Climate & Development Knowledge Network

GESI and EbA Integrated Disaster Risk Reduction in Cities

A Training Manual for Local Governments in India

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About CDKN

The Climate and Development Knowledge Network (CDKN) is a Southern-led global programme, established in 2010 to enhance the well-being of those most affected by climate change – especially women, girls and marginalised groups – through transformative climate action. Its current five-year phase (2022–2027) supports equitable, locally-led, financed and ecosystem-based climate responses that mobilise the capacity and leadership of local actors, including community organisations, governments, researchers and civil society groups, across the Global South. CDKN is managed by SouthSouthNorth, in partnership with Fundación Futuro Latinoamericano (FFLA) and ICLEI South Asia, and co-funded by the Ministry of Foreign Affairs of the Netherlands and Canada's International Development Research Centre.

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Abbreviations and Acronyms

ASHA	Accredited Social Health Activist
CAP	Climate Action Plan
CAP	Common Alerting Protocol
CAG	Community Action Group
CBO	Community-Based Organisation
CDKN	Climate and Development Knowledge Network
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
DDMA	District Disaster Management Authority
DM Act	Disaster Management Act
DRCT	Disaster Resilience Core Team
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
Eco-DRR	Ecosystem-based Disaster Risk Reduction
EOC	Emergency Operations Centre
GCF	Green Climate Fund
GEF	Global Environment Facility
GESI	Gender Equality and Social Inclusion
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
GoI	Government of India
ICCC	Integrated Command and Control Centre
ICT	Information and Communication Technology
IRCS	Indian Red Cross Society
IPCC	Intergovernmental Panel on Climate Change
MCR 2030	Making Cities Resilient 2030
MHA	Ministry of Home Affairs
MHVRA	Multi-Hazard Vulnerability and Risk Assessment
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
NAFCC	National Adaptation Fund for Climate Change
NDMA	National Disaster Management Authority
NDMI	National Disaster Management Information
NDMP	National Disaster Management Plan
NDR	National Disaster Response
NDRF	National Disaster Response Fund
NDRM	National Disaster Risk Management
NDM	National Disaster Mitigation
NIDM	National Institute of Disaster Management
NIUA	National Institute of Urban Affairs

NMHS	National Mission on Himalayan Studies
PWD	Public Works Department
PDNA	Post-Disaster Needs Assessment
PHC	Primary Health Centre
PSS	Psycho-Social Support
PwD	Persons with Disabilities
QRMT	Quick Reaction Medical Team
R&D	Research and Development
RWAs	Resident Welfare Associations
SDR	State Disaster Response
SDRF	State Disaster Response Fund
SDRM	State Disaster Risk Management
SDM	State Disaster Mitigation
SDMA	State Disaster Management Authority
SDMF	State Disaster Mitigation Fund
SHGs	Self-Help Groups
SOPs	Standard Operating Procedures
UDMA	Urban Disaster Management Authority
ULBs	Urban Local Bodies
UT	Union Territory

Introduction

India is increasingly facing **climate-induced disaster risks** such as urban flooding, heatwaves, landslides and cyclones. According to the Climate Risk Index 2026, India ranks 9th among countries most affected by extreme climate events[1]. Between 1980 and 2023, nearly 539 natural disasters were recorded in India, which led to casualties of around 0.105 million people, affected nearly 2 billion people, and resulted in an estimated economic loss of USD 141.06 billion[2]. While climate change worsens risks at the regional scale, hazard vulnerability in urban areas is amplified by rapid and unplanned urbanisation, high population density, increased pressure on basic services and infrastructure, development within high-risk zones, environmental degradation and socio-economic disparities. Urban areas in India account for more than 30% of the population, 75% of resource consumption and nearly 60% of GDP contribution[3]. It is estimated that by 2050, more than 50% of India's population is projected to reside in urban areas[4]. Studies indicate that 43 of the world's 100 risk-prone cities are located in India[5]. Moreover, climate-induced disasters affect different population groups differently and often exacerbate existing inequalities. For example, during the heatwave of 2010 in Ahmedabad, India, significantly higher death rates were recorded among females compared to males[6]. Building resilience requires cities to move beyond reactive disaster management approaches and adopt an inclusive and systematic process of disaster risk reduction, preparedness, and resilience-building. There is a need to enhance the existing knowledge and skills of city officials with tools and methodologies for effective disaster risk reduction and overall disaster management.

This manual aims to strengthen the capacities of city officials for planning, financing, implementing, and monitoring **disaster risk reduction (DRR)**. This manual also attempts to set out a structured pathway for **Urban Local Bodies (ULBs)** to move from a response and relief-centred approach to a mitigation and preparedness-centred approach to disaster resilience. It inculcates inclusive and ecosystem-based planning by integrating Gender Equality and Social Inclusion (GESI) as well as Ecosystem-based Adaptation (EbA) at every stage.

Disaster resilience planning is a paradigm that is advancing with time, where policies, institutional and financing frameworks continue to evolve. The transition from the 15th to the 16th Finance Commission reshapes the fiscal basis for disaster management for the 2026–31 period. ULBs and those supporting them should treat this manual as a living framework: one to be revisited as policies are updated, as new evidence emerges from post-disaster assessments, and as cities themselves change.

Objectives of the manual

- To cultivate holistic knowledge about disaster management, disaster resilience, and disaster risk reduction
- To enhance knowledge on the mechanisms of multi-stakeholder engagement and participatory processes for disaster resilience action planning
- To build capacity for conducting climate-induced disaster risk assessment
- To build capacity for planning, financing, implementing, and monitoring disaster resilience across all stages of the disaster management cycle
- To foster the need for mitigation and preparedness-centric disaster resilience
- To understand the process and benefits of mainstreaming GESI and EbA in the disaster resilience planning process

Target audience

This manual is primarily for senior to middle-level officials from various departments of ULBs. It can also be used by:

i. Other officials including environment officers, environmental engineers, health officers, planners and other decision-makers from local authorities;

ii. Elected representatives and executives/professionals from local bodies and other government agencies; and

iii. Practitioners and other decision-makers involved in climate resilience planning.

Structure of the manual

The manual is organised into eight modules:

MODULE 1-4

1. **Introduction to disaster resilience**
   Overview of the concepts of climate-induced disasters, disaster resilience, disaster risk reduction, policy and institutional frameworks, and mainstreaming of GESI and EbA
2. **Engagement process**
   Institutional structures, stakeholder groups, and communication and consultation mechanisms
3. **Baseline assessment**
   City profiles, hazard and disaster profiles, urban systems analysis, gender and social inclusivity assessment, and assessment of city resilience
4. **Pre-disaster planning**
   Risk assessment and mapping, disaster prevention and mitigation, preparedness measures and financing

MODULE 5-8

5. **Planning for disaster response**
   GESI-integrated disaster response, preparedness requirements, enabling environments and actions for ULBs
6. **Post-disaster planning**
   Recovery, reconstruction and rehabilitation
7. **Disaster risk governance**
   Disaster governance arrangements, institutional responsibilities, key actors and operationalisation of disaster resilience structures.
8. **Disaster finance**
   Financing mechanisms for climate-induced disaster resilience interventions.

Integration of GESI and EbA

Disasters do not affect populations uniformly, as noted in the introduction to this manual. Addressing these differentiated impacts requires that **Gender and Social Inclusion (GESI)** aspects be built into risk assessment, planning, response, recovery, and governance alike, rather than layered on as a separate activity.

Healthy rivers, wetlands and green cover are themselves a form of disaster-resilient infrastructure. These natural assets absorb floodwater, buffer storm surges and stabilise slopes. Often, their degradation is a driver of the very disasters this manual addresses. Every module has therefore treated the local ecosystem not as an external consideration, but as a system to be assessed, protected and restored alongside built infrastructure. This is the integration of an ecosystems approach or **Ecosystem-based Adaptation (EbA)** in disaster risk reduction.

MODULE 1: Introduction to Disaster Resilience

Learning objectives

This module aims to introduce the key concepts and commonly used terminology related to disaster risk reduction (DRR) and disaster resilience. It reflects upon the relevant global and national frameworks related to DRR. It further emphasises the need for GESI and EbA integration in climate-induced DRR planning.

Learning Unit 1.1: Concepts of Climate-Induced Disasters and DRR

Understanding climate-induced disasters requires clarity in concepts of hazard, exposure and vulnerability. It further requires an understanding of the concept of multi-hazards. These are explained below[7].

Hazard

A hazard is defined as 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. Hazards do not automatically result in disasters. The impact of a hazard depends on the level of exposure and vulnerability of people, infrastructure, services and ecosystems.

Types of Hazards

Hazards may originate from natural processes, biological processes or human activities (Table 1). Understanding different hazard types is essential for identifying risks and developing appropriate resilience measures.

Table 1: Types of hazards

Type of hazard	Description	Example
Hydrometeorological	Caused by long-lived, meso-scale to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability, these hazards are becoming increasingly severe due to climate change and urbanisation.	• Floods • Droughts • Cyclones • Extreme rainfall events • Heatwaves • Storm surges
Geological	These originate primarily from internal Earth processes, although hydrometeorological factors often contribute to their occurrence and impacts. Many Indian cities, especially those located in mountainous and coastal regions, face significant geological risks.	• Earthquakes • Landslides • Tsunamis • Ground failures
Biological	These are hazards of organic origin or conveyed by biological vectors, including pathogenic microorganisms, toxins and bioactive substances. Rapid urbanisation and changing climatic conditions often increase the risk of biological hazards in cities.	• Epidemics • Vector-borne diseases • Pandemics

Multi-Hazard Concept

Cities rarely experience hazards in isolation. Multiple hazards may occur simultaneously, sequentially, or interact with one another to create more severe impacts (Table 2). Understanding the multi-hazard nature of disasters is particularly important in urban settings where infrastructure systems, services and communities are highly interconnected (Figure 1).

Table 2: Compound and cascading disasters

Compound Disasters	Cascading Disasters
The IPCC defines compound disasters as: "Two or more extreme events occurring simultaneously or successively, combinations of extreme events with underlying conditions that amplify the impact of the events, or combinations of events that are not themselves extremes but lead to an extreme event or impact when combined."	Cascading disasters refer to extreme events in which secondary impacts increase over time and generate unexpected events of significant consequence. According to Pescaroli and Alexander (2015), cascading disasters occur when secondary events emerge from the original hazard and contribute significantly to the duration and severity of disaster impacts.
Examples: • Cyclone accompanied by flooding. • Heatwave combined with drought conditions. • Extreme rainfall coinciding with high tides.	**Examples:** • Heavy rainfall may trigger landslides. • Landslides may disrupt transport networks. • Disruption of transport networks may delay emergency response and relief operations. • The resulting impacts can often be as severe as the original hazard.

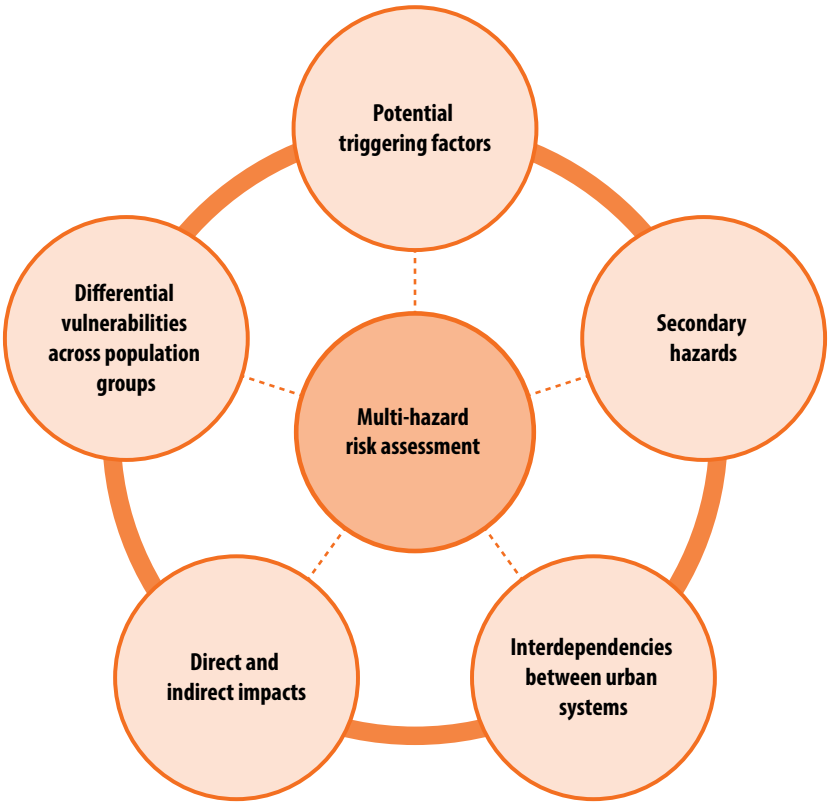


Figure 1: Key components of multi-hazard risk assessment

Understanding these relationships enables cities to design more effective resilience interventions.

Climate-induced hazards and major impact areas in cities

Different climate-induced hazards affect different parts of a city and different population groups within it in distinct ways. Table 3 summarises the major impacts and priority areas associated with the hazards most relevant to Indian cities.

Table 3: Major climate-induced hazards in cities and impacts

Climate hazard	Major impacts	Priority areas
Urban floods (Areas within a 250m radius of flooding hotspots)	• Water-borne disease outbreak - Largely impacting children and elderly people • Long periods of inundation - Highly impacting persons with disabilities (PwDs), school-going children, elderly people, and the informal workforce • Power failures	• Slums and squatters • Unauthorised colonies • Night shelters • Roads • Landfill sites
Cyclones (Exposure to storm surges and cyclonic events)	• Slum settlements face coastal inundation even during non-monsoon days • Failure of basic services (power and water supply, telecommunications, roads) - informal workers, school children and women have to manage households with very limited resources • High tides bring in sea water, causing localised flooding and saline intrusion that affects drinking water	• Slums and squatters • Night shelters • Dilapidated structures • Heritage buildings • Power lines • Telecommunication lines
Heatwaves (Population exposed to 35°C and higher mean surface temperature)	• Health effects on construction workers, gig workers and people in the informal sector • High risk for pregnant women, elderly people and infants • Poor air quality • High risk for patients with chronic diseases	• Slums and squatters • Informal sector
Landslides (Living in the vicinity of landslide-prone locations)	• Slums and unauthorised settlements experience heavy loss and damage	• Slums and squatters • Informal sector • Dilapidated structures • Heritage buildings
Source: Mumbai Climate Action Plan, Brihanmumbai Municipal Corporation, C40, 2022		

Exposure

Exposure can be understood as the presence of people, infrastructure, economic, social, or cultural assets in places and settings that could be adversely affected due to a hazard. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

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 sensitivity of a system to harm and its ability to respond to threats." This is explained in Figure 2.

Vulnerability is assessed in terms of who or what is vulnerable to what and why. 'Who' or 'what' includes population groups, zones/wards, and sectors (e.g., infrastructure for drinking water supply and solid waste management), whereas, 'to what' includes impacts of climatic threats (e.g., water scarcity and spread of vector-borne diseases). The 'why' generally comprise capacities and resources to deal with the impact of climatic hazards. For example, heatwaves and rising temperatures increasingly affect most urban residents. However, outdoor workers, street vendors, construction labourers, and low-income households living in densely built settlements are far more vulnerable due to prolonged heat exposure, limited access to cooling, poor housing conditions, and restricted financial capacity to cope with heat-related health risks.

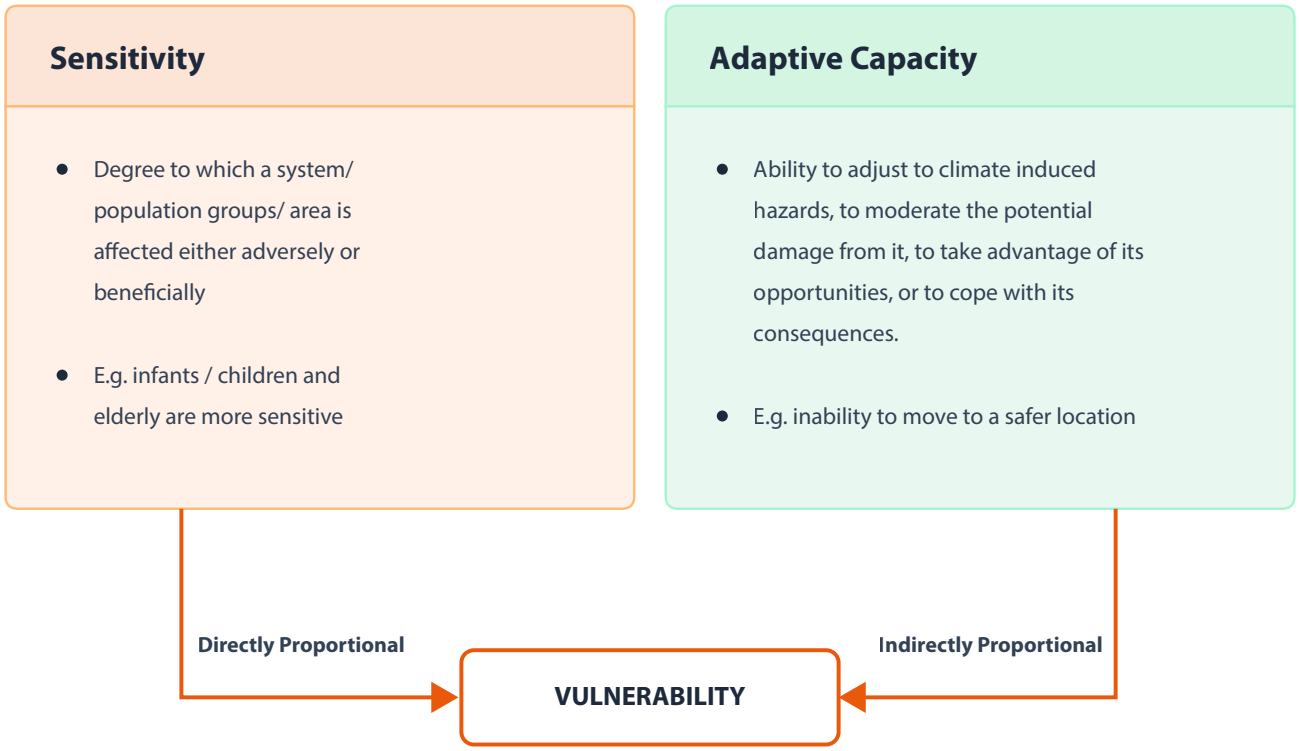


Figure 2: Concept of vulnerability

Disaster

As per the DM Act (2005), disaster is a catastrophe, mishap, calamity or a grave occurrence arising from natural or human-induced causes that results in substantial loss of life, human suffering, damage to property, destruction of infrastructure, disruption of livelihoods, or degradation of the environment. Disasters occur when the magnitude and severity of a hazardous event exceed the coping capacity of the affected community, institution or system. The extent of disaster impacts depends on the level of exposure and vulnerability of the affected population, infrastructure, services and ecosystems. For example, a flood occurring in an uninhabited area may not necessarily become a disaster. However, the same flood affecting a densely populated urban area with inadequate drainage infrastructure, vulnerable settlements and limited preparedness can result in significant loss of life and property and therefore become a disaster. Disasters may be sudden-onset events such as cyclones, floods, earthquakes and landslides, or slow-onset events such as droughts, water scarcity and heat stress. Regardless of their nature, disasters can reverse development gains, increase poverty, disrupt economic activities and place considerable strain on governance systems and public finances.

