihood	Consequence	Risk Score (Likelihood x Consequence)	Risk Status
Increased precipitation disrupts/damages water supply infrastructure.	4	4	16	High
Increased precipitation can cause water to freeze in the pipelines.	4	4	16	High
Increased temperatures will lead to greater demand for water, thereby putting additional stress on the supply system.	3	3	9	Medium
Higher temperature will lead to increase water demand, thereby put extra pressure 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 Matrix as per the CRCAP tool [52]

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

ICIMOD has been working on resilience building at various levels of decision-making with government and non-government organisations in Nepal. The Ministry of Environment and Forest with support from ICIMOD has developed the Vulnerability and Risk Assessment (VRA) Framework and Indicators For National Adaptation Plan (NAP) Formulation Process in Nepal. The VRA framework was developed for both NAP and LAPA (Local Adaptation Plan of Action) on the basis of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). The process of VRA includes scoping vulnerability and risk, developing the VRA framework, identifying key indicators, data collection, analysis of data and Identifying climate change impact and risk. The entire process helps in identifying impacts and risk to design adaptation options and strategy[53].

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 risk from climate impacts.

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

Vulnerability = Sensitivity and Adaptive capacity

Sensitivity[54]: "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[55]**:** "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 government should identify the areas/wards of the municipal boundary 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 municipality that are affected by the maximum number of extreme climate risks by overlaying the maps. These areas will represent the Vulnerability of Hotspots in the city/village.

Figure 8 shows a map of vulnerable hotspots of the Gangtok city prepared using the ICLEI ACCRN Process. The climate core team identified three fragile urban systems for Gangtok through Shared Learning Dialogues, incuding water supply, storm water drainage, and transportation. 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 one fragile urban system while green colour indicates wards that are impacted by two fragile urban systems. The orange colour indicates the wards that are impacted by three fragile soico-ecological systems.