Disaster Risk

Disaster risk refers to the potential disaster losses in lives, health status, livelihoods, assets and services that could occur to a particular community or society over a specified future period. According to the United Nations International

Strategy for Disaster Reduction (UNISDR), 2009 disaster risk is often represented as the interaction of hazard, vulnerability and exposure (Figure 3).

Disaster Risk (R) = f (Hazard, Vulnerability, Exposure)

This relationship demonstrates that disaster risk increases when the frequency or intensity of hazards increases, the exposure of people, infrastructure and assets increases, and/or the vulnerability of communities and systems increases.

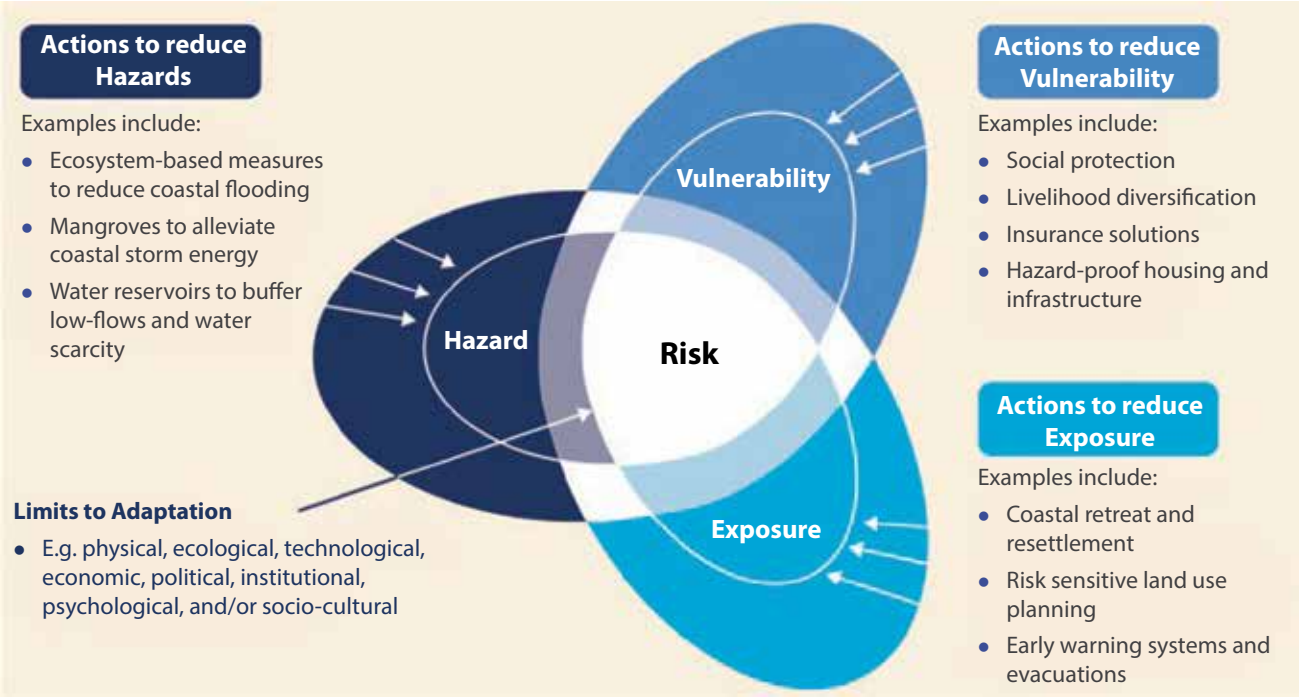


Figure 3: Concept of risk[8]

Assessing disaster risk serves as the first step towards adopting disaster risk reduction measures. Disaster risk assessment helps identify existing and emerging hazards, vulnerable population groups, critical infrastructure and services at risk, potential economic losses, institutional gaps, capacity constraints and priority areas for intervention. A comprehensive understanding of disaster risk enables urban local bodies to make informed decisions and prioritise investments in resilience-building measures.

Disaster Risk Reduction

Disaster Risk Reduction (DRR) refers to strategies and actions that assist in reducing risks and vulnerabilities to disasters and preventing or limiting the adverse impacts of hazards within the broader context of sustainable development. DRR comprises a set of activities aimed at minimising vulnerabilities and disaster risks in society through prevention, mitigation and preparedness measures[9]. Cyclone-resistant construction, flood-resilient infrastructure and risk-sensitive land use planning are some examples of DRR.

Although often used interchangeably with DRR, disaster risk management (DRM) can be thought of as the implementation of DRR, as it describes actions aimed at reducing risk. Since we cannot reduce the severity of natural hazards, the main opportunity for reducing risk lies in reducing vulnerability and exposure. Reducing these two components of risk requires identifying and addressing the underlying drivers of risk, particularly poor economic and urban development choices and practices, environmental degradation, poverty and inequality, and climate change, which create and exacerbate conditions of hazard, exposure and vulnerability. This reflects a broader paradigm shift from a response and relief-centred approach towards a prevention, mitigation and preparedness-centred approach.

Disaster Management Cycle

Disaster management is a continuous process that encompasses a range of activities undertaken before, during and after disaster events. The disaster management cycle provides a framework for organising these activities and ensuring a comprehensive approach to disaster risk management.

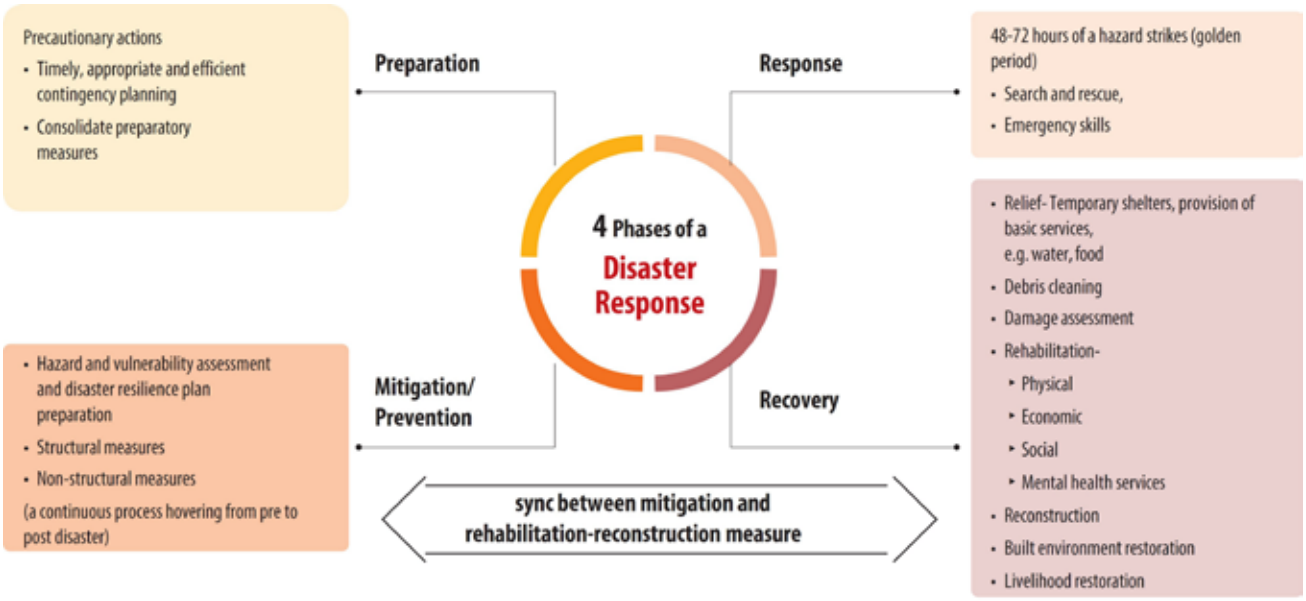


Figure 4: Disaster management cycle[10]

The cycle consists of four interrelated phases (Figure 4) as described below[11]:

Mitigation and Prevention: Mitigation and prevention measures are undertaken during normal periods, before disasters occur. These measures aim to reduce existing risks and prevent the creation of new risks. Mitigation is a continuous process that extends across the disaster management cycle and incorporates lessons learned from previous disasters. Key mitigation measures range from conducting risk assessments, enforcing resilient land use planning and development controls to protecting ecosystems and building disaster-resilient infrastructure.

Preparedness: Preparedness focuses on ensuring that communities, institutions and systems are ready to respond effectively when disasters occur. It strengthens the ability of institutions and communities to respond quickly and effectively during emergencies. Preparedness involves planning, training, and educating stakeholders before disasters.

Response: Response refers to the immediate actions taken during and immediately after a disaster. The first 48–72 hours following a disaster are often referred to as the "golden period" because actions taken during this period can significantly influence survival rates and overall disaster outcomes. Key response actions must include protection of vulnerable populations among other activities. Effective response requires robust preparedness, risk information, coordination and resource mobilisation.

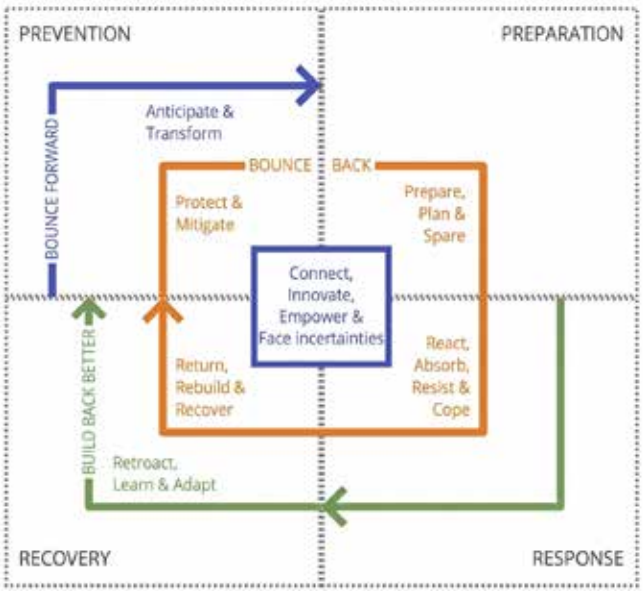
Recovery: Recovery begins immediately after response activities and may continue for months or even years. The objective of recovery is not merely to restore pre-disaster conditions but to reduce future disaster risks and vulnerabilities. Recovery has three important aspects: relief, rehabilitation and reconstruction.

Disaster Resilience

Disaster resilience refers to the ability of a system, community or society to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner. According to UNDRR, resilience involves the preservation and restoration of essential structures and functions through risk management. Resilience is often understood through three complementary dimensions of 'bounce back', 'bounce forward' and 'build back better' (Figure 5).

Bounce Back	Bounce Forward	Build Back Better
The ability to recover rapidly and restore essential functions following a disaster.	The ability to learn from disasters, adapt and improve systems and institutions.	The ability to reconstruct infrastructure, services and governance systems in ways that reduce future risks and vulnerabilities.

The components of disaster resilience are interlinked with the actions, strategies, and time horizons of the four basic dimensions of disaster management explained above. Some components of the "bounce forward" dimension apply to all dimensions of risk management such as innovation, flexibility, or autonomy, for example. It can be seen as a process that recognises the gains of each of the major phases. Through this perspective, resilience would be strengthened at each stage of risk management using different capacities[12].



Source: Graveline, M.K. and Germain, D., (2022)

Figure 5: Concept of Build Back Better

Key elements for assessing disaster resilience include technological capacity, skills and education levels, economic status and growth prospects, quality of environmental and natural resource management institutions, livelihood assets, political structures and processes, infrastructure systems, flows of knowledge and information, and speed and breadth of innovation. Assessing resilience requires understanding whether these elements have been strengthened, enhanced, or incorporated within urban systems to effectively address disaster risks across the entire disaster management cycle.

Transition from Disaster Risk to Disaster Resilience

Traditional disaster management emphasises emergency response, relief distribution and post-disaster recovery. However, climate change and increasing disaster losses have highlighted the limitations of this approach. It is increasingly recognised that reducing disaster impacts requires addressing the underlying drivers of risk before disasters occur. This has led to a gradual transition from disaster risk management towards disaster resilience.



While disaster risk focuses on understanding the likelihood and consequences of losses, disaster resilience focuses on strengthening the capacity of systems, communities and institutions to anticipate, withstand, adapt to and recover from hazards. The transition from disaster risk to disaster resilience reflects a shift from merely understanding and assessing the risks faced by communities and systems towards strengthening their capacity to anticipate, withstand, adapt to, recover from, and transform in the face of those risks. This transition emphasises the need to integrate resilience considerations across all stages of the disaster management cycle and mainstream them into all sectors of urban development and governance.

Disaster resilience can be viewed as the broader outcome of effective disaster risk reduction. Together, DRR and resilience provide the foundation for sustainable, inclusive and climate-responsive urban development.

Learning Unit 1.2: Policy and Institutional Overview

ULB officials must be familiar with the key global, national and institutional frameworks that guide climate-induced disaster resilience planning. These include the policy commitments, governance mechanisms and planning frameworks that support disaster risk reduction, climate adaptation, gender equality and social inclusion, and ecosystem-based approaches in urban areas.

Global Frameworks for Disaster Resilience

Climate-induced disaster resilience is supported by several global frameworks that collectively promote disaster risk reduction, climate adaptation, sustainable development, ecosystem conservation and social inclusion. The key global frameworks include:

- Sendai Framework for Disaster Risk Reduction (2015–2030)
- Sustainable Development Goals (SDGs)
- Paris Agreement
- New Urban Agenda

- Enhanced Lima Work Programme on Gender and its Gender Action Plan
- Kunming–Montreal Global Biodiversity Framework
- Ramsar Convention on Wetlands

Together, these frameworks provide strategic direction for strengthening resilience at national, state, and local levels.

GESI and EbA considerations in Paris Agreement

Gender Equality and Social Inclusion (GESI)	Ecosystem-based Adaptation (EbA)
Highlights that disaster risk reduction, climate adaptation and actions should consider gender equality, intergenerational equity, rights of Indigenous Peoples, and social inclusion, ensuring that vulnerable groups are actively considered in climate resilience planning.	Recognises the importance of protecting the integrity of ecosystems and biodiversity for both climate change mitigation and adaptation. It promotes adaptation measures that account for ecosystem vulnerability.

Guiding Principles D, F and I of the Sendai Framework emphasise inclusive, accessible, and non-discriminatory participation in DRR, empowerment of local authorities and understanding location-specific disaster risk

Making Cities Resilient[13]

MCR 2030 is a global partnership to strengthen local government and ensure that cities become inclusive, safe, resilient and sustainable by 2030. Its main objectives are to improve cities' understanding of risk and secure their commitment to local disaster risk reduction and resilience, to strengthen cities' capacity to develop local plans to enhance resilience, and to support cities implement local plans to enhance resilience.

Box 1: Stages of cities reporting under MCR 2030

STAGE A: **Cities know better**	• awareness-raising on DRR and resilience
STAGE B: **Cities plan better**	• improving risk analysis, improving diagnostic skills for planning, and improving strategies and planning
STAGE C: **Cities implement better**	• increasing access to finance, ensuring resilient infrastructure, adopting nature-based solutions, integrating climate risk into strategies and plans, and ensuring inclusion

The "Ten Essentials for Making Cities Resilient" serves as an operational framework for implementing the Sendai Framework at the local level (Figure 6). The framework aligns directly with the Sendai priorities for action. It recognises the critical role of ecosystems in disaster risk reduction and promotes healthy ecosystems for continued service provision, emphasises social cohesion and community participation, and supports risk-informed urban planning and governance. The framework highlights the importance of strengthening both urban systems and communities to reduce disaster risks.

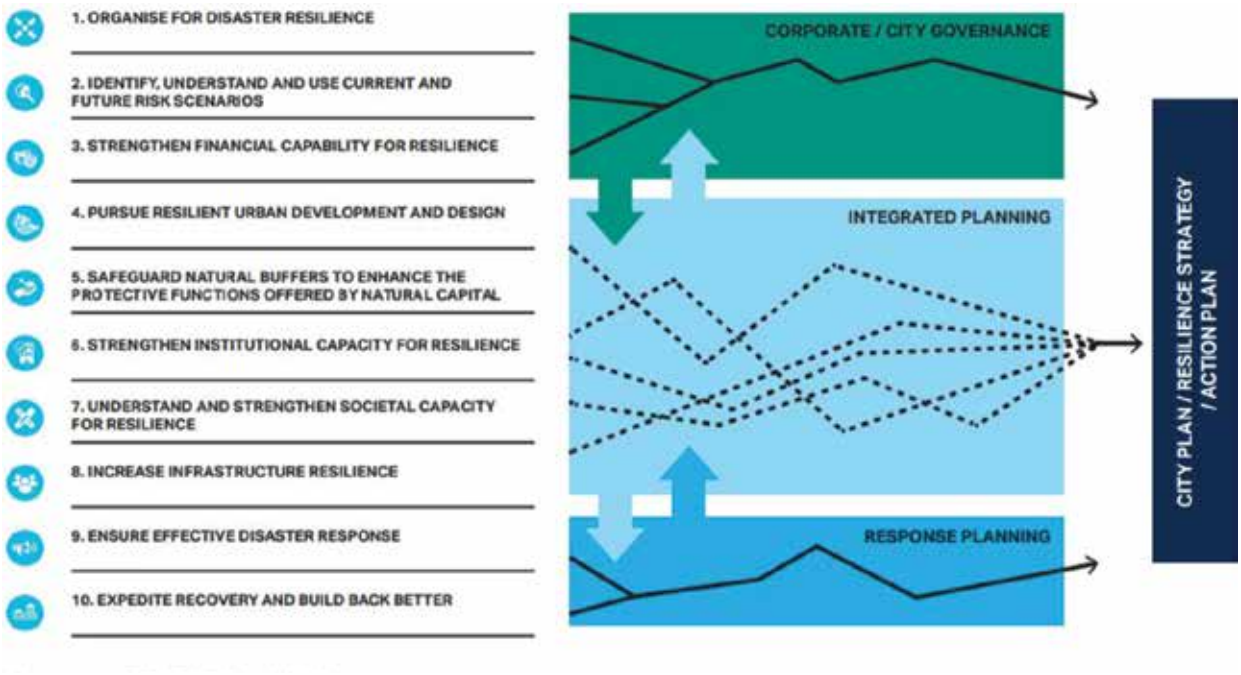


Figure 6: Ten Essentials for Making Cities Resilient

National Policy and Institutional Framework for Disaster Risk Reduction

India has established a comprehensive policy framework for disaster management and disaster risk reduction. Key national frameworks include:

- Disaster Management (Amendment) Act, 2025
- National Policy on Disaster Management, 2009
- Prime Minister's Ten-Point Agenda for Disaster Risk Reduction, 2016
- National Disaster Management Plan (NDMP), 2019
- NDMA Guidelines on Climate-Induced Disasters

The overall vision is to build a safe and disaster-resilient India through prevention, mitigation, preparedness, response, and recovery.

Disaster Management (Amendment) Act, 2025

The Disaster Management (Amendment) Act, 2025, strengthens decentralised disaster governance and introduces important institutional reforms[14]. A key provision of the Act is the establishment of **Urban Disaster Management Authorities (UDMA)** in capital cities and million-plus urban centres. Other important provisions include the National and State Disaster Databases, advisory on Gender-responsive DRR and Management, 2025, and advisory for Protection of Platform - Gig Workers During Heatwaves, 2025.

However, currently, more than 80% of central investment in disaster management is allocated to disaster response and relief. Most of the post-disaster reconstruction projects aimed at "build back better" remain limited, with structured and systematic implementation mechanisms often lacking. Further, monitoring and evaluation systems remain weak, and localised planning processes are inadequate. These factors highlight the pressing need for a paradigm shift from a response and relief approach towards a mitigation and preparedness-centred disaster resilience approach.

Learning Unit 1.3: Mainstreaming GESI and EbA in Climate-Induced Disaster Resilience Planning

Gender Equality and Social Inclusion (GESI)

Climate-induced disasters do not affect everyone equally. People's individual characteristics, social position, economic status, and access to resources determine their level of vulnerability before, during, and after disasters. Understanding these differences is essential for developing inclusive and resilient cities. Gender inequality is often aggravated by other forms of social and cultural intersectionality, resulting in different levels of disaster risk among individuals and communities. Therefore, disaster resilience planning should recognise that vulnerability is shaped by multiple social, economic and environmental factors rather than by hazards alone.

Gender and Social Dimension of Disaster Risk and Resilience

Disaster vulnerability is influenced by intersectionality, where multiple characteristics interact to shape an individual's exposure, sensitivity, and adaptive capacity (Figure 7). These factors include gender, age, disability, ethnicity, marital status, language, class, income, and education. Further, these have a direct bearing on the achievement of the Sustainable Development Goals (SDGs) according to the principle of **Leave No One Behind**. Disaster resilience planning therefore requires understanding not only the hazard but also the diverse needs, capacities, and vulnerabilities of different population groups.

Box 2: Intersectionality[15]

Intersectionality is a way of describing how different forms of inequality or discrimination compound each other, creating a new type or level of disadvantage and risk. It is a concept that acknowledges and explores the interconnections between diverse social identities and systems of oppression. It emphasises the way in which different forms of discrimination and disadvantage, including those based on race, gender, class, sexuality, and disability, can intertwine and intersect, resulting in distinctive experiences and inequalities for persons who possess multiple marginalised identities. From an intersectional standpoint, inequities are not attributable to isolated factors, but rather arise from the intersections of various social contexts, power dynamics, and lived experiences.



Figure 7: Factors of Intersectionality influencing Disaster Risk and Resilience

Factors of Vulnerability

Disaster vulnerability is not determined solely by exposure to hazards. Existing gender roles, unequal access to resources and social inequalities significantly influence people's ability to anticipate, cope with and recover from disasters. These gender-specific vulnerabilities, combined with other intersectional factors, further increase disaster risk and reduce resilience. The factors of vulnerability and specific needs of vulnerable groups is elaborated below (Table 4).

Needs of Different Groups

Different population groups have different needs throughout the disaster management cycle. Disaster response and recovery measures should therefore be inclusive, equitable and context-specific. Since disaster impacts vary among individuals and communities, needs are manifold in a convergent situation and require coordinated planning across sectors.

Table 4: Factors of vulnerability and needs of different groups

	Factors of vulnerability for different groups	**Specific needs of vulnerable communities**
Vulnerable groups (PwD, elderly and margilanised)	• Less access to resources • Pre-defined devalued social roles • Limited participation in decision-making • Restricted mobility and communication • Greater engagement in underpaid, insecure and informal employment	• Accessibility of basic services • Equitable relief distribution • Livelihood reconstruction, including consideration of the informal economy • Access to health, sanitation and nutrition services • Continuity of education • Participation in planning and decision-making
Women	• Dual burden of productive and reproductive work • Exclusive responsibility for household chores • Limited employment opportunities	• Gender-sensitive healthcare • Safe and secure shelters • Appropriate clothing and hygiene facilities • Protection from gender-based violence • Livelihood restoration
Men	• Expectation to bear full financial responsibility for the household • Limited awareness of household care responsibilities • Psychological trauma arising from disaster-related economic losses	• Recognition of their specific vulnerabilities • Psychological support • Livelihood restoration

Women, Children and Youth as Agents of Change

Disaster resilience is not only about addressing vulnerabilities but also about recognising the capacities of communities. Women, children and youth possess valuable local knowledge, leadership potential and social networks that contribute significantly to disaster resilience. It is common understanding that women have close connections with natural resources. They possess knowledge of local hydrology, seasonal cropping patterns, climate-smart agriculture and disease-tolerant cropping practices. They further have strong social networks that facilitate dissemination of information and community mobilisation.

Women and youth can act as agents of change by[16]:

- Sharing information on disaster impacts
- Identifying critical population groups such as elderly persons, children, pregnant women and lactating mothers
- Motivating communities to adopt resilient construction practices
- Promoting ecosystem protection
- Championing behavioural change from schools to households
- Supporting awareness generation and risk communication
- Designing innovative early warning and communication mechanisms
- Participating in community mapping and data collection
- Supporting behaviour change campaigns
- Developing innovative dissemination mechanisms for disaster information

These capacities contribute across all stages of the disaster management cycle, particularly mitigation, preparedness, response, and recovery.

Training and Sensitisation for Making Women, Children and Youth Agents of Change

Training and sensitisation are essential for strengthening the capacity of women, children and youth to contribute effectively to disaster risk reduction and climate resilience. Capacity-building interventions should focus on enhancing local knowledge, technical skills, leadership and preparedness across all stages of the disaster management cycle.

Key areas of training include:

- Traditional knowledge and skills such as food preservation, kitchen gardening, rainwater harvesting, and other local practices that strengthen household and community resilience
- Local knowledge on disaster risk mapping, critical infrastructure, and natural resources to support preparedness and mitigation planning
- Training in Information and Communication Technology (ICT) tools, including GIS, Google Maps and other digital platforms, to improve risk assessment, communication and emergency response
- Skill building in alternative livelihoods to diversify income sources and enhance resilience against climate-induced disasters
- Emergency warning and evacuation, including understanding early warning systems, timely response to warnings and supporting the evacuation of critical population groups
- Risk knowledge and awareness through community sensitisation programmes, promoting leadership, engagement and participation of women, children and youth in disaster risk reduction activities
- Capacity development of teachers to integrate disaster safety into schools and strengthen school preparedness
- Sensitisation and skill development for children and youth to build careers in disaster resilience and climate action

These interventions contribute across different stages of the Disaster Management Cycle, particularly mitigation/ prevention, preparedness, response and recovery, by strengthening local capacities, promoting inclusive participation and enabling communities to become active partners in building disaster resilience.

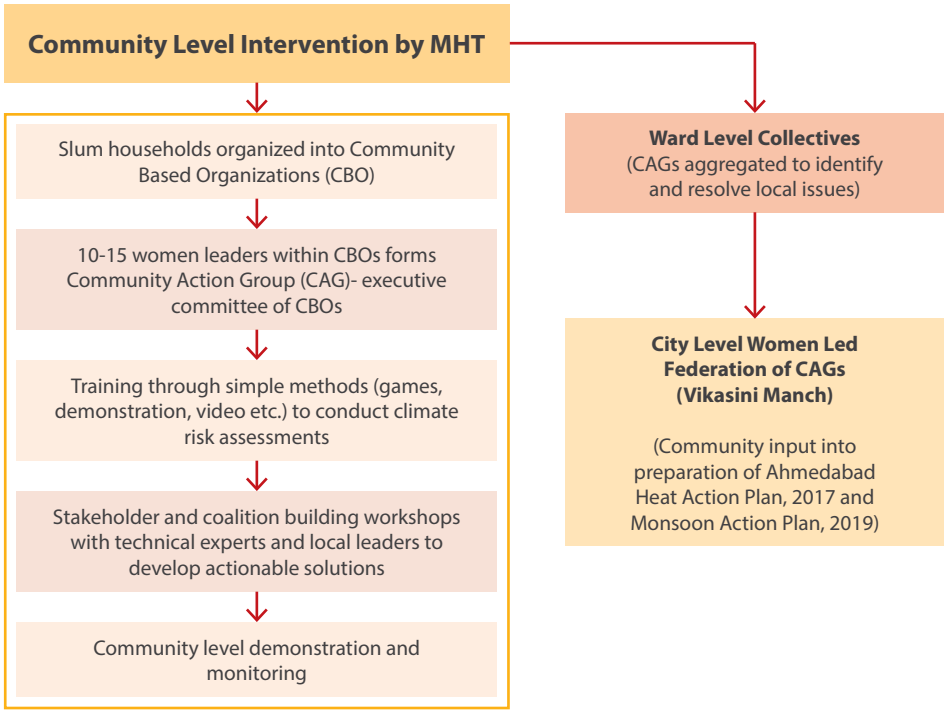


Figure 8: Women Capacitated as Agents of Change for Disaster Preparedness: Mahila Housing Trust, Ahmedabad

Principles for Mainstreaming GESI in Climate-Induced Disaster Resilience Planning

Mainstreaming Gender Equality and Social Inclusion (GESI) requires integrating equity and inclusion throughout the disaster resilience planning process rather than treating them as standalone activities. It recognises that different social groups experience disasters differently and therefore require differentiated approaches throughout planning, implementation, monitoring and evaluation.

Principles for mainstreaming GESI in disaster resilience planning include[17]:

- Promoting equity in planning, implementation and benefit sharing
- Ensuring inclusive participation of all social groups throughout the planning process
- Recognising, respecting and developing the capacities of women, children, youth, elderly persons, PwD and other vulnerable communities
- Avoiding overburdening women with additional work during planning and implementation
- Preventing the transfer of disaster risks and adverse impacts from one group to another
- Promoting the use of local and traditional knowledge in disaster resilience planning
- Undertaking gender-disaggregated assessments to understand differentiated vulnerabilities, capacities and needs
- Leveraging appropriate technologies to improve access to information, communication and service
- Promoting empowerment, ownership and leadership among vulnerable communities

Box 3: Equality and Equity

Equality means that the different behaviours, aspirations and needs of women, men and other social groups are considered, valued and favoured equally. Whereas, equity implies fairness of treatment for women, men and different social groups according to their respective needs. This may include treatment that is different but considered equivalent concerning rights, benefits, obligations and opportunities. While equity is the process, equality is the goal.

Applying these principles helps ensure that climate-induced disaster resilience planning is equitable, inclusive, participatory and responsive to the diverse needs and capacities of all sections of society.

Mainstreaming GESI in Climate-Induced Disaster Resilience Planning

GESI should be integrated throughout the disaster resilience planning process using a participatory and multi-sectoral approach. Mainstreaming begins with understanding the diversity of communities and continues through planning, implementation, financing, and monitoring. The process includes steps from identifying social groups within the city, understanding varied risks, formulating GESI-enabling policies, institutional arrangements and monitoring mechanisms, to monitoring equity and inclusivity outcomes to evaluate effectiveness (Figure 9).

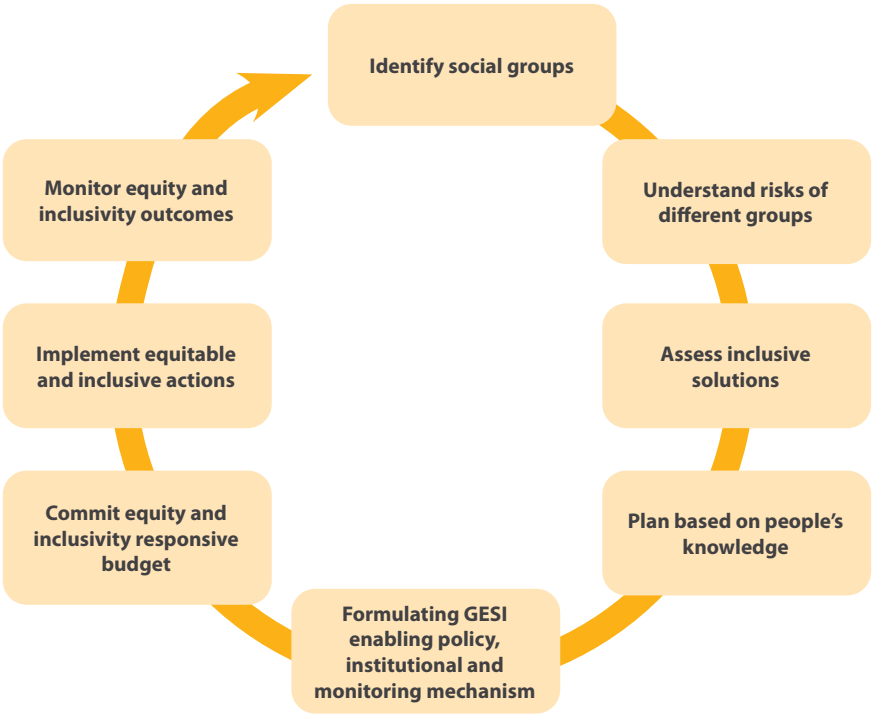


Figure 9: Mainstreaming GESI in Climate-Induced Disaster Resilience Planning[18]

These steps should be undertaken through multi-sectoral engagement, involving government departments, technical institutions, civil society organisations, community groups, academia and the private sector.

Ecosystem-based Disaster Resilience

Ecosystem-based Disaster Risk Reduction (Eco-DRR) refers to the sustainable management, conservation and restoration of ecosystems to reduce disaster risk (Estrella and Saalismaa, 2013). The approach recognises that healthy ecosystems form the foundation of resilient communities and resilient development. This approach provides benefits for both people and nature beyond adaptation and disaster risk reduction within the overall framework of sustainable development.

Need for Ecosystem-based Disaster Resilience

Ecosystem-based approaches address disaster risk in all its dimensions by reducing hazards, exposure, and vulnerability through ecosystem services. They are considered "no-regrets" strategies because they generate benefits under both present and future climate conditions while remaining cost-effective over the long term. Beyond reducing disaster

risks, ecosystem-based approaches provide the following benefits:

- Supporting sustainable livelihoods and development
- Promoting proper environmental management
- Encouraging multidisciplinary collaboration in decision-making
- Strengthening participatory planning and governance

These multiple benefits make ecosystem-based approaches an important component of climate-induced disaster resilience planning.

Ecosystem Services in Disaster Risk Reduction

Ecosystem services contribute to disaster risk reduction through different pathways (Figure 10).

Provisioning services, such as food, freshwater, fuelwood, fibre and biochemicals, reduce vulnerability by supporting livelihoods and ensuring access to essential resources before, during and after disasters.

Regulating services reduce hazards and exposure by regulating climate, water, disease and ecological processes. Wetlands store floodwaters, forests stabilise slopes, mangroves reduce storm surge impacts, while vegetation regulates erosion and improves water quality. These services absorb the energy from physical hazard events and act as natural buffers.

Supporting services including nutrient cycling, soil formation and primary production, indirectly reduce vulnerability by sustaining the ecological processes that support all other ecosystem services.

Cultural services contribute indirectly to hazard reduction. In places where wetlands, forests or landscapes have cultural, religious or spiritual significance, communities are more likely to conserve and protect them. Maintaining these ecosystems in a healthy condition enables them to continue performing their hazard mitigation functions effectively.