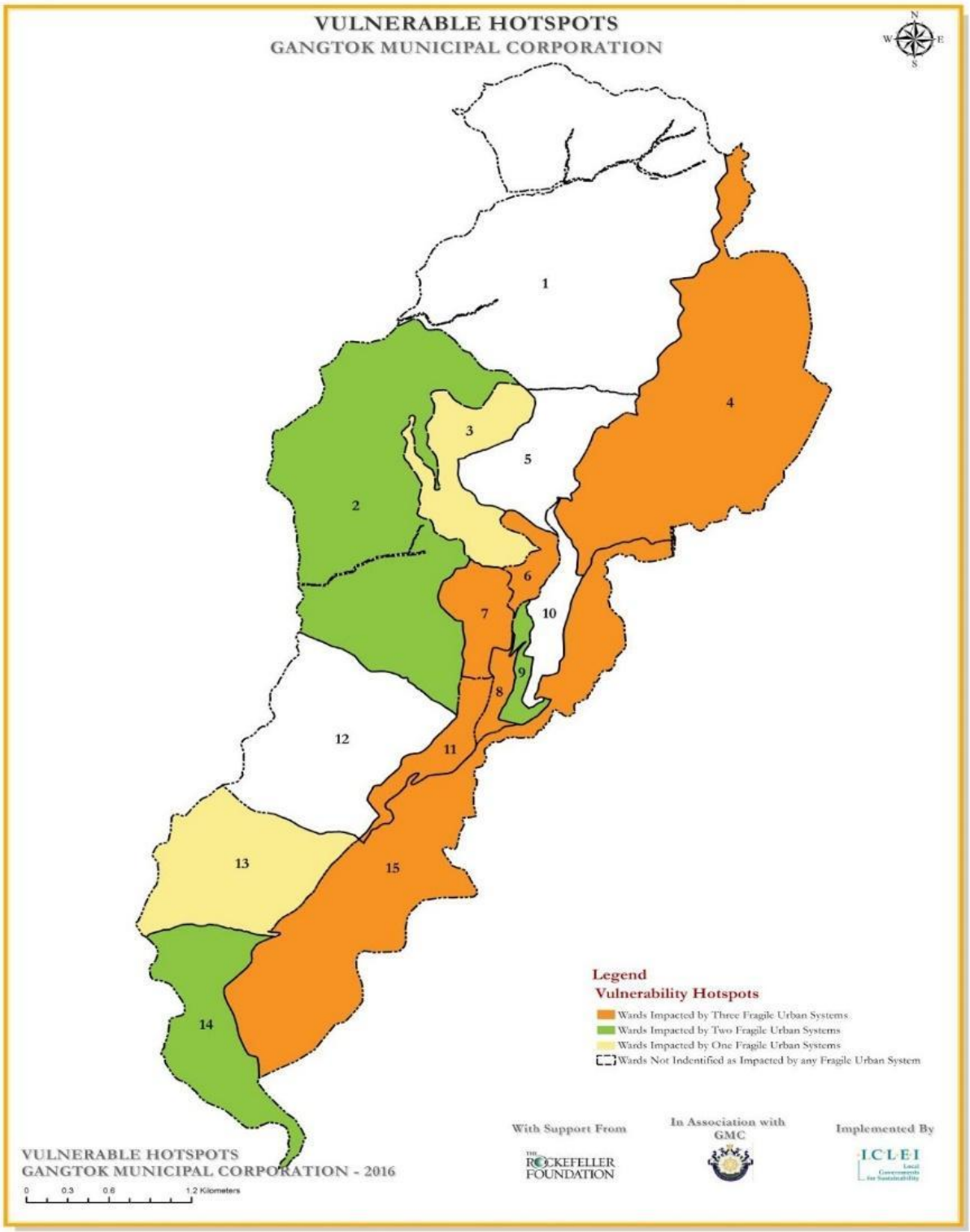


Figure 8: Vulnerability Hotspot Map for Gangtok, India

Identification of Actors and Assessment of their Adaptive Capacity

The local government should recognise the actors (i.e. individuals, households and public/private sector organisations) that can play a key role in improving resilience of the city/village. The capacity of different actors to contribute to resilience and adaptation are 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[56]."

Access to Resources – "whether they have access to the resources necessary to respond to stress (such as technology, human resources and funds[57]."

Access to information – "whether they can use data and other information necessary to develop effective plans and actions and to improve responses to disruptions[58]."

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[59].

Table 11: Actors' Capacities Rating and Scoring as per the CRCAP Tool[60]

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 Actors as per the CRCAP Tool

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 or medium 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 Capacity as per the ICLEI ACCCRN Process[61]

Climate Fragility Statements	Area/ward	Actors	Capacity to Organise & Respond (A)	Resources (B)	Access to Information	Adaptive Capacity Score (A)*(B)*(C)	Supporting Notes
Increased precipitation may lead to more runoff and sedimentation thereby increasing cost of water treatment and damaging water supply systems	*Ward 5*	Local Authorities *s*	3	2	2	12 (Medium)	
			2	3	2	12 (Medium)	
		Resident Welfare Association	2	2	1	4 (Low)	
Heavy rainfall that causes flooding can destroy crops over wide areas, while excess water can cause other impacts such as 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 services as 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[62]

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 required resources 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 systems as per the CRCAP Tool[63]

Examples of level of Climate Resilience Capacity						
	Economic	**Technology/ Infrastructure**	**GHG Emissions**	**Governance**	**Social**	**Ecosystem Services/Natural Environment**
Low	Limited inherent capacity to adapt to impacts (e.g. the amount of finance required is very high as compared to the benefits accrued; cannot raise funds legally; no strong tax base to call upon).	Limited technology/infrastructure available to help adapt to impacts (e.g. use of outdated materials in building codes; no way of 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).	The sector's contribution to GHG emissions is less than 5% and mitigation interventions are limited.	The governance structure in place had limited capacity to adapt to impacts (e.g. no collaboration between agencies; no support from higher governance levels) i.e. inadequate rules and practices.	There is a limited societal structure in place to help adapt to impacts (e.g. there are disenfranchised or uninvolved citizens and/or a lack of community and aid).	The ecosystem services/natural environmental capacity to adapt to impacts is limited (e.g. there is no marsh or dune system that can provide protection against storms; all habitats are isolated and disconnected from other natural areas).
Medium	The capacity to adapt to impacts can be developed (e.g. required finance is comparable to benefits; a system for raising funds exists; tax base is available for support).	Technology/infrastructure needed to adapt to impacts is available (e.g. structures can be renovated and retrofitted; new knowledge can be regularly integrated into purchasing agreements, potential to improve urban services).	The sector's contribution to the overall City GHG Emissions is less than 10% and mitigation interventions are possible.	There is a governance structure in place that can help adapt to impacts (e.g. collaborative work between agencies in possible; the governance structure works closely with higher levels) i.e. some rules and practices are in place.	There is a societal structure in place to help adapt to impacts (e.g. citizens show interest in community initiatives).	The ecosystem services/natural environmental capacity are able to adapt to impacts (e.g. the municipality takes into account ecosystem services while planning for developmental projects).