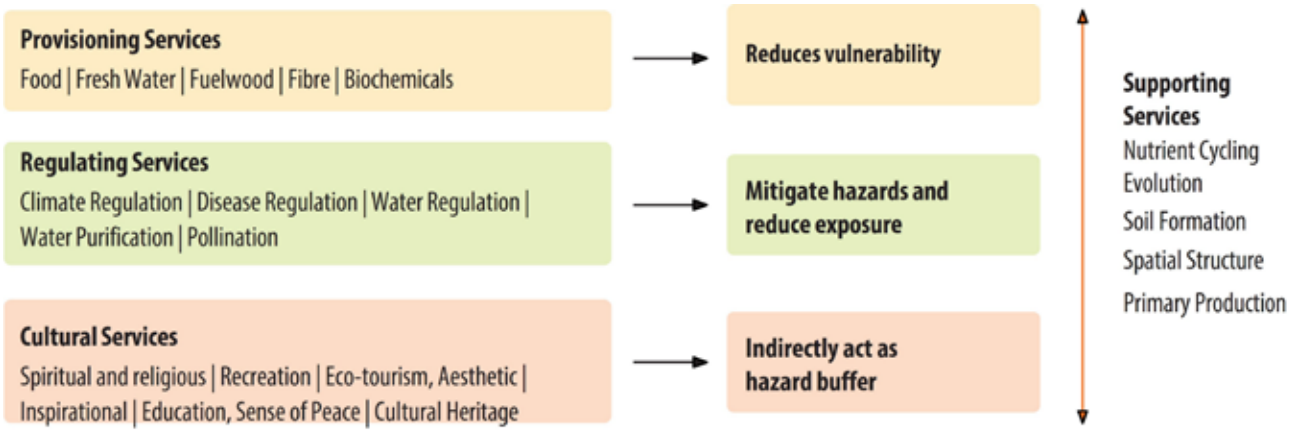


Figure 10: Ecosystem Services in Disaster Risk Reduction[19]

Ecosystem Services in Hazard Mitigation

Different ecosystems perform distinct hazard mitigation functions and contribute to climate-induced disaster resilience (Table 5). Mountain forests, wetlands, mangroves, dryland vegetation, parks, and urban water bodies all provide multiple ecosystem services that reduce disaster risk while simultaneously supporting biodiversity, livelihoods, and essential ecosystem functions. Integrating these natural systems into land use planning, watershed management, coastal zone management, and urban planning can significantly reduce disaster impacts while providing long-term environmental and social co-benefits.

Table 5: Ecosystems and their hazard mitigation functions

Ecosystem	Hazard mitigation functions
Mountain forests and vegetation on hillsides	• Vegetation cover and root structures prevent landslides • Catchment forests reduce flood risk • Forests support water recharge, drought mitigation and safeguarding drinking water supply
Wetlands and floodplains	• Mitigate waterlogging • Coastal wetlands, tidal flats, deltas and estuaries reduce the magnitude of storm surges and tidal waves
Coastal ecosystems (mangroves, saltmarshes, coral reefs, barrier islands and sand dunes)	• Protect against hurricanes, storm surges, flooding and other coastal hazards • Coastal wetlands buffer against saltwater intrusion and adapt to gradual sea-level rise by trapping sediment and organic matter • Sand dunes (with associated plant communities) and barrier islands act as barriers against waves, currents and storm surges
Drylands	• Natural vegetation management mitigates drought and controls desertification • Maintaining vegetation cover and agricultural practices such as shadow crops and nutrient-enriching plants increases drought resilience
Parks and water bodies	• Support micro-climate regulation, reducing the urban heat island effect • Improve urban flood regulation through their natural sponging capacity

Box 4: EbA as a No-Regret or Low-Regret Strategy[20]

Ecosystem-based Adaptation is widely recognised as a no-regret or low-regret strategy for disaster risk reduction. No-regret adaptation measures are not affected by uncertainties related to future climate change because they address existing climate variability while simultaneously building adaptive capacity for future climate risks. These measures generate benefits regardless of future climate scenarios.

Examples include mangrove restoration, watershed protection and wetland conservation. Mangrove restoration stabilises sediments, protects coastlines, supports fisheries, enhances livelihoods and contributes to carbon storage.

According to the City of London Corporation:

- No-regret measures deliver benefits that exceed their costs regardless of the extent of climate change
- Low-regret measures involve relatively low costs and potentially large future benefits
- Win-win measures contribute simultaneously to climate adaptation and broader development outcomes

In addition to disaster prevention and hazard mitigation, ecosystem-based approaches generate multiple co-benefits, including biodiversity conservation, climate change adaptation, carbon storage, improved quality of life, water and soil protection, cultural values, and prolonging the effectiveness of engineered infrastructure.

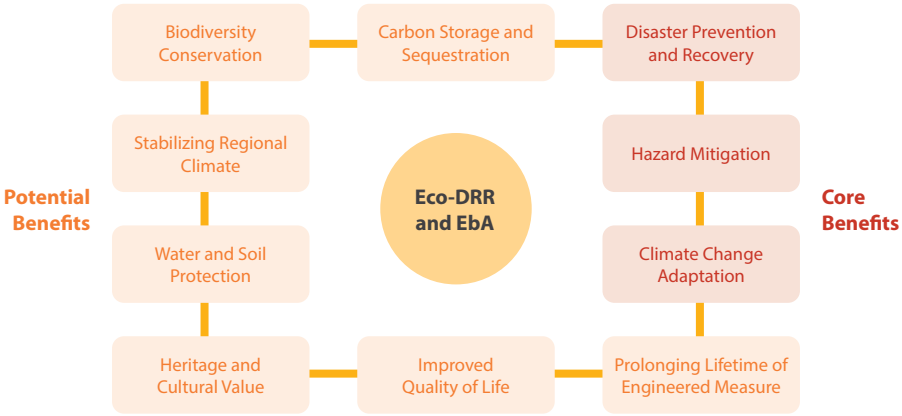


Figure 11: Eco-DRR and EbA potential benefits and core benefits

Mainstreaming EbA in Climate-Induced Disaster Resilience Planning

Mainstreaming EbA into disaster resilience planning is a continuous process involving steps such as identification of ecosystem base, assessing ecosystem services and risks, and promoting investment in EbA solutions. (Figure 12)

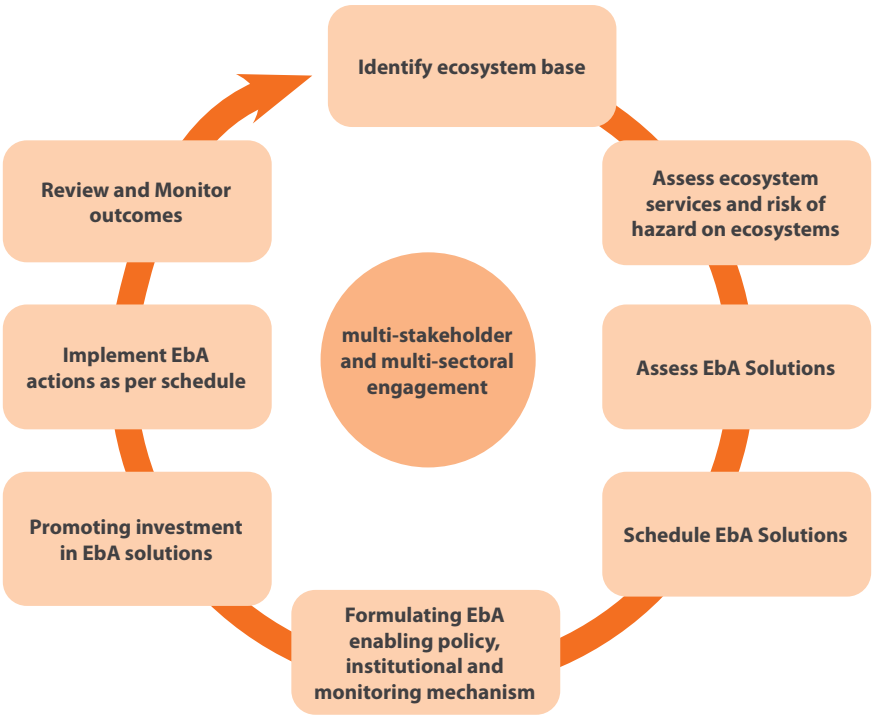


Figure 12: Mainstreaming EbA in DRR process

The entire process should be supported through continuous multi-stakeholder and multi-sectoral engagement.

Safeguards for Effective Mainstreaming of EbA

Implementation of ecosystem-based approaches should ensure:

- Fair and equitable access to benefits
- Prevention of harm to biodiversity, ecosystems and ecosystem services
- Transparent governance and access to information
- Full, effective and inclusive participation
- Respect for the rights of women and men, indigenous peoples and local communities
- Prevention of transfer of risks and impacts
- Sustainable resource use
- Appropriate impact assessment with robust monitoring and evaluation

Ecosystem conservation and restoration should not disrupt the livelihoods of communities dependent on ecosystem resources. Communities should be actively engaged through community-based ecosystem management, while livelihood diversification, training and capacity building should be promoted wherever necessary.

Where ecosystem management involves multiple institutions, implementation should be based on joint consultation, transparent information sharing and coordinated governance. Monitoring systems should recognise that ecosystem restoration often delivers benefits over the long term and should therefore combine quantitative and qualitative indicators.

MODULE 2: Engagement Process

Learning objectives

This module aims to elucidate the need for multi-stakeholder engagement, especially with the vulnerable and marginalised groups. It explains the institutional structure and stakeholder landscape for climate-induced disaster resilience planning and provides information on developing a systematic citywide communication and stakeholder engagement.

Disaster resilience is a cross-sectoral issue. Bringing all relevant stakeholders onto a single platform creates the opportunity for a comprehensive and robust disaster resilience strategy, one that is easier to ratify institutionally, mainstream across departments, and implement on the ground.

Learning Unit 2.1: Institutional Structure

City governments must formulate a Disaster Resilience Core Team (DRCT) or Urban Disaster Management Authority (UDMA) for institutionalising disaster management. The DM Act mandates the formation of UDMAs for state capitals and municipal corporations, whereas smaller ULBs (non-municipal corporations) can form a DRCT, or modify an existing disaster management unit. These will be discussed in detail in Section VIII. The DRCT must include all relevant departments, including those that are responsible for protecting local ecosystems, those involved in socio-economic empowerment of traditionally vulnerable communities, and other relevant departments. It must also ensure more than 50% representation of women.

The DRCT has distinct responsibilities at each stage of the disaster management cycle, as summarised below. In the pre-disaster phase, it must conduct inclusive disaster risk assessments, plan for structural and non-structural measures, prepare disaster management plans, and facilitate early warning. Under disaster response, it must facilitate inclusive and equitable search and rescue operations, whereas during recovery, the DRCT must conduct rapid damage assessments, highlighting damage to traditionally vulnerable groups and the natural ecosystems.

Across all four stages, the core team needs to ensure that actions are contextualised to the probability and severity of the hazards concerned. Every stage must integrate the concerns and capacities of gender and other social groups, as well as natural ecosystems, and the end-to-end process should remain participatory throughout.

Learning Unit 2.2: Stakeholder Groups

Effective disaster resilience planning requires multi-sectoral engagement across cross-cutting jurisdictional areas and multi-stakeholder engagement, including community engagement to understand vulnerability and adaptive capacity. Stakeholders may be individuals or organisations, government agencies, NGOs, research institutions, private-sector actors, or community leaders, and should be identified based on their sphere of influence.

Relevant municipal and cross-cutting departments include:
Development planning
Infrastructure and service provisioning (water, wastewater, waste)
Transportation
Local economic development
Disaster management
Incident Response Team
Biodiversity Management Committee/Horticulture Department
Urban Community Development / Mission for Elimination of Poverty in Municipal Areas (MEPMA)
Public health
Water and food security
Electricity distribution
Pollution abatement
NGOs/CBOs volunteer services

Community stakeholder groups requiring particular attention include:
Women, elderly, children, PwD
Daily wagers
Slum dwellers
Transgender persons
Indigenous communities

Stakeholders can be categorised according to their relationship to the disaster resilience process. This helps ULBs decide how intensively and in what manner to engage with each group. The four broad categories of stakeholders are:

- Information providers to help develop the disaster resilience strategy
- People involved in the implementation of the disaster resilience strategy
- People who influence the implementation of disaster resilience actions
- People impacted by the implementation of disaster resilience actions

Each ULB should map its own local stakeholders against these categories, as the relative weight of each category will vary by the city's context. Organisational stakeholders are important as they provide sector-specific input in disaster resilience planning. This supports scientific, evidence-based planning and implementation of disaster resilience activities and the effective mainstreaming of disaster risk in sectoral plans. On the other hand, community groups provide information on specific challenges and needs of the vulnerable and marginalised sections. They help in driving participatory planning, consequently building community resilience.

Learning Unit 2.3: Communication and Consultation Mechanism

City officials must be equipped with the practical tools needed to design a citywide communication plan and to match consultation methods to different stakeholder groups.

Citywide communication

Disaster resilience may be a new topic for some stakeholders, and it may generate apprehensions and negative reactions regarding the purpose and process among others. The rationale for engagement therefore needs to be carefully explained, and the process's need and outcome clearly communicated. Table 6 represents the key aspects of

a citywide communication plan.

Table 6: Sample citywide communication plan matrix

Target audience	Objective, message	Activity	Communication medium
Public entities (city/district/ state, as applicable)	To inform them that climate-induced disaster resilience planning for the city is underway	Internal cum external launch, depending on target audience	Newsletter, staff meetings, exchange of letters
Community, private sector and others	To inform them of the aim of creating a climate-induced disaster-resilient city	External launch	Media release

Stakeholder consultation mechanism

Consultation tools should be matched to the target group, and every consultation should be formally documented. Table 7 sets out indicative consultation tools and documentation media by target group.

Table 7: Stakeholder consultation mechanism, by target group

Target group	Consultation tool	Medium of documentation
• Government • NGOs/CBOs • R&D institutes • Private sector • National / international funding agencies	• Key informant interviews • Consultation workshops	• Capturing suggestions and feedback on a pre-structured template • Written documentation of interviews • Audio-visual recording of the consultation
• Women • Elderly people • PwD • Indigenous communities • Slum dwellers • Transgender persons • Children	• Focus group discussions (FGDs) • Interpersonal communication • Telephonic interviews • Aggregated representation in consultation workshops, through bodies such as Resident Welfare Associations (RWAs) or Self-Help Groups (SHGs)	• As applicable to the tool used, per the documentation media above

In the process of formulating the consultation mechanism, the ULB must consult key stakeholders for both pre- and post-disaster planning and document every communication. It must ensure that consultation tools for different groups are contextualised.

Points to capture through consultation

- Sex-disaggregated assessment (for example, 'men'/'women' rather than 'participants')
- Impact of previous events on life and livelihood, including schooling, employment, training, access to land, and new employment
- Intersectionality of vulnerable groups, for example, extreme poverty, single-headed households, elderly age, or health conditions such as pregnancy, lactation or menstruation
- Role in decision-making, and in performing household chores and care-giving work

- Perception of ecosystem services, especially as perceived by traditionally vulnerable groups
- Impact of previous events on the local ecosystem, and the consequential impact of this on communities

Considerations for effective community participation

- Well-defined objectives, encompassing disaster risk identification and risk reduction
- Realistic timing and location for consultations
- Appropriate communication methods and use of the local language
- Ensuring meaningful representation of community members throughout each step
- Incorporating local knowledge
- Maintaining fairness, equity, transparency and accountability
- Maintaining confidentiality and anonymity
- Consensual information-sharing
- Non-judgemental and empathetic behaviour

MODULE 3: Baseline Assessment

Learning objectives

The module on baseline assessment aims to develop skills for preparing a robust understanding of city structure and assessing occurrences and impacts of climate-induced disasters. It includes analysis of urban systems (infrastructure and socio-ecological) and GESI aspects.

Learning Unit 3.1: Preparation of the municipal profile

A robust baseline begins with a comprehensive city profile. This profile should capture:

- Nature and location of the city
- Socio-economic and demographic details, capturing the traditionally marginalised population
- Details of the local government body, such as area, administrative divisions and institutional structure
- Institutional coordination for both horizontal and vertical
- Service performance for all major urban systems, including the local ecosystem
- Spatial distribution of all major urban systems, including the local ecosystem
- Municipal finance
- Citizens' grievances database
- Major initiatives regarding development planning, different urban systems, and disaster management (ongoing and upcoming), including their activities, funding and beneficiaries

City profiling should also assess policies, programmes, schemes, projects and programmes for their contribution to disaster resilience and inclusivity, and their integration with the local ecosystem.

Social registry - socio-economic and demographic data

Table 8 sets out indicative sources of socio-economic and demographic data for traditionally vulnerable groups.

Table 8: Indicative sources of socio-economic and demographic data by vulnerable groups[21]

Group	Indicative data source
Women	Census
Elderly people	Census
PwD	Census/National Family Health Survey (state-level proxy)
Indigenous communities	Census
Children	Census
Slum dwellers	Census
Daily wagers	Workers' associations/NGOs/CBOs, etc.
Transgender persons	NGOs/CBOs working towards the cause

Since Census 2011 is a dated dataset, ULBs should endeavour to engage NGOs, CBOs, or other relevant organisations to gather baseline data on traditionally vulnerable communities. Community-level stakeholder consultation, as described in Chapter 3, would also facilitate this baseline analysis. National Family Health Survey reports can indicate attitudes towards gender roles and gender-based violence, though only as state-level proxy data. Baseline data collection should also capture intersectionality factors, including poverty, caste, marital status, financial dependency, and physical or mental ailment (including learning disabilities).

Building a gender and social inequality-informed database

A robust database on gender and social inequality draws on several types of information[22]:

- **Disaggregated quantitative data:** Quantitative data on disaster impacts, disaggregated by traditionally vulnerable group, should be collated, with potential estimation from Census data
- **Qualitative data:** Qualitative information on disaster impacts for specific vulnerable groups, including insights from surveys, focus group discussions and key informant interviews, should be reviewed
- **Inequality data:** Existing information on inequality within a given context should be considered, also drawing on surveys, FGDs and key informant interviews
- **Intermediary outreach and capturing missing voices:** ULBs may partner with individuals and organisations experienced in supporting minority groups to connect with them and gather insights
- **Critical questions:** It would be ideal to question stereotyping, sexism, heteronormativity, cisnormativity or exclusion within the existing analysis of differential impacts, drawing on insights gathered through the steps above

City profiling should map the following major urban infrastructure and socio-ecological systems (Table 9 and 10).