Examples of level of Climate Resilience Capacity						
	Economic	**Technology/ Infrastructure**	**GHG Emissions**	**Governance**	**Social**	**Ecosystem Services/Natural Environment**
High	Robust inherent economic ability to adapt to impacts (e.g. required finance is less as compared to benefits, mechanism for raising funds exist; very strong tax base to call upon).	Technology/infrastructure to adapt to impacts (e.g. most structures are new and have used the latest materials & building codes; new knowledge is regularly integrated into purchasing agreements, very high potential to improvement of urban services, replication at larger scale possible) very high energy saving and GHG emission reduction potential).	Contribution of the sector to overall City GHG Emissions is more than 15% and significant reduction of GHG emissions is possible through mitigation interventions.	Robust governance structure in place to adapt to impacts (e.g. good interagency collaborative processes; work closely with higher levels) i.e. good rules and practices.	Robust societal structure in place to adapt to impacts (e.g. citizens are heavily involved in their communities; active and effective community and aid.	Ability of Ecosystem services/natural environmental to adapt to impacts of changing climate.

Table 15: Climate Resilience Capacity of the Fragile Socio-economic System – based on CRCAP tool [64]

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 by engaging private companies)	High (50% of GHG emissions from electricity use for government facilities is from water supply)	Medium (coordination with Department of water supply and sewerage management, Nepal)	High (increasing demand from local community 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 (finance is 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 Nepal).	Medium (There is a societal structure in place to adapt to impacts, such as citizens who are deeply involved in their communities, and an active and effective community and aid).	Medium (Local government 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 prioritize and integrate these measures to existing municipal plans.

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

A resilience strategy helps to cope by anticipating, preventing, absorbing and bouncing back after changes, setbacks, shocks and stresses, particularly those brought about by rapid social, demographic, technological and environmental change. Once the climate risks for the local government have been identified and the fragile infrastructure and socio-ecological systems have been assessed for their impacts particularly on vulnerable populations, the local government should identify solutions that will help them to 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 Exercise as per the ICLEI ACCCRN Process[65]

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 increasing cost of water treatment and damaging water supply systems.	*Ward 5*	*Resident Welfare Association* *NGOs*	*Private sector* *Water Authority*	*Economic/ source of finance* *Ecosystem Services*	*Technology/ infrastructure* *Governance*	*Social* *GHG Emissions*	• Rooftop water harvesting to be made compulsory to deal with water shortage and stress caused by from an anticipated rise in temperatures and reduction in precipitation. • Watershed management measures to conserve the ground and surface water.
Heavy rainfall followed by flooding can destroy crops over wide areas, and excess surface water can cause other problems, including soil waterlogging, anaerobicity and reduced plant growth.	*Ward 2*	*Women farmer*	*Local Authority* *Agriculture department*	*Economic/ source of finance* *Technology/ infrastructure*	*Technology/ infrastructure* *Governance* *GHG Emissions*		• Introduce Climate-smart farming to deal with increasing temperature and precipitation. • Training and capacity building of local farmers

Prioritisation of Interventions

The list of resilience interventions should be evaluated against a following of resilience indicators.

Redundancy: "A system that is resilient can work and achieve results through multiple paths or nodes even when one of them fails and when performance is critical. On the other hand, a "single best solution" cannot resilient because the system collapses if this single option fails. It is preferable to have backup systems, or decentralised nodes for service delivery in a linked network".

Example: Hospitals and emergency communications facilities have shared or linked backup electrical generators[66].

Flexibility: "Essential systems should not be rigid or designed for only one function, but should be able to perform under a variety of conditions. Any overloaded system is bound to fail, but a flexible system is designed to fail under stress safely and predictably, rather than suddenly and catastrophically"[67].

Example: Dikes are designed so that if their capacity is exceeded, they fail in predictable ways, channelling flooding away from populated areas[68].

Responsiveness/re-organisation: "Systems should be able to respond and adapt to meet unexpected shocks under extreme conditions. This means excellent coordination and flexible organisational structures that can adjust to new conditions, and have access to a variety of resources such as knowledge, equipment, skills, information and experience."[69]

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: "To avoid repeating past mistakes and to integrate lessons from other cities into planning, resilient systems have mechanisms to learn from and build on experience. This means having methods for monitoring and evaluating performance under stress, as well as multiple sources of knowledge and documentation (strengthening "corporate memory."[70]

Example: Different government agencies share a common monitoring and reporting system to track groundwater quality and extraction in the face of more frequent droughts or sea-level rise[71].

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 means having appropriate procedures for periodic monitoring and evaluation of performance, which requires multiple sources of knowledge and documentation."[72]

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[73].

Social resilience: A resilient system should also have the potential to improve the social resilience of marginalised groups by providing the ability to cope up with social risks[74].

Example: Providing agricultural equipment to women that reduce their drudgery can help to save time and energy for other activities, while also empowering women economically[75].

Table 17: Prioritisation of Resilience Intervention – Example and Work Exercise as per the CRCAP Methodology[76]

Potential Climate Resilience Interventions	**Resilience Indicators**						**Overall Resilience** **6/6: very high** **5/6: very high** **4/6: High** **3/6: Medium** **2/6: Average** **1/6: 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)**	
Make roof-top water harvesting mandatory to help cope with water stress due to anticipated increase in temperatures and decrease in precipitation.	Yes; Supports a greater self sufficiency at the household level	Yes; System permits water to be diverted towards recharging of groundwater	Yes; In case the city's water supply system is disrupted or shut down, households have stored rainwater for use	No; There are city helplines, but responsibility lies with individual households	Yes: Electricity consumption falls and there is GHG emission mitigation potential due to reduced pumping requirement.	Yes; Can improve the livelihood of the women by providing decentralised access to drinking water.	Very High
Introduce Climate-smart farming to deal with increasing temperature and precipitation	Yes; Supports conventional as well new farming system.	Yes; Provide farmers a good yield even in changing climate	Yes; Farmers can modify the farming system according to sudden shocks	Yes It will increase the access to information among the farmers. They can learn new techniques of climate smart farming.	Yes: Farmers can use farming techniques that will reduce Greenhouse gas emissions.	Yes; Can improve the livelihood of the women farmers	Very High

According to the CRCAP Methodology, interventions should also be evaluavated on 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[77]."

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[78]."

The impact of the intervention can be assessed using:

- Timeframe – most actions should be completed within a short or medium timeframe[79].
- Criticality or overall impact - the proposed intervention should have a significant and measurable impact on the targeted climate risk[80].

Table 18: Feasibility and Impact – Example and Exercise as per the CRCAP Methodology[81]

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)**		
e.g. Make roof-top water harvesting mandatory to tackle water stress due to anticipated rise in temperatures and reduction in precipitation.	High (technology is easily available)	Medium (would require a change in building by-laws and building codes)	High (not an expensive option to implement with substantial results)	Short term	High
Introduce Climate-smart farming to deal with increasing temperature and precipitation.	Medium (technology is not easily available)	High (Local authorities are ready to support.)	High (New policies describes fund available for climate-smart farming)	Medium Term	High

Integration into the Municipality Plan

The shortlisted interventions and actions should be aligned with existing development plans or ongoing programmes. It 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.