Table 9: Urban (infrastructure and socio-ecological) systems

Urban Infrastructure	Socio-ecological system	Type of data to be considered
• Water source and supply system • Sewerage • Stormwater drainage • Solid waste management • Road and transport • Electricity distribution • Housing	• Public health • Education • Community spaces • Key economies • Local ecosystem	• Service-level assessment across the value chain • Comparison with relevant standards, such as the Service Level Benchmark (SLB) • Level of accessibility and affordability • Expanse of services • Performance efficiency

Local ecosystem profile

Table 10: Indicative ecosystem components and data sources

Abiotic	Biotic	Type of data to be considered
• Atmosphere • Hydrosphere (rivers, wetlands, lakes) • Pedosphere (soil, rocks)	• Flora (trees, mangroves, grasslands) • Fauna (animals, birds)	• Central - India Meteorological Department (IMD) • State/district - State Biodiversity Board, Irrigation and CAD Department, Ground Water Department, State Wetland Authority, Department of Soil and Water Conservation, Department of Agriculture, Department of Environment • ULB - Urban biodiversity department, lake protection committee under the development authority

Ecosystem assessment should proceed through the following steps, prioritising the highlighted tasks[23]:

- **Scoping of ecosystem components** and assessing the state of the ecosystem
- **Ecosystem services assessment** - Screening of services, covering both supply (what quality and quantity of benefits) and demand (who benefits)
- **Drivers of change in the ecosystem** - Identifying stewards and degraders
- **Services to ecosystems (S2E)** - Taking into account changes made to the ecosystem, and ecosystem-enabling governance and protection

Guidelines for local ecosystem assessment

- For scoping of ecosystems, meetings may be conducted in which experts and stakeholders share information and react to each other's perspectives.
- At least one ecosystem that might play an important role for the most vulnerable social groups should be considered.
- At least one expert for each of the scoped ecosystems should be interviewed to understand ecosystem services, changes in the ecosystem, services to the ecosystem, and the relevant actors involved
- ULBs should be explicit about the assumptions made regarding the links between ecosystem status, services and changes in ecosystem services. Every effort should be made to build a good evidence base with regard to causality, sustainability, thresholds, and uncertainty.
- The scope of the ecosystem assessment could be expanded or reduced depending on the post-disaster scenario, while reviewing and updating the plan.

Local ecosystem assessment: Illustrative example

Table 11 illustrates how the ecosystem services assessment framework can be applied to two example ecosystems within a city.

Table 11: Local ecosystem assessment - Illustrative example

Ecosystem	State	Ecosystem Services								Stewards	Degraders	Changes Made to Ecosystem
			Food	Water	Climate Regulation	Carbon Sequestration	Erosion Prevention	Species Habitat	Tourism			
River	Mildly polluted	Supply	xx	CLASS C Water	xx	xx	xx	Freshwater species	Riverfront Area	Water Board	Industries	Partial concretization of river bank without considering riverine ecosystem
River	Mildly polluted	Demand	xx	City Population	xx	xx	xx	City Population	City and nearby areas' Population	Water Board	Industries	Partial concretization of river bank without considering riverine ecosystem
Wetland	Encroached	Supply	Vegetables and Paddy	xx	Flood protection	Carbon capture	xx	Birds	Birdwatching	Biodiversity Board	Planning Department	1/3rd of the wetland is encroached in last 5 years, bird species reduced to 3-5 types
Wetland	Encroached	Demand	City and nearby areas' Population	xx	Population in neighbourhood	City Population	xx	City Population	City and nearby areas' Population	Biodiversity Board	Planning Department	1/3rd of the wetland is encroached in last 5 years, bird species reduced to 3-5 types

Assessing city projects and programmes

When reviewing existing and planned city projects and programmes, ULBs should assess them in terms of their planning and actions. Some key points are - contextualisation of gender and relevant ecosystems, assessment of gender-disaggregated/traditionally vulnerable community-specific needs, disaster resilience aspects, with a focus on build back better and 'bounce forward', GESI- and EbA-appropriate actions, and gender and culturally sensitive Information, Education and Communication (IEC) activities.

Learning Unit 3.2: Hazard and Disaster Profile

It is essential for ULBs to build a long-term climate-induced disaster profile for their city, based on historical loss and damage data. It develops their ability to identify the right parameters, data sources, and disaggregation needed to understand how hazards have affected people, infrastructure, livelihoods, and the environment over time.

Climate-induced disaster profile

A city's climate-induced disaster profile should be built on a 20-year historical loss and damage statement that captures both spatial and volumetric measures. Table 12 sets out the parameters, indicative data requirements, and sources for this assessment.

Table 12: Parameters, indicative data requirements and sources for disaster profile

Parameters	Indicative data requirement	Indicative Data Sources
Human loss	Injured, dead, missing, directly affected, indirectly affected, evacuated	• Housing department • Urban development department • Health department • Environment department • Horticulture department • Finance department • MSME department • Development authority • Water board • Transport department • Urban local body • Disaster response force • Police/fire department / civil defence • Hospitals • Civil society organisations
Housing damage	Houses damaged, houses destroyed, damage type, construction type, built condition type	
Physical infrastructure damage	Roads, public buildings, vehicles, water supply, drainage, industries, public transport	
Social infrastructure damage	Education centres, hospitals and health centres, community spaces	
Environmental damage	Rivers and water bodies, urban vegetation, coastal ecosystems, green cover	
Livelihood loss	Livelihoods lost from key sectors of the economy	
Health and psychological impact	Post-disaster physical and mental ailments	

For each disaster, the profile should identify the impacts of past events and the city's response in addressing those challenges, and should capture dimensions such as seasonality, spatial extent, frequency, intensity (for example, flood discharge, depth of flooding, wind speed, or storm surge) and future probability. Critically, this 20-year climate-induced disaster profile must include gender and traditionally vulnerable community-disaggregated data, compiled separately for each disaster type.

Learning Unit 3.3: Urban System and Gender and Social Inclusivity Analysis

ULBs need to assess the fragility of urban infrastructure and socio-ecological systems against key resilience characteristics, and to identify why particular systems are critical or vulnerable. It also strengthens their capacity to analyse gender and social inclusivity gaps, so that both technical and social dimensions of vulnerability are understood together.

Infrastructure and socio-ecological systems analysis

This analysis should identify systems that are already failing or under significant pressure from hazards and consider the impact of disasters on the resources and assets used by traditionally vulnerable communities. System fragility is assessed against eight resilience characteristics:

- Flexibility and diversity
- Redundancy
- Safe failure/maintaining critical threshold
- Equitable and inclusive
- Interlinkage with the local ecosystem
- Disaster preparedness and prevention-centric approach
- Participatory and consultative
- Energy efficiency

Energy efficiency should be measured by GHG emissions, based on secondary data sources. Table 13 presents an illustrative example of system fragility analysis from water supply system

Table 13: System fragility analysis - Illustrative example, resilience characteristics

Resilience characteristic	What it means	Illustrative example
Flexibility and diversity	A mix of multiple options; key assets and functions are distributed or decentralised, so not all are affected by a single event	A flexible water supply system withdraws water from multiple sources sufficient in both drought and flood situations, allowing it to function under different conditions
Redundancy	Alternatives, back-up systems and contingency plans; multiple pathways and options for service delivery if one or several options fail	The water supply is dependent on a perennial river, with a sufficient reserve of groundwater as a backup if the primary source fails
Safe failure	Ability to absorb sudden shocks or slow-onset stress, to avoid catastrophic failure	The water treatment system is extremely old and requires repair; there is no assurance of safe failure in the event of a disaster
Equitable and inclusive	Provides accessible, affordable, safe and quality-compliant services to all communities, despite a hazard striking	Clean and affordable potable water is supplied to traditionally vulnerable communities, such as slum dwellers, even during a hazard event

Resilience characteristic	What it means	Illustrative example
Interlinkage with local ecosystem	System planning, functioning and management duly recognises and integrates with local ecosystem functions, which in turn potentially increases flexibility and redundancy	The water supply system harnesses the potential of intra-city or local freshwater sources, such as lakes, rather than relying solely on distant sources
Disaster preparedness and prevention-centric approach	The system is well prepared to mitigate the impact of a disaster	The water supply system considers the impact of urban flooding and adopts contingency measures in advance
Participatory and consultative	System administration acknowledges traditional knowledge and community insights and perspectives in planning and implementation	The water board conducts a pre-monsoon survey in previously affected areas, and adopts measures based on insights shared by the community

System fragility statement

Having considered existing and anticipated problems caused by system fragility, and defined the responsible entity, the assessment should be summarised as a fragility statement for each urban system (Table 14). The guiding question is: 'How does the fragility of this urban system impact other functions, systems and services in your city?' The responsible entity should also be identified, whether the system is part of the city government's function, the responsibility of another entity, or a shared responsibility, since this determines whether the ULB can act alone, in collaboration with another department, or needs to approach another entity with the issue and a proposed course of action.

Table 14: System fragility statement - Illustrative example

Urban system	Why is it critical or fragile?	Responsible entity and fragility statement
Water supply	• Centralised water treatment facility from a single surface water source (no redundancy) • Single source of water that dries up in summer (no flexibility) • Unregulated and unmonitored extraction of groundwater • Not utilising local water sources (no interlinkage with ecosystem) • Water supply disrupted, especially for traditionally vulnerable communities, when a hazard strikes (not equitable and inclusive) • Energy-intensive water supply system	• Responsible entity: ULB/Water Board, etc. • Fragility statement: The system is old and largely dependent on transporting water over large distances, whereby even minor disruptions within the distribution network cause significant shortages; alternatives are not utilised and managed optimally, thereby disrupting clean and potable water supply to the entire community, especially when a hazard strikes.

Gender and social inclusivity analysis

Parameters for gender and social inclusivity analysis include:

i. Status of traditionally vulnerable communities, and their ability to exercise their human rights
ii. Different skills, capacities and aspirations
iii. Gendered division of labour
iv. Differential access to, and control over, resources and urban systems

v. Different levels of participation, leadership and decision-making authority
vi. Indications of gender-based violence
vii. Barriers to development faced by traditionally vulnerable communities
viii. Access to information and capacity building

Stakeholder consultation involving NGOs, CBOs and research organisations, as well as community-level stakeholder consultation (as described in chapter 3), would facilitate this gender and social inclusivity analysis.

Learning Unit 3.4: Disaster Resilience Assessment

A robust tool for assessing disaster resilience in cities is the UNDRR Disaster Resilience Scorecard for Cities and the Ten Essentials for Making Cities Resilient framework. The scorecard helps city officials assess the city's overall resilience and inform the development of a local disaster risk reduction strategy.

Disaster Resilience Scorecard for Cities

The Disaster Resilience Scorecard for Cities is structured around the Ten Essentials for Making Cities Resilient. Its primary purposes are to assist countries and local governments in monitoring and reviewing progress and challenges in implementing the Sendai Framework and to enable the development of a local disaster risk reduction strategy (resilience action plan).

Its scope covers governance and financial capacity (Essentials 1-3), disaster planning and preparation (Essentials 4-8) and disaster response and post-event recovery (Essentials 9-10).

Of the 117 indicators in the Detailed Assessment, 8 relate specifically to an ecosystem-based approach, spread across three Essentials. On the other hand, 4 out of all the indicators relate specifically to GESI, spread across four Essentials.

Box 5: GESI and EbA Indicators in Scorecard

EbA

- **Essential 4 - Pursue Resilient Urban Development and Design:** application of land-use zoning (4.4.1)
- **Essential 5 - Safeguard Natural Buffers to Enhance the Protective Functions Offered by Natural Capital:** awareness of the role of ecosystems in disaster resilience (5.1.1); ecosystem health (5.1.2); impact of land-use and other policies on ecosystem services (5.2.1); green and blue infrastructure embedded into city projects (5.2.2); identification of critical environmental assets (5.3.1); transboundary cooperation (5.3.2)
- **Essential 8 - Increase Infrastructure Resilience:** adequacy of protective infrastructure (8.1.1)

GESI

Of the 117 indicators in the Detailed Assessment:

- **Essential 1 - Organise for Resilience:** Consultation in plan-making (1.1.2)
- **Essential 7 - Understand and Strengthen Societal Capacity for Resilience:** Engagement of vulnerable groups of the population (7.2.2)
- **Essential 9 - Ensure Effective Disaster Response:** Check likely ability to meet needs for shelter/safe places, including consideration of the need for gender-sensitive shelter (9.5.2)
- **Essential 10 - Expedite Recovery and Build Back Better:** Plan for post-event recovery and economic reboot, ensuring social equality (10.1.1)

MODULE 4: Pre-Disaster Planning

Learning objectives

This module deals with the knowledge and skills required for pre-disaster planning and disaster preparedness. It includes disaster risk assessment, formulation of GESI- and EbA-integrated strategies and actions, and consideration of traditional knowledge in disaster prevention.

Learning Unit 4.1: Climate-Induced Disaster Risk Assessment

Climate-induced disaster risk assessment aligns with the conceptual approach established in the IPCC AR5 Working Group II1 framework. The framework conceptualises climate-induced disaster risk as a function of the interaction between climate-related hazards, exposure of people, infrastructure and systems and vulnerability arising from socioeconomic and environmental sensitivity and adaptivity capacity. This unit builds participants' ability to measure disaster risk and to map its spatial distribution across a city. It equips them to identify hazards, assess exposure and vulnerability using structured scoring methods, and synthesise these into ward-level risk categories and future-looking scenarios.

Disaster Risk Assessment

Understanding disasters as the outcome of the interaction between hazards, exposure and vulnerability forms the basis for disaster risk reduction and resilience planning. Disaster Risk Assessment consists of four analytical steps:

1. Hazard Assessment
2. Exposure Assessment
3. Vulnerability Assessment (including sensitivity and adaptive capacity)
4. Risk assessment

The overall process of the assessment is shown in Figure 13 below:

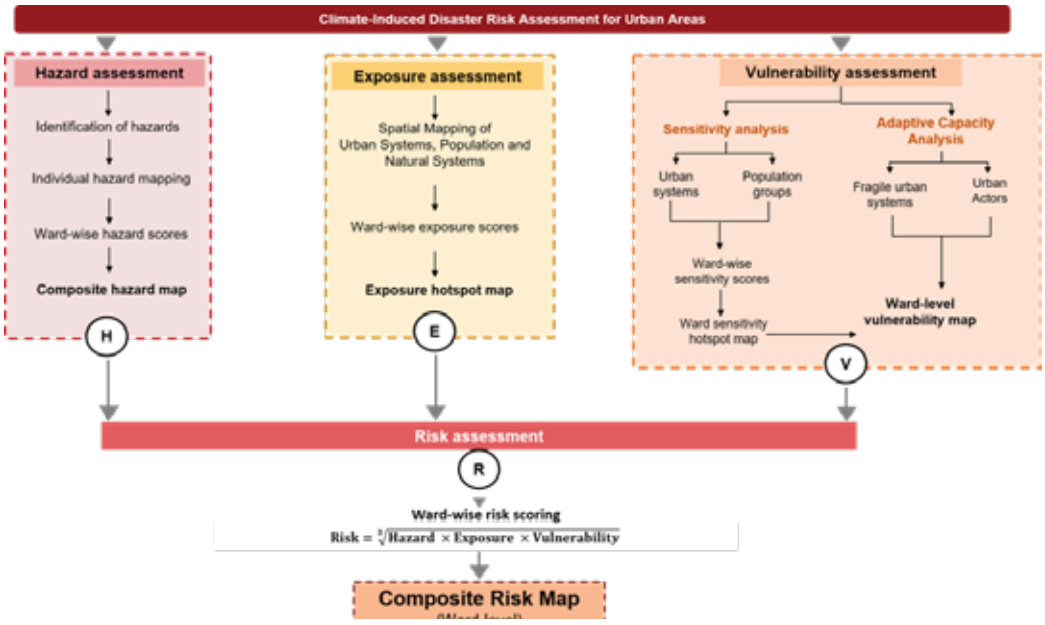


Figure 13: Climate-induced disaster risk assessment process

The broad process involves identification of climate hazards, mapping of individual hazard layers, and preparation of a composite hazard map. This composite map is prepared on the basis of combined scoring for all the layers for each ward. A similar process is followed for preparation of a composite exposure hotspot map. Exposure includes urban systems and services, different population groups, and natural assets. Vulnerability assessment is based primarily on the sensitivity of urban systems, population groups, and natural assets. This is an empirical analysis based on ward-wise sensitivity scoring. This leads to a ward sensitivity hotspot map. In addition to sensitivity, the adaptive capacity of fragile urban systems and urban actors (stakeholders) is considered in order to support the final assessment. The final risk index is calculated by combining the scores related to hazard, exposure, and vulnerability (sensitivity) for each ward. The final output of this exercise is a composite risk map based on the risk index. The climate risk map shows the degree of risk for all wards in the city in terms of low, moderate, high, and extreme risk.

Some important points to consider regarding climate risk assessment:

- The accuracy of this assessment depends on the availability of data.
- Stakeholder consultation is an integral part of this process for data collection and verification of results. It is also useful when there is a lack of data in the local government and can replace objective data with subjective information, which can still be used for preparing an action plan.
- It is based on a mix of qualitative and quantitative processes.
- It captures ward-level impacts from multiple hazards.
- It must be flexible to adjust it as per the city's context.

Hazard assessment

The hazard assessment provides spatial and quantitative layers of climate hazards in terms of magnitude, location, and frequency. Information from this assessment will be later combined with exposure and vulnerability to derive climate risk.

Step 1: Identification of climate hazards

The first step is to identify the climate hazards in the city. Identification can be based on the climate trend analysis and information of past events in the baseline assessment. Examples of climate hazards in cities are heat stress, urban flooding, sea level rise, landslides, etc.

Step 2: Developing individual spatial hazard layers

Next, spatial hazard layers should be developed using a combination of satellite datasets, meteorological data, and available city-level data using GIS. These layers represent the geographical extent and intensity of each hazard.

Step 3: Ward-wise hazard scoring

This exercise develops ward-level hazard scores by aggregating and normalizing hazard information derived from city-level spatial analysis (Step 2). It helps identify wards experiencing relatively higher hazard intensity. Here, a consolidated table of normalized hazard values is prepared for all wards (e.g., average intensity, maximum value, or percentage area affected). This is shown in Table 15. Normalisation is done using the following formula to ensure comparability across hazards.

$$\textbf{Normalization Value} = \frac{\text{Actual Value - Minimum Value}}{\text{Maximum Value - Minimum Value}}$$

Table 15: Composite hazard score for each ward (template)

Wards	Heat Stress		Flood		SLR		Other		Hazard Score (Average of normalized values) (a+b+…/N)
	Temp Hotspot area	Normalized (a)	Flood Area	Normalized (b)	Inundation Area	Normalized (c)	Actual	Normalized (d)	
1									
2									
3									
4									
…n									

N = No. of hazards

Step 4: Developing composite hazard map

Finally, a city hazard map is prepared using the composite hazard scores (Figure 19). The wards are classified into four categories of low, moderate, high, and extreme, based on the scores. The composite hazard map helps identify wards experiencing relatively higher hazard intensity or multiple hazards. The map provides information on the type and intensity of hazard, for example, the area affected by flooding, temperature range for heat islands, etc.