In Nepal, since the gender budget code and the climate budget code are separate, this section provides an opportunity to integrate the two and identify interventions that can be financed by either budget code, with co-benefits to the other. For instance, climate resilient interventions that are targeted to improving resilience of women can be financed through the gender budget code, rather than the climate code. This will keep the climate budget free to be used for other climate related interventions. Such activities will also help to support integrated and resilient development.

Table 19: Linking Resilience Interventions to Ongoing Programmes – Examples and Exercise (CRCAP Tool[82])

Resilience Interventions	Relevant Programmes	Ongoing/upcoming/ Planned	Can the programme be leveraged – Yes/no; if yes how?
e.g. Make roof-top water harvesting mandatory to tackle water stress caused by an anticipated rise in temperature and reduction in precipitation.	Housing Scheme for the Urban Poor	Upcoming (following financial year)	Yes. Building designs can be modified to include roof-top water harvesting and storage systems.

Key Existing Plans and Policies of Nepal (Link)

- Climate Change Policy 2019
- National Adaptation Plan
- Local Adaptation Plan of Action
- Reducing Emissions from Deforestation and Forest Degradation (REDD+) program
- Nationally Determined Contributions 2020

Module 4: Monitoring, Evaluation and Scaling

Learning objectives: The main objective of the session is to encourage municipalities to conduct an in-depth and systematic 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 to monitor 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.

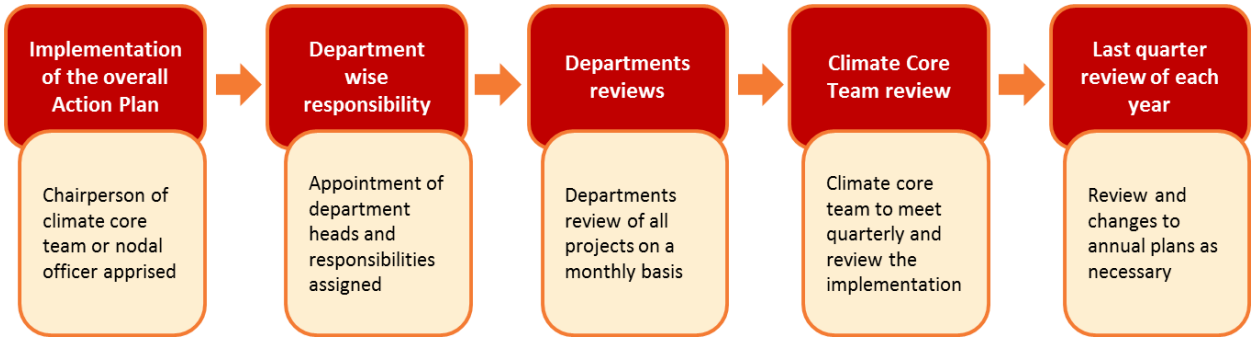


Figure 9: Process of Monitoring of Implementation of Resilience Intervention

Table 20 below gives a draft M&E Framework that can be adopted by local governments to suit their needs.

Resilience Marker

The Resilience Marker methodology has been developed by ICIMOD's Resilient Mountain Solutions (RMS) Initiative to help the municipal planners and decision-makers to design, plan and assess resilient interventions by understanding the complex socio-ecological system and anticipate risks for long-term planning. The Resilience Markers can be used as monitoring indicators to strengthen the M&E framework and assess the resilience outcomes of projects/programs.

Assessing resilient interventions and establishing a baseline to measure the progress against resilience outcomes continue to pose a huge challenge for policymakers, planners, practitioners, and donors due to methodological ambiguity arising from complex and non-linear interactions among the social and ecological systems. The widely used indicator-based approach to assess the resilience of project/programme outcomes is a top-down approach that does not capture dynamic interactions and complex relationships in a socio-ecological system, which determine the system's behaviour. However, the resilience markers highlight the systems thinking approach, which helps to unpack complex cause-effect relationships and identify self-organising capacities to understand the system's resilience behaviour. This can help avoid selecting interventions that are mal-adaptive in nature. The resilience markers are defined as identifiable and measurable structural elements in a complex socio-ecological system that can facilitate the system's adaptability and can also transform if put to stress. In addition, resilience markers can provide long-term monitoring indicators to capture processes and strengthen the M&E framework to assess the progress of any project and programme outcomes. Policy makers can also use them as a decision support tool to design programmes and policies.