Range	Hazard Level
<=0.250	Low
0.251 –0.500	Moderate
0.501 – 0.750	High
>=0.751	Extreme

The final output of hazard assessment is a composite hazard map for the city. Figure 14 shows examples of flood and heat hazard maps.

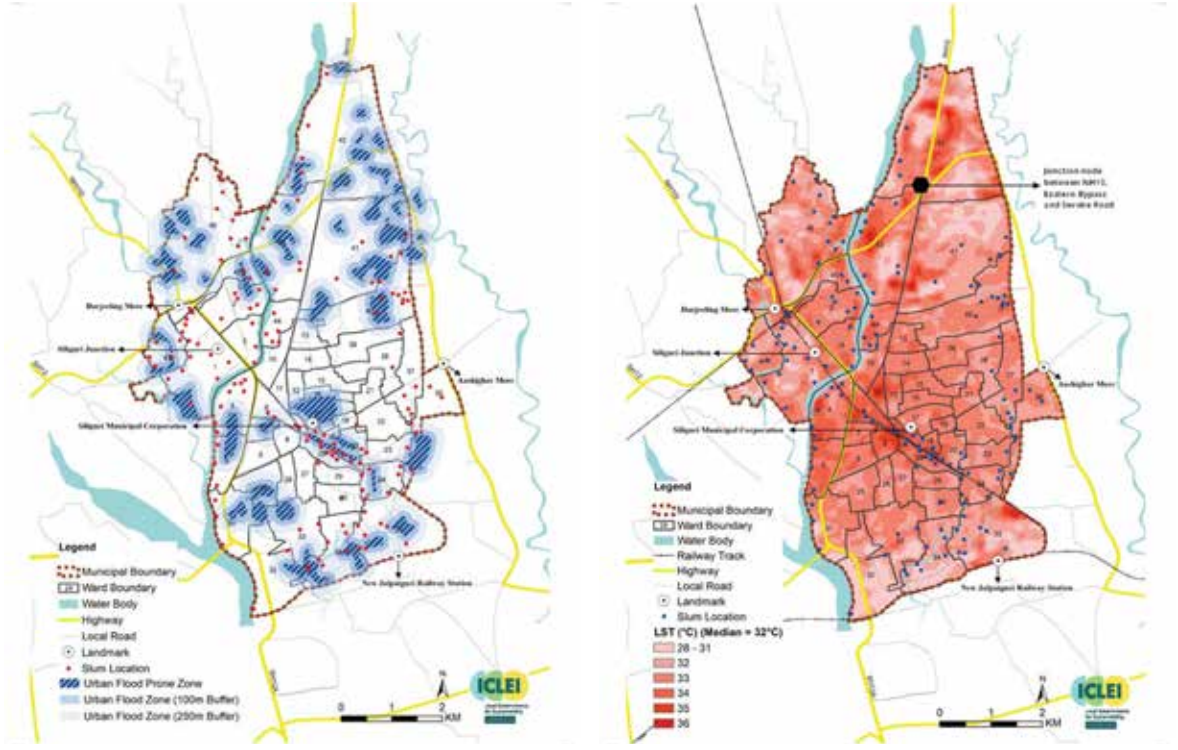


Figure 14: Example - Flood and heat hazard maps (Siliguri, India)

Alternative method for hazard assessment

As explained in Module 2, in the absence of substantial data and GIS-based information, stakeholder consultation can be an alternative method for hazard assessment. Consultations should be undertaken with key stakeholders like NGOs, local authorities, RWAs, CSOs, and community members to map the following:

- Areas of inundation, flooding spots
- Landslide-prone areas
- Urban heat islands

Issues related to infrastructure and services can also be mapped through stakeholder consultations. All this information can be mapped for each ward to prepare a hazard map.

Exposure assessment

In line with the IPCC AR5 risk framework, exposure does not represent impact by itself; rather, it defines what is located where in relation to climate hazards. When combined with hazard intensity and vulnerability, exposure determines the magnitude of the potential risk a city faces.

The exposure assessment uses three categories of spatial layers to identify who and what are located within hazard-prone areas (Table 16).

Table 16: Spatial layers for exposure assessment

Urban Infrastructure and Services	Population groups	Natural Systems
• Water supply • Sewerage and stormwater • Solid waste • Power substations • Transportation • Health and education • Fire services • Archaeological spots	• Slum dwellers • PwD • Elderly • Children • Women • Outdoor workers, gig workers	• Green spaces • Natural open areas • Water bodies • Biodiversity hotspots • Key ecosystems (wetlands/ forests/etc.)

This assessment is primarily map-based and helps identify wards having the highest concentration of people, critical infrastructure, and natural systems that may be adversely affected by climate hazards.

Step 1: Mapping of urban infrastructure

The first step in exposure assessment is the preparation/collation of spatial layers to represent the location and distribution of infrastructure and services. This is done based on the urban system analysis done in the baseline assessment (Figure 15). Next is the identification of the infrastructure in each ward that intersects with the hazard-prone areas. This overlaying of hazard and infrastructure data sets provides contextual insight into operational stress points to support vulnerability assessment in the next stage.

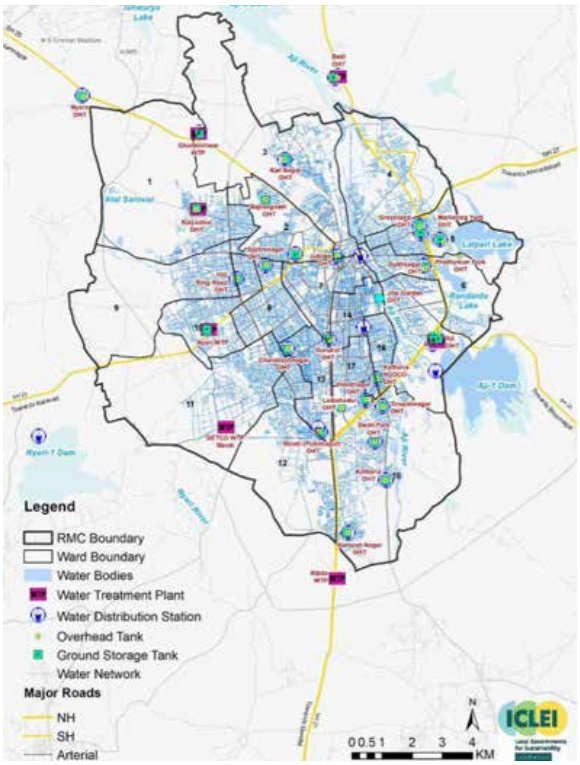


Figure 15: Example - Water supply infrastructure map (Rajkot, India)

In addition, issue mapping may be incorporated where available using data from citizen complaint registers or information from city officials, which capture recurrent service disruptions such as waterlogging complaints, sewer overflows, water supply failures, power outages, waste collection issues, and health issues. Overlaying these datasets with hazard layers provides contextual insight into operational stress points and reinforces the identification of climate-sensitive urban systems.

Step 2: Mapping of population groups

For population groups, basic information in mapping should include ward-wise distribution of population, population density, and informal settlements (slums, as shown in Figure 16). Where available, demographic aspects such as age, gender, poverty, or occupation should be included to support overall risk assessment. Next, these layers should be overlaid with the hazard layers to identify the size of different population groups intersecting with hazard-prone areas.

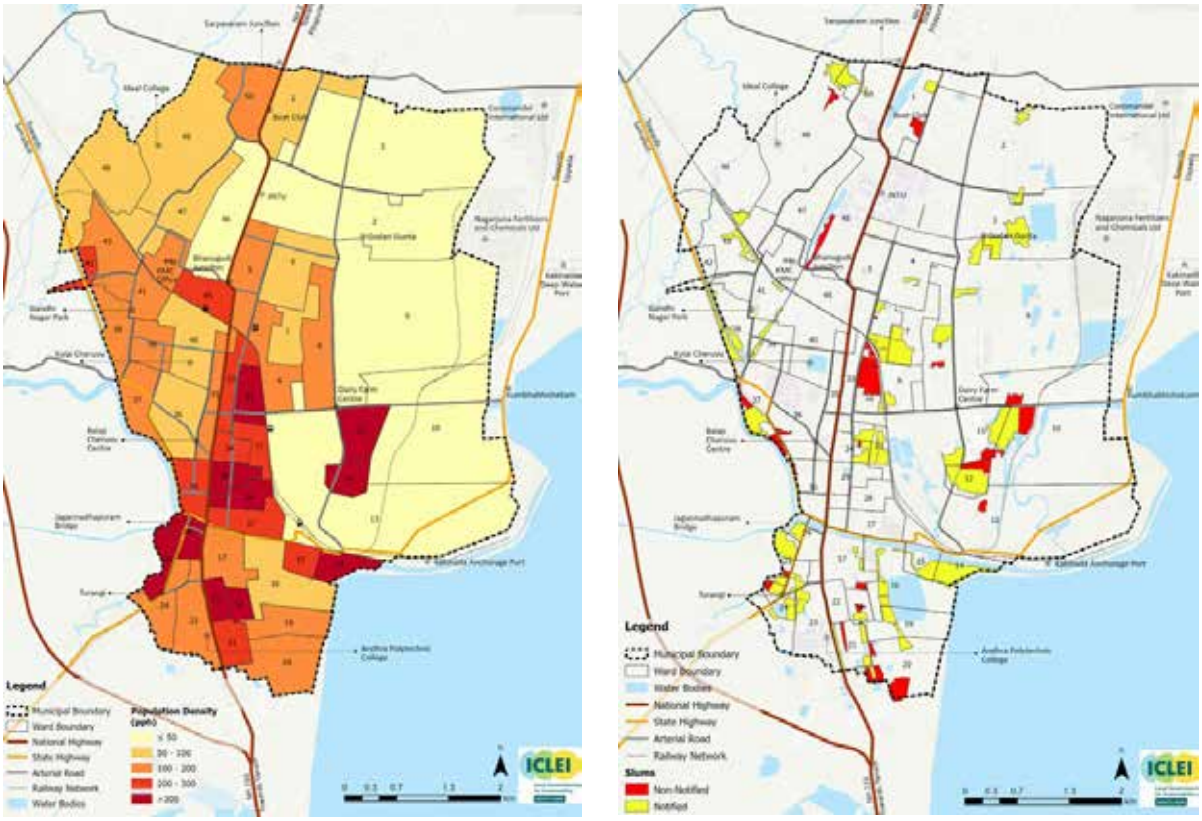


Figure 16: Example - Population density and Slum location (Kakinada, India)

Step 3: Assessing natural systems

The exposure of natural systems is assessed using remote sensing-based environmental indicators, which provide insight into ecosystem presence and condition. The following indices are used:

(a) Normalized Difference Vegetation Index (NDVI): This is used to map vegetated areas across the city (Figure 17). Lower NDVI values indicate reduced green cover, surface heat exposure, and lower ecological buffering capacity. NDVI is calculated from satellite imagery using the reflectance values of the Near-Infrared (NIR) and Red bands, based on the formula:

$$\textbf{NDVI} = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}$$

Satellite imagery is processed to generate a city-wide NDVI map. Pixel values range from approximately –1 to +1, where higher values represent dense and healthy vegetation, and lower values indicate sparse vegetation, built-up areas, or degraded land.

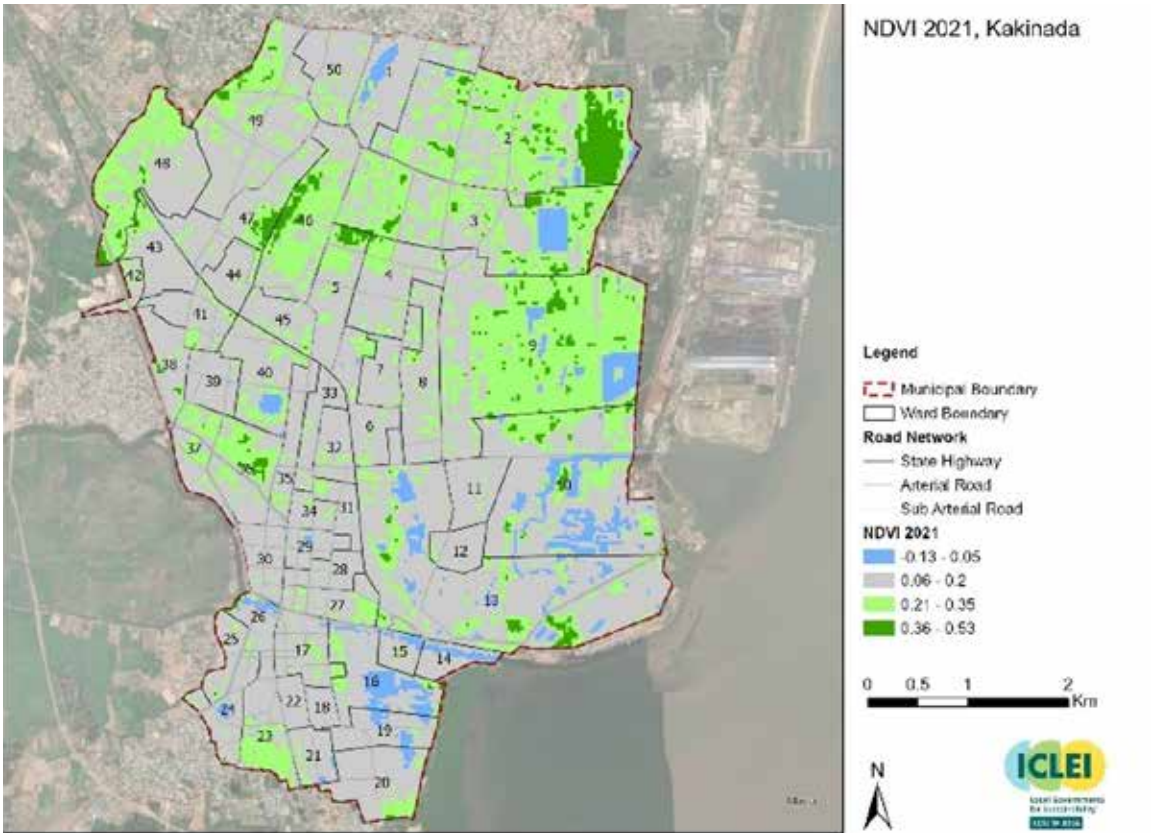


Figure 17: Example - NDVI Map (Kakinada, India)

(b) Normalized Difference Water Index (NDWI): NDWI identifies surface water bodies, wetlands, drainage features, and moisture conditions. Lower NDWI values indicate reduced water presence and higher susceptibility to heat stress, flood runoff, and drought conditions. NDWI is computed using reflectance values from the Green and Near-Infrared (NIR) bands as:

$$\textbf{NDWI} = \frac{(\text{Green} - \text{NIR})}{(\text{Green} + \text{NIR})}$$

Processed satellite imagery is used to generate a city-wide NDWI layer, where positive values indicate the presence of water and lower or negative values indicate dry surfaces and built-up areas.

These layers do not directly measure environmental vulnerability but provide spatial context for areas lacking thermal buffers, locations sensitive to hydrological disruption, and areas where ecosystem degradation may worsen climate impacts.

Step 4: Calculating Ward-wise Exposure Scores

Using the spatial layers prepared in the exposure assessment, ward-level indicators are compiled in terms of exposure components. A consolidated table of normalized exposure scores for all wards is prepared (Table 17).

Table 17: Normalized Exposure Scores (template)

Wards	Urban infrastructure and services		Population Groups		Natural assets		Exposure (Average of normalized values) (a+b+c+…)/N
	Actual number of assets	Normalized (a)	Actual population number	Normalized (b)	Area of natural assets	Normalized (c)	
1							
2							
3							
…n							

N = No. of parameters considered

Step 5: Developing the Ward-Level Exposure Map

Finally, a ward-level exposure map is developed using the ward exposure scores, and by combining information on urban infrastructure, population, and natural systems (Figure 18). Based on the composite exposure scores, wards are classified into exposure categories, as mentioned in the table below.

Range	Exposure
<=0.250	Low
0.251 –0.500	Moderate
0.501 – 0.750	High
>=0.751	Extreme

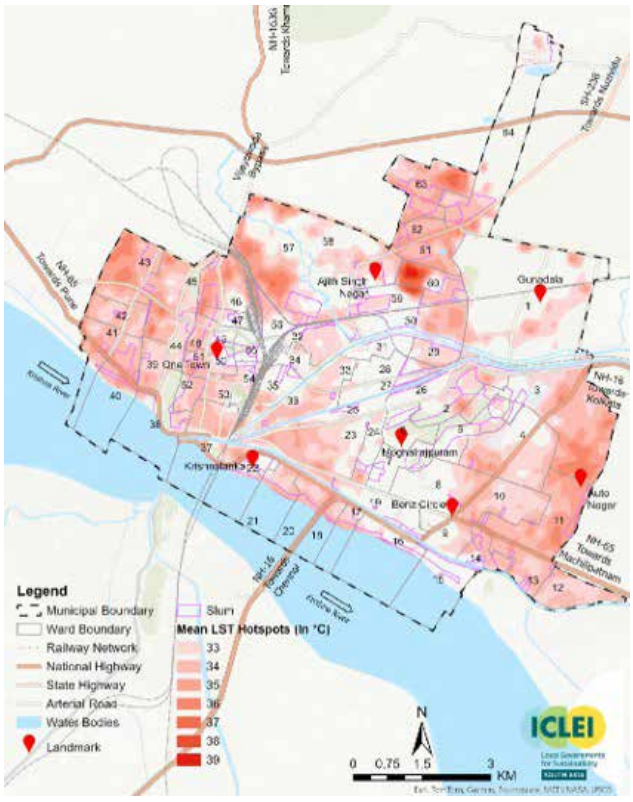


Figure 18: Example - Exposure of slum settlements to high land surface temperature (Vijayawada)

Alternative method for exposure assessment

Similar to hazard assessment, exposure can also be assessed through stakeholder consultations. Consultation with NGOs, local authorities, RWAs, CSOs, community members, etc. should be done to map:

- The location of infrastructure and public assets – municipal buildings, water pumping stations, garbage collection points, markets, hospitals, schools, etc.
- Slum pockets, unauthorized colonies, etc.
- The location of natural assets like water bodies, forests, green spaces, open spaces, wetlands, etc.

Vulnerability assessment

As per the AR5 framework, vulnerability is defined on the basis of two components: sensitivity and adaptive capacity. These are described below:

Sensitivity: The degree to which a population, system, or sector is affected when exposed to a climate stressor. It increases with ageing or inadequate infrastructure, identified sectoral issues, concentration of vulnerable groups, degraded ecosystems, or limited access to essential services.

Adaptive Capacity: The ability of institutions, households, vulnerable groups, and urban systems to anticipate, cope with, and recover from climate impacts. It is shaped by the quality of governance, financial, technical, and human resources, institutional coordination, emergency preparedness, and access to basic services.

Sensitivity analysis helps in identifying vulnerable areas/wards prone to climate impacts, while adaptive capacity helps in determining vulnerable groups and critical urban systems that are at risk and least able to respond. The output of a sensitivity analysis is further used in the risk assessment, where it is combined with hazard and exposure data to obtain the risk score.

Vulnerability is directly proportional to sensitivity and indirectly proportional to adaptive capacity of the systems and people. Here, the fragility statements developed in Urban System Analysis are used.

Sensitivity analysis

Sensitivity analysis quantifies and maps the city's sensitivity to climate hazards based on climate impacts on fragile urban systems and population groups. It helps identify wards where multiple system failures may occur and where the potential impacts of climate hazards are likely to be more severe. It further helps identify populations who may be impacted by climate hazards.

Sensitivity is analysed on the basis of 'likelihood' and 'consequence'–the likelihood of a climate fragility statement identified above and its consequence on that urban system and the population.

This can be expressed as:

Sensitivity = Likelihood x Consequence

Sensitivity scoring of climate fragile systems

In this, the likelihood of each climate fragility statement is analysed, based on projections made during baseline assessment. For example, if the projected increase in precipitation has a 'high' level of confidence, its likelihood of occurrence will be higher. Table 18 shows the categories for rating and scoring likelihood.

Table 18: Likelihood Rating and Scoring (Reference table)

Likelihood rating	Description	Score
Almost certain	Highly likely to occur; could occur several times per year. Likelihood: probably greater than 50%	5
Likely	Reasonable likelihood; may arise once 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 the foreseeable future – negligible probability	1

After likelihood, the consequence (impact) of each climate scenario needs to be analysed. Here, the focus is to identify system failures, which could have direct and serious impacts on the poorest and most vulnerable groups in the city. Therefore, it is recommended to consider the impacts on both the system as well as the poor and vulnerable.

Consequences can range from 'catastrophic' to 'insignificant' (Table 19). The analysis includes assigning a score from 1 to 5 for each climate variation, where 1 corresponds to an 'insignificant' impact, while 5 corresponds to a 'catastrophic' impact on systems and vulnerable populations. Table 19 shows one way of assessing consequence, using "Impact on the system" and "Impact on poor and vulnerable" as measures. However, you may also write your own Consequence Scale.

Table 19: Consequence Rating and Scoring (Reference table)

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

For each Climate Fragility Statement, multiply both 'likelihood' and 'consequence' scores to arrive at a "Sensitivity Score' for each impact (Table 21). Finally, for each climate fragility statement, assess its Sensitivity Status based on its respective Sensitivity Scores. Please refer to the 'Summary of Sensitivity Matrix' in Table 20 for assessing the sensitivity status.

Table 20: Summary of a Sensitivity Matrix

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

**SS: Sensitivity Score*

Table 21: Sensitivity Score Analysis (Example)

Urban System	Climate Fragility Statements	Likelihood	Consequence	Sensitivity score (Likelihood x Consequence)	Sensitivity Status	Wards Impacted
Water supply	Increased precipitation disrupts/ damages water supply infrastructure	4	4	16	High	2, 5, 6
	Increased precipitation can cause water to freeze in the pipelines	4	4	16	High	1, 2, 4, 5
	Increased temperatures will lead to increased demand for water, thereby posing additional stress on the supply system	3	3	9	Medium	1, 2, 6

Ward Sensitivity Score – urban infrastructure

For each ward, sensitivity is calculated as the average sensitivity score of all climate fragility statements applicable to that ward (derived from Table 22). This ensures that wards affected by multiple high-risk system failures are ranked as more sensitive than those exposed to fewer or lower severity.

The steps are as follows:

Normalisation of sensitivity scores

For each ward, calculate the average sensitivity score (actual value) using the following formula:

Average Sensitivity Score = (Sum of sensitivity scores for the ward) / (Number of applicable fragility statements)

To enable comparison across wards, normalize scores on a scale from 0 to 1 using:

$$\textbf{Normalization Value} = \frac{\text{Actual Value - Minimum Value}}{\text{Maximum Value - Minimum Value}}$$

Table 22: Normalized Sensitivity Score for urban systems (Example)

Wards	**Sensitivity Score**	
	Actual Value (Average of sensitivity score for all CFS)	**Normalization Value =** $\frac{\text{Actual Value - Minimum Value}}{\text{Maximum Value - Minimum Value}}$
1	(16+9)/2 = 12.5	[(12.5-0)/(16-0)] = 0.78
2	(16+16+9)/3 = 12.7	[(12.7-0)/(16-0)] = 0.79
3	0	[(0-0)/(16-0)] = 0
4	16	[(16-0)/(16-0)] = 1
5	(16+16)/2 = 16	1
6	(16+9)/2 = 12.5	0.78
7		

In the same way, a consolidated table of normalised sensitivity scores for population groups needs to be prepared for all the wards (Table 23).

Table 23: Normalized Sensitivity Score for population groups (template)

Wards	**Elderly population**	**Normalized Value (e)**	**Women population (w)**	**Normalized Value ( )**	**…n**	**Normalised population sensitivity score e + w + n — ----------n**
1						
2						
3						
4						
...n						

Finally, the composite sensitivity score for each ward needs to be calculated by combining sensitivity scores of urban fragile systems and population groups (Table 24).

Table 24: Ward sensitivity score (template)

Wards	Normalised urban system sensitivity score (Nu)	Normalised population sensitivity score (Np)	Ward sensitivity score Nu + Np — ---------- 2
1			
2			
3			
4			
...n			

Based on the normalized sensitivity values, a ward sensitivity map should be prepared, classifying all the wards into sensitivity categories, as mentioned in the table below.

Range	Vulnerability
<=0.250	Low
0.251 –0.500	Moderate
0.501 – 0.750	High
>=0.751	Extreme

Figure 19 shows an example of composite sensitivity map.

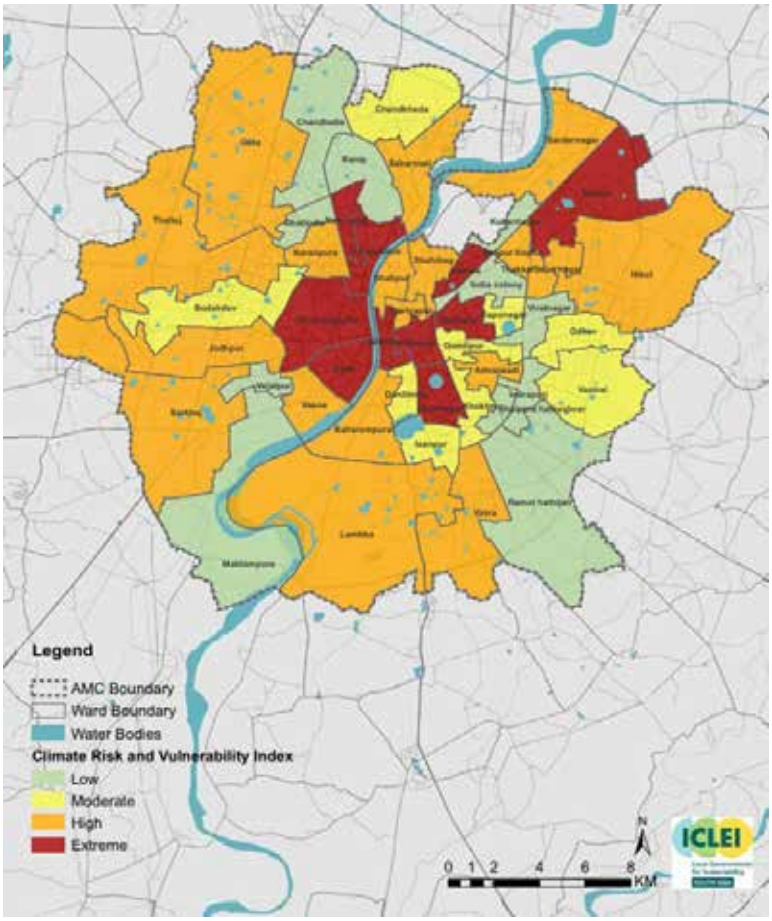


Figure 19: Example - Sensitivity map (Ahmedabad)

Adaptive capacity

Adaptive capacity is the capacity of systems to absorb shocks and their response to these shocks. It plays an important role in determining the resilience of systems. In the context of climate change, adaptive capacity requires agents (actors/stakeholders) to make choices and respond to opportunities in ways that manage both direct and indirect climate impacts. Agents' level of access to resilient systems influences their adaptive capacity, as does the manner in which institutions (rules and practices) structure relationships among agents (actors) and between agents and systems.

Step 1: Assessing the adaptive capacities of fragile urban systems

Adaptive capacity can be described on the basis of five broad categories: economic, technology/ infrastructure, governance, social, and ecosystem services (Tables 25 and 26). For each fragile system, rate each of the five categories of adaptive capacity as high/medium/low.

Given below are some guiding questions for deriving adaptive capacity of fragile urban systems.

Economic: Does the system have the financial resources to undertake the necessary actions to manage climate change–budget allocation, tax base, ability to charge fees, etc.? Is it able to operate as a "business" or does it follow the traditional public service model?

Technology/infrastructure: Does the system have the necessary technological knowledge and resources? Is current infrastructure adequate to cope with additional stresses from climate change? Are major changes in technology needed? What is the capacity to introduce the required changes?

Governance: Is responsibility for this system clearly established? Does the responsible entity have the necessary authority to make the required changes? Is there sufficient support from higher levels of government? Are the stakeholders coordinated and supportive of necessary change?

Social: Does the community have the understanding and resources necessary to play their part in this system? Is the community part of the problem, or part of the solution?

Ecosystems: What is the capacity of this system to protect or restore the ecosystem? Is there adequate understanding and enough data about the current status of the city ecosystem, its strengths, and weaknesses?

Table 25: Reference table for compiling information about the adaptive capacity of the fragile urban systems

Examples of Resources to Enhance Adaptive Capacity					
	Economic	**Technology / Infrastructure**	**Governance**	**Societal**	**Ecosystem Services / Natural Environment**
Low	Limited inherent economic ability to adapt to impacts (e.g., no legal authority to raise funds; no strong tax base to call upon)	Limited inherent technology/infrastructure to adapt to impacts (e.g., use of outdated materials in structural codes; no system for integrating new knowledge into changes)	Limited governance structure in place to adapt to impacts (e.g., no interagency collaboration; no support from higher levels), i.e., Rules and Practices	Limited societal structure in place to adapt to impacts (e.g., disenfranchised or uninvolved citizenry; lack of community and aid)	Limited ecosystem services/ natural environmental ability to adapt to impacts (e.g., no marsh or dune system to provide storm protection; all habitat is isolated and disconnected from other natural areas)
High	Robust inherent economic ability to adapt to impacts (e.g., mechanism for raising funds exists; very strong tax base to call upon)	Robust inherent technology/infrastructure to adapt to impacts (e.g., most structures are new and have used the latest materials and structural codes; new knowledge is regularly integrated into purchasing agreements)	Robust governance structure in place to adapt to impacts (e.g., good interagency collaborative processes; work closely with higher levels), i.e., 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)	Robust ecosystem services/ natural environmental ability to adapt to impacts (e.g., highly functioning dune or marsh system provides storm protection; habitat systems are connected allowing for species and sediment movement)

Table 26: Adaptive Capacity of the Fragile Urban System (Example)

Fragile urban system	Economic	Technology/ Infrastructure	Governance	Societal	Ecosystem Services
E.g., Water Supply	Low (Funds not available for new infrastructure)	Medium (Access to improved technology can be accessed through engagement of private companies)	Medium (Coordination with Irrigation and Public Health Dept to be improved)	High (Increasing demand from citizens for improved water supply systems)	Low (Water bodies being lost in the city)

Step 2: Assessing the adaptive capacity of urban actors

Actors (i.e., individuals, households and public/private sector organisations) play a critical role in building urban resilience. Their ability to contribute to resilience and adaptation is broadly dependent on three key capacities:

i. **Capacity to organise and respond:** The capacity to organise and re-organise in response to threat or disruption

   Example: *Slum communities residing in a flood-prone area have received training on how to purify water for drinking and maintain hygienic conditions to prevent the outbreak of post-flood diseases. Or trained Search and Rescue Teams exist within the community that can respond effectively during floods.*

ii. **Resources:** Access to the resources necessary to respond (manpower, technology, funds)

   Example: *Slum communities residing in a flood-prone area have been provided with water filters that will ensure safe drinking water even during flood situations. Or, the Search and Rescue Teams have the necessary equipment and medicines.*

iii. **Access to information:** Availability of data and information necessary to develop effective plans and actions and to improve responses to disruptions

   Example: *Slum communities residing in a flood-prone area have access to improved information that can be locally managed–early warning systems, which would enable them to respond more effectively. Or, there are regular refresher and updated training courses for the members of the Search and Rescue Teams.*

The combination of these three characteristics would help determine the adaptive capacity of each urban actor.

The actors analysis can be used to identify:

1. How different categories of actors relate to different systems (who, what, where, why)
2. What categories of actors may be missing
3. Groups of actors that may be disempowered, lacking in capacities or otherwise marginalised

Note: *When defining the actors, it is encouraged to be as specific as possible. Therefore, rather than mentioning 'residents of Ward XY', it should be specified as 'women, children and elderly in Slum 22'. More precision in determining the actors would make it simpler to target and organise an effective response.*

For the actor analysis, the actors for each fragile urban system need to be identified first. Next, only those actors need to be identified who fall in the 'high risk' locality, that is, those affected by, and those who have control over, the system (individuals, households and public/private sector organisations). As shown in Table 27 and 28, these actors should be rated against three criteria:

i. Capacity to organise and respond
ii. Access to resources
iii. Access to information

Table 27: Actors' Capacities Rating and Scoring (Reference table)

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 (manpower, technology, funds)	1
Medium access to the resources necessary to respond (manpower, technology, funds)	2
High access to the resources necessary to respond (manpower, 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

Finally, for each actor, their 'Adaptive Capacity Score' needs to be calculated by multiplying the scores allocated to each of the three characteristics. Based on the Adaptive Capacity Scores of each actor, for a particular fragile system, it can be determined which actors have a High, Medium or Low adaptive capacity. Table 30 will help with assessing the level of adaptive capacity of each of the actors.

Actors with a **'Low'** level of adaptive capacity would be those that would need to be ***specifically targeted*** by the actions (or resilience strategies) that are undertaken to reduce the fragility of the identified urban system.

Actors with a **'High'** level of adaptive capacity can be engaged in the proposed actions as they have the capacity to effectively respond to the impacts of the fragile systems.

Similarly, those falling in the **'Medium'** category might need to be specifically targeted or can also be engaged in the proposed actions, depending on which end of the range they are on, i.e., closer to the 'low' category or the 'high' category.

Table 28: Actor Analysis (Example)

Urban System	Area / ward	Actors	Capacity to Organise & Respond (A)	Resources (B)	Access to Information (C)	Adaptive Capacity Score (A)*(B)*(C)	Supporting Notes
Water Supply	Ward 5	Slum dwellers	1	1	1	1 (Low)	Dependent on shallow aquifers that are easily contaminated; access to water tankers is too expensive; no information on water purification techniques
		Private Sector	2	3	2	12 (Medium)	
		Resident Welfare Association	2	2	1	4 (Low)	
		Water authority	2	3	3	18 (High)	

Urban System	Area / ward	Actors	Capacity to Organise & Respond (A)	Resources (B)	Access to Information (C)	Adaptive Capacity Score (A)*(B)*(C)	Supporting Notes
		NGO	2	1	3	6 (Low)	

Table 29: Summary of Vulnerability Assessment (Example)

Urban System	Vulnerable Areas	Urban Actors		Adaptive Capacity of the system		
		Vulnerable Actors	Potential supporting actor	Low	Medium	High
Water Supply e.g.: Contamination of water supply due to flooding made worse by lack of alternative sources	Ward 5	Slum Dwellers Resident Welfare Association NGOs	Private sector Water Authority	Economic/ source of finance Ecosystem Services	Technology/ infrastructure Governance	Social

The adaptive capacity analysis must be used to identify urban systems and actors that are least prepared to respond to climate risks. Proposed interventions should be prioritised by focusing on systems with low resilience and actors with limited capacity. The findings must be applied to design targeted adaptation measures, capacity-building initiatives, and institutional strengthening actions, and to identify potential supporting actors for implementation. This will help ensure that proposed climate actions are need-based, inclusive, and focused on enhancing overall urban resilience.

Risk Assessment

The final step in the Climate Risk Assessment is to integrate the results of the hazard, exposure, and vulnerability analyses to identify climate risk hotspots within the city. This combined assessment supports identifying and prioritizing wards requiring immediate and targeted adaptation interventions.

At the ward level, a composite risk score is calculated by combining the normalized scores for hazard, exposure and vulnerability (sensitivity score). This is shown in Table 30.

Climate Risk = $\sqrt[3]{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}$

Table 30: Ward-wise Risk Scores (Example)

Wards	Hazard Score	Exposure Score	Vulnerability (Sensitivity Score)	Risk Score [(Hazard + Exposure+ Vulnerability) / 3]
1	0.25	0.3	0.25	0.80
2				
3				

Based on risk scores, classify ward risk into the categories (risk index) mentioned in Table 30 and prepare the Ward-Level Climate Risk Map, visually representing the spatial distribution of climate risk intensity across the city (Figure 20).

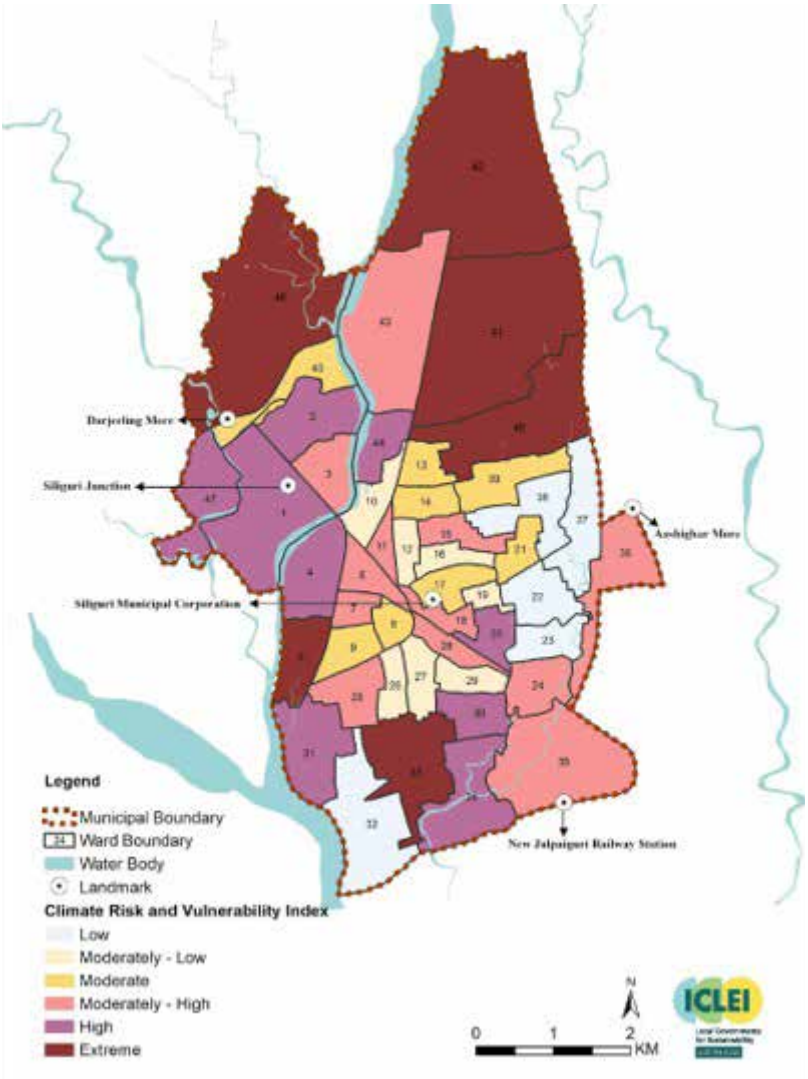


Figure 20: Example – Composite Climate risk map (Siliguri)

Table 31: Climate risk index

Range	Risk
<=0.250	Low
0.251 –0.500	Moderate
0.501 – 0.750	High
>=0.751	Extreme

A brief narrative summary should accompany the risk map, to support interpretation and decision-making. This summary should clearly highlight:

- Wards across each risk category
- Hazards contributing to risk in High and Extreme risk wards
- Exposure factors, such as population density, slum concentration, and critical infrastructure presence

Table 32: Climate risk summary (template)

Risk	Population	Slum Population	No. of wards
Low			
Moderate			
High			
Extreme			

The outcomes of this assessment are validated through a joint workshop with the Climate Core Team and Stakeholder Group.

Linkage with next steps

Climate risk assessment of a city forms the key decision-making factor for identifying mitigation and prevention actions. It helps the local authorities in efficient planning and prioritisation of preparedness and response measures. The level of vulnerability helps determine resource allocation for recovery, rehabilitation and reconstruction.

Learning Unit 4.2: Climate-Induced Disaster Prevention and Mitigation

Mitigation means enabling urban systems to be disaster-resilient in the correct way during the construction phase. It is easier to construct new disaster-resistant infrastructure and buildings than to retrofit existing ones. Disaster-resilient infrastructure must be based on the risk assessment and scenario-building. Mitigation actions must account for both the most probable and the most severe scenarios.

Key elements of disaster mitigation are:

- **Urban systems:** Ensuring the structural safety of buildings and infrastructure, including temporary shelter; adequacy, quality compliance, accessibility and affordability of infrastructure, especially through a gender and social lens; and ecosystem conservation and restoration
- **Technical education:** Inculcating good practices while planning and implementing disaster-resilient infrastructure and buildings
- **Maintaining resilient standards:** Building them into the planning, design and implementation of infrastructure and buildings, while emphasising inclusivity and ecosystem-based approaches
- **Retrofitting:** Retrofitting critical infrastructure to withstand potential disasters, accounting for the specific needs of gender and social groups and interlinking with the local ecosystem

Prioritising mitigation actions through resilience parameters

Once potential mitigation interventions have been identified, they should be prioritised against a set of ten resilience parameters.

- **Redundancy:** Systems function through multiple paths or nodes when performance is critical; a 'single best solution' is not resilient.
- **Flexibility:** Systems are designed to work under a variety of conditions, not be rigid or designed only for one specific situation.
- **Responsiveness / re-organisation:** Systems respond and change to meet unexpected shocks, through flexible organisation and access to resources (information, skills, equipment, knowledge and experience).
- **Organizational ability (inclusive, competent, accountable and well-informed):** Systems learn from and build on experience, do not repeat past mistakes, integrate lessons from other cities, and have monitoring and evaluation mechanisms.

- **Social resilience and inclusivity:** Systems have the potential to improve the social resilience and inclusivity of marginalised groups by providing access to resources, a participatory approach, and greater decision-making power

Disaster Prevention

Prevention refers to averting the large negative fallout that can follow the occurrence of a hazard event.

Early warning system and forecasting

- Establish a network of sensors to capture salient parameters of the hazards in concern
- Develop EWS ensuring last-mile connectivity to all people in society
- Display various end-user early warning systems pictorially as maps
- Robust, operational, round-the-clock mechanism to disseminate early warning to various key stakeholders

Inclusive warning dissemination should have the following features:

- It should be easily comprehensible.
- RWAs, CBOs and SHGs, with special focus on women members, should be engaged.
- NGOs/CBOs working with specific vulnerable groups (e.g., PWD, transgender persons) should be engaged.
- It should be multilingual, with priority given to the local language.
- It should involve multimedia, e.g. mobile phones, social media, television, radio, satellite phones, etc.
- It should involve innovative, locally contextualised tools, e.g., beating drums, waving flags, or dissemination should be centred around a local religious place or community hall
- It should be **hazard-specific** and **locally contextualised**.

Early warning systems should also maintain a clear **ecosystem linkage**. For example,

- **Flood:** Water level in the river/wetland
- **Glacial lake outburst flood:** Spread and level of the mountain wetland
- **Landslide:** Vegetation on slopes

ULBs can engage with R&D institutes to develop early warning systems.

Learning Unit 4.3: Climate-Induced Disaster Preparedness

Preparedness comprises the steps to be undertaken to face hazards without incurring avoidable losses. Its key elements draw on both the Hazard Risk Assessment and the Early Warning System. Key elements of disaster preparedness are listed below.

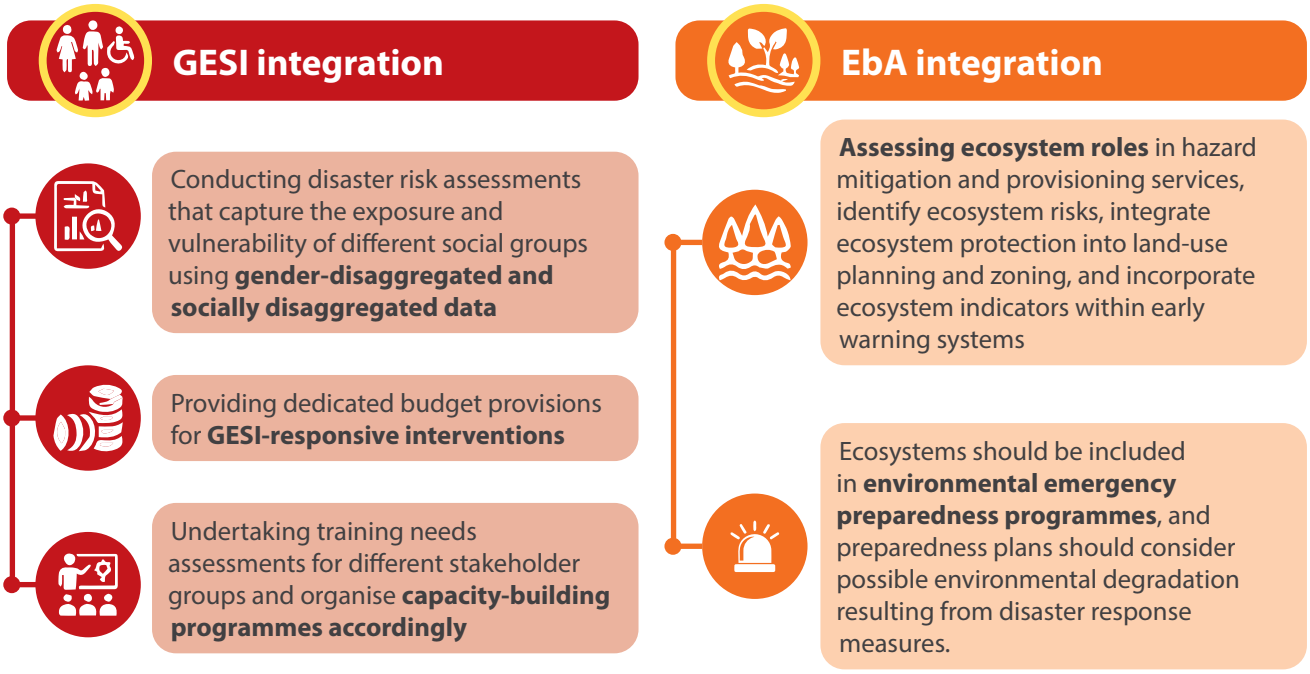
- **Emergency Operations Centre (EOC),** including setting up and efficiently operating the EOC, especially for risk communication, and rehearsing all operations, including golden hour operations
- **Risk communication,** as assessed through the Hazard Risk Assessment, with information and knowledge on disaster impact, mitigation of that impact and its positive benefits, and the role of each stakeholder, communicated through a comprehensive and creative communication plan and content suited to different target audiences
- **Mock drills** at regular intervals, in all institutions, RWAs and offices, to understand reaction time and shortcomings in preparedness
- **Training of community members** in first aid, search and rescue techniques, and emergency response procedures
- **Equitable dissemination of warnings** of an impending disaster, as gauged through the early warning system
- **Evacuation and relocation to safe temporary shelter** for both humans and livestock; critical for the EOC to

undertake once the early warning system has issued a warning, giving equitable attention to PwD, elderly people, children, and pregnant women

- **Emergency response and relief measures** kept readily available

Integrating GESI and EbA in prevention and mitigation

Ensuring equitable and inclusive disaster preparedness requires inclusive and gender-equitable risk communication



to vulnerable sections. ULBs must use the languages of local communities, leverage the leadership of women's organisations and other gender equality and inclusion stakeholders, and ensure universal access for emergency drills and awareness programmes. Further, ULB s must pre-position emergency supplies and equipment designed to meet the needs of vulnerable groups.

MODULE 5: Response During Disaster

Learning objectives

This module deals with the critical aspects and components of disaster response specific to urban areas. It aims to emphasise the need for equity and inclusivity in disaster response in urban areas.

Learning Unit 5.1: Fundamentals of disaster response

Response measures are those taken immediately after receiving an early warning of an impending disaster, or after a disaster in cases where an event occurs without warning. The primary goal of disaster response is saving lives, protecting property and the environment, and meeting the basic needs of humans and other living beings affected by the disaster. The immediate focus is to search and rescue those affected, and evacuate those likely to be affected by the disaster or by a secondary disaster that is likely to follow.

Disaster response predominantly focuses on immediate and short-term needs and is sometimes called disaster relief. Effective, efficient and timely response relies on disaster risk-informed preparedness measures, including the development of response capacities of individuals, communities, organisations, and the national and sub-national government. Emergency operations are a critical set of specialised agencies with specific responsibilities for serving and protecting people and property in emergency and disaster situations. They include civil protection authorities and police and fire services, among many others. The division between the response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Responses must also be sensitive to the diverse needs and circumstances of those affected, which often require tailored strategies to effectively reach and serve the most impacted groups. The GESI lens in disaster response highlights that vulnerability and capacity are shaped by social structures, not solely by biology or exposure to hazards. Interventions should therefore be cognizant of, and address, underlying issues of power, rights, and access to services, so that disasters do not reinforce existing inequalities.

A disaster can also trigger secondary events or cascading impacts. For example, cyclones can lead to flooding, and long periods of flooding can cause disease outbreaks. Response must therefore be multifaceted and time sensitive. It must include rapid assessment, close coordination, quick decision-making, and the fast deployment of human resources and machinery, together with close monitoring[24].

Box 6: India's national disaster response force

India has the largest disaster response force in the world, reflecting the scale of investment needed to respond effectively across the country's diverse hazard profile. *(Source: NDRF)*

GESI-centred disaster response

A GESI-centred approach to disaster response rests on two mutually reinforcing principles: equity, which focuses on ensuring that operations are fair and responsive to varying needs, and inclusivity, which promotes the meaningful representation and engagement of individuals in response planning and delivery. Equitable and inclusive approaches prevent disasters from deepening existing inequalities, and they increase community compliance with, and the legitimacy of, response efforts.

These principles operate alongside intersectionality. The recognition that a person's vulnerability is shaped by the overlap of multiple identities and circumstances at once, such as gender, age, disability, income, caste or migration status. A woman with a disability living in an informal settlement, for instance, faces compounded barriers that are not captured by looking at gender, disability, or informal housing status alone. Response planning must account for these overlapping vulnerabilities rather than treating each characteristic in isolation.

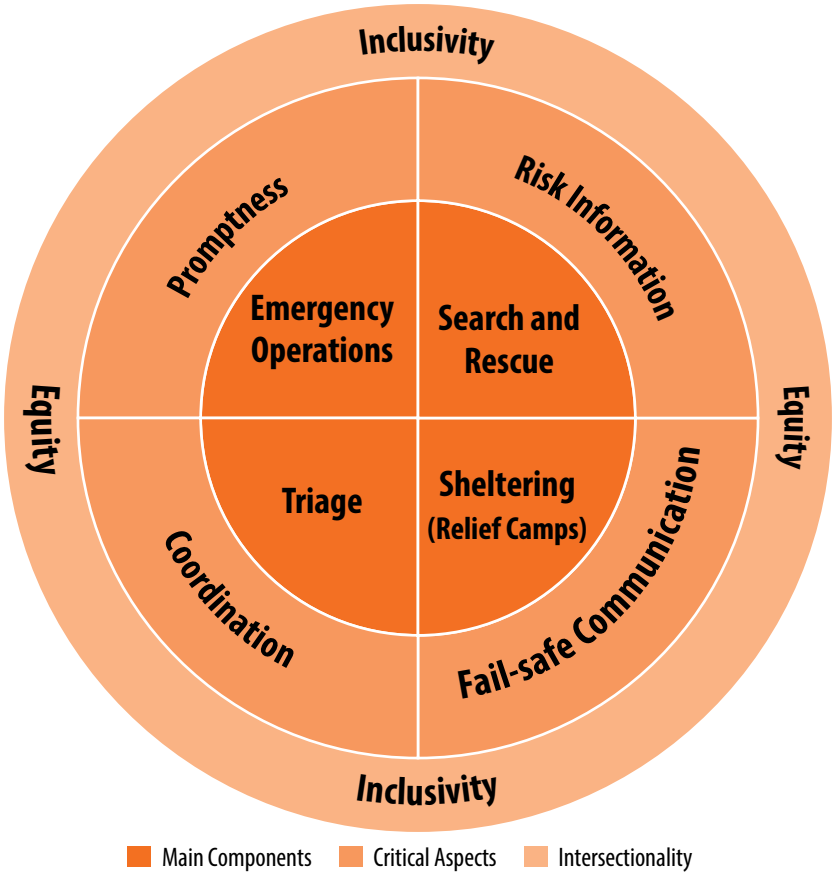


Figure 21: Components of disaster response

The core operational components of disaster response are search and rescue, emergency operations, sheltering (relief camps), and triage. These sit within an outer ring of critical aspects: equity, inclusivity, promptness, coordination, fail-safe communication, and risk information. Golden hour response and triage cut across all of these as the overarching time frame within which the components operate[25].

GESI-centred disaster response requires special focus on vulnerable groups, including PwD, elderly persons, slum dwellers and squatters, children, women (pregnant, menstruating or lactating), transgender persons, and women-headed households.

Alert system for disaster responses

Disaster responses are generally based on alert systems. For disseminating alerts, the Ministry of Home Affairs (MHA) has devised a uniform system, categorising alerts into three stages: Yellow, Orange and Red (Table 33). While generating and transmitting alerts to stakeholders and line departments, the concerned agency must indicate the category of the alert as well as its corresponding stage.

Table 33: Preparation for response based on flood alerts[26]

Type of flood	Stage	Response timeframe
Sudden flash flood to sporadic heavy downpour (low floods)	Yellow	As required To be communicated to the Emergency Operations Centre (EOC) through the Emergency Management System (EMS)
Waterlogging in all arterial and sub-arterial roads and intersections (moderate floods)	Yellow	As required
Flooding of roads and streets (high floods)	Orange	Within 12 hours to be communicated to the EOC and the State Disaster Management Authority (SDMA)
Breach of embankments/flooding of flood plains (unprecedented floods)	Orange/Red	Within 12 hours / Immediate
Water logging in residential buildings (unprecedented floods)	Red	Immediate to be communicated to the EOC, District EOC/SDMA and National EOC (NEOC) with updates every 3 hours

Operational readiness

The effectiveness of disaster response depends on the robustness of disaster planning and preparedness, in other words, on operational readiness. Operational readiness must include information on hazard, vulnerability and risk; impact areas, sectors and vulnerable groups disaggregated by gender, age, disability and other overlapping identities. Readiness is also based on the clarity of the plan