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 the 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 Non Revenue Water from 30% to 20% by replacing existing old water supply pipeline with DI pipeline.	October 2018 to December 2021	INR ----	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 identified Preparation of prefeasibility is in progress.						

Box 6: Resilience markers of Kavre district, Nepal

Kavre district is well known for the seasonal agricultural produce its supplies to the capital city, Kathmandu. However, socio-economic and ecological challenges, including the impacts of climate change, make the agriculture sector and the people dependent on it more vulnerable. ICIMOD and its partner organisation CEAPRED have been working in Kavre district for almost a decade now, aiming to improve the resilience of farming people and ecosystems by piloting and scaling up of proven, simple, affordable and gender-responsive solutions, developing an entrepreneurship ecosystem, and developing the capacity of local communities, governments and other institutions.

To understand the socio-ecological system dynamics and assess the resilience outcomes of ICIMOD/CEAPRED interventions for long-term policy planning and decision making, resilience markers were studied for three sub-systems, viz. socio-economic, agriculture and water management in Kavre.

The targeted intervention of Jholmal, a home-made liquid bio-fertiliser and bio-pesticide introduced to minimise and replace the use of chemicals in farms was assessed in the resilience marker study. It was observed that there are complex interactions between the population (social) subsystem and ecological subsystem. For example, as a consequence of climate change and rising temperatures, farmers may need to use more chemicals to deal with the increase in pests and weeds and to improve productivity and incomes. Their rising incomes will improve their capacity to buy more chemicals for use in the field, thus increasing productivity and reinforcing the feedback. Increasing global warming will simultaneously increase the incidence of weeds and pests, which in turn will raise the overhead costs of the farmers. Then, at a certain point of time, their purchasing power to buy chemicals will reduce and they will not able to use pesticides, thus balancing the system feedback.

Low household incomes are causing out-migration of men, labour shortage in agriculture and reduced farm productivity; in turn, low incomes from farming are forcing men to out-migrate, reinforcing this feedback. However, interventions to build the capacity of women can increase the workforce for farming and balance the feedback. When Jholmal was introduced as an alternative, it reduced the use of chemical pesticides, reduced the overhead costs of the farmers, helped reduce pests and increased farm productivity. However, for long term sustainability, the use of Jholmal must be dynamic and not static as observed from different simulations.

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

Scaling

Scaling of climate resilience interventions beyond successful experiments and pilots to encourage widespread adoption is one of the most critical challenges that development practitioners and policymakers face, and is key to enhancing the impact on systems to achieve transformative and positive change. The process begins with demonstration of practices, technologies and approaches that are adopted by farmers or villagers in the immediate vicinity, leading to a certain degree of replication. However, when the demonstrated technologies and approaches are adopted by a local agency or actors for replication in their projects and programmes over a larger area with their resources, it would be scaling out in the true sense. But an intervention or approach will be considered to have been scaled up only when it has been adopted and incorporated into larger programmes (or schemes) funded and executed by provincial or subregional or national agencies (or funding agencies) as a policy component.

What is Scaling?
Scaling is a process of expanding the use of a desirable practice, technology, or process either through upward changes in the policy environment that drive dissemination of the process or method (‘scaling up’), or outward spread across sectors, jurisdictions or landscapes (‘scaling out’).

The following seven attributes are important for scalability:

- **Credibility:** Results and impacts of the model are well documented and provable. The model has been evaluated independently and tested in a setting similar to the one for upscaling. The model is acceptable to relevant stakeholders outside the immediate implementation process.

- **Observability:** Results and impacts are visible and comprehensible to the project stakeholders, and attributable to the model. Results and impacts can be easily communicated to an interested public.
- **Relevance:** Relevant stakeholders, partners and the project´s target group consider upscaling necessary and desirable. The model reacts to an observable and expressed need, and is designed to include marginalised groups (gender, youth, ethnic) in as many aspects as possible. The model creates significant improvements in systemic (social and/or ecological) resilience towards climate change effects.
- **Relevant advantage**: The model has a better cost-benefit ratio than comparable alternatives. Upscaling produces economic advantages, economies of scale for specific aspects of the model.
- **Easy to transfer:** Technologies or innovations promoted by the model are easy to adopt for the target group, and not likely to create conflict within the target group. Human and financial resource input needed for the introduction of the model is replicable across a wider area. The scaled up model can be applied through existing infrastructure and facilities, and can be implemented mainly through locally available resources and materials, also in a scaled up setting. Few potentially blocking or disabling decision-makers are involved in the implementation.
- **Compatibility:** The model addresses social, political and environmental aspects that can also be traced in the upscaling setting; the activity is in line with relevant legal frameworks and policy practice.
- **Testability:** The target group can test the model in small steps without full adoption.

The implemented interventions can be assessed for their contribution to climate resilience using the aforementioned seven parameters. For each intervention, rate the seven categories of adaptive capacity in terms of high/medium/low.

Table 21: Attributes of scalability

Resilience Interventions	**Credibility**	**Observability**	**Relevance**	**Relevant advantage**	**Easy to transfer**	**Compatibility**	**Testability**
e.g. Roof-top water harvesting is made mandatory to deal with water stress due to anticipated rise in temperatures and reduction in precipitation.	High	Medium	High	High	High	Medium	High
Climate-smart Farming to deal with increasing temperature and precipitation.	High	High	High	Medium	High	Low	Medium

Strategy for Scaling: Comprehensive Planning and Multi-level Engagement

In addition to the seven characteristics of scalability mentioned above, the municipality can also consider the results of the up- and out-scaling of many of its solutions. If there is strategic and strong engagement with institutions at all levels, it will result in upscaling of the approach and its integration into government's adaptation plans and programmes. The out- and up-scaling strategy, which was used in the Resilient Mountain Solutions initiative at ICIMOD, is outlined in Table 22.

Table 22: Up- and out-scaling and their main strategies and actions

Scalability	Strategies and actions
Out-scaling	Replicating project geographically to a larger area, if possible from project resources, else work with local governments to out-scale solutions.
	Disseminate principles with adaptation to new contexts; co-production of additional knowledge; leveraging media by engaging local journalists and opinion makers.
Up-scaling	Engaging with local governments (municipalities and province) from the beginning to ensure ownership. This helps local government officers take ownership, proudly vouching for to score brownie points from their own systems.
	Policy efforts by engaging with government at different levels and showcasing the project as a response to government priorities.

Besides strategies for scaling, it is also crucial to identify enabling and hindering factors that have to be addressed consciously all the time to achieve scaling. These are presented in Table 23.

Table 23: Enabling and hindering factors for scaling

	Enabling factors	Hindering factors
Context-specific characteristics (environmental, economic, social, cultural)	• Simple and affordable technologies that are appropriate (low investment, low risk, good returns) for small-holder mountain farmers. • Farmers understand the need for environmental conservation and climate resilient practices.	• Subsistence farming prevents farmers from taking risks with new technologies– vulnerability will increase if technology fails.
Policies and/or institutions (at different governance level)	• Government's proactive approach to adaptation and resilient planning; • Engagement of district and local government from the beginning	• No blue print possible, technologies have to be site specific
Communications and learning	• Open dialogue at every level • Engagement with journalists • Exposure visits of decision makers	• Communication and engagement with decision makers can take time
Global socio-economic trends	• Remittance income from migration helps women farmers play active role in decision making.	• Pandemic like COVID19 can change everything unpredictably

The Resilient Mountain Solutions initiative suggests that a high adoption rate (out-scaling) of resilience-building solutions can be achieved by using technologies that provide simple and affordable solutions, address local concerns, and also integrate local culture and tradition with scientific knowledge without extensive outside support; and by focusing on marginalised groups in remote mountain areas, who often do not have access to larger government development schemes. For up-scaling, the crucial factor is engagement with stakeholders at multiple levels – local, district, provincial and central governments, the media and like-minded organisations.

Module 5: Financing Climate Resilience Initiatives

Learning Objectives: This module is 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 subnational authorities to mobilise technical and financial resources for implementation of climate resilience initiatives.

Sources of Finance for Climate Resilience Initiatives

The UNFCCC defines climate finance as "finance that aims at reducing emissions, and enhancing sinks of greenhouse gases 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 aim of developed countries to mobilise $100 billion a year by 2020 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 $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 channels - both 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 transiting to a low-carbon economy implies that in all circumstances, public budgets will be insufficient to address the financing challenge and, 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. There are several types of climate finance, varying 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 $10.3 billion and $4.43 billion, respectively, for the period 2014-2018. While GCF finances both adaptation and mitigation projects, GEF is dedicated largely to mitigation.
- A large quantum of climate finance is also mobilised through institutions that are not directly under the guidance of the UNFCCC, such as the United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation (UN REDD

Programme), 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 $8-billion Climate Investment Funds are crucial in fostering climate change mitigation and adaptation projects. In 2017, climate financing from the main Multilateral Development Banks (MDB) alone has reached $35.2 billion.

It is estimated that Nepal will require an additional amount of $2.4 billion of investment by 2050 to build its climate resilience. Also, the annual average investment requirement for the entire SDG period is estimated to be 48 percent of the GDP on average.

Considering the challenges Nepal faces as one of the most climate vulnerable countries in the world, there are several public and private financing mechanisms available that it can avail of to support low-carbon, climate-resilient development. Nepal is able to access various international sources of climate finance. Multilateral finance channels through Climate Investment Funds through the Scaling Up Renewable Energy Programme (SREP) in Low-Income Countries, the Pilot Program for Climate Resilience (PPCR), the Least Developed Countries Fund (LDCF), Adaptation Fund, Global Environment Facility (GEF), Forest Fund and the Green Climate Fund among others. Bilateral funds come from the United Kingdom and the European Union, primarily through the National Climate Change Support Programme (NCCSP).

It is estimated that around $652.40 million of international funds in the form of grants was made available to the country from 1997 to 2014. Sixty-seven percent of the resources came through two multilateral development banks - Asian Development Bank (ADB) and the World Bank (WB). This is followed by 31% of the funds channelled through the European Union countries. Under the Fast-Start-Finance (FSF), Nepal received around $8.3 million directly.

Regarding international financing, the government largely accepts different kinds of financial instruments depending on the programmes , such as grants, soft loans and co-financing. Of all the funds received till 2014, 69 percent was in the form of grants, while 31 percent was received in the form of concessional loans.

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 develop climate 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 collaborative effort of the European Investment Bank (EIB) and the Global Covenant of Mayors (GCoM), which represents over 9000 cities from six continents and aims to give technical assistance to help design and finance municipal climate action projects. On this Challenge, the GCoM and the EIB partner with global and local city networks such as ICLEI, the C40 Cities Climate Leadership Group, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The GCCC is part of a new cooperation under the banner of Global Urbis, an ambitious global effort unveiled during the One Planet Summit in Paris in December 2017 that provides technical help and funding for climate action to cities and local governments around the world. 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)[83]:** 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 proposes a comprehensive and transformative approach to closing investment value chain gaps by establishing a global financing framework based on synergies among 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, Mexico and Argentina combined. The cities and partners of the GCoM share 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/

6. **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[84].

Climate Finance Compendium[85]: Adapting to climate change in developing nations alone will cost $280 billion to $500 billion per year by 2050, according to UN Environment. In addition, the Global Commission on Adaptation estimates that investing $1.8 trillion in priority areas globally between 2020 and 2030 may create $7.1 trillion in net benefits while reducing natural disaster impacts — which could apply to the present epidemic. 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[86].

Box 7: Green Climate Fund – Nepal

Nepal recently received its first climate grant from the UN Green Climate Fund. The country will get about $27.4 million for a project aimed at enhancing the capacity of 1.9 million people of Nepal's Kandace river basin to cope with climate change impact.

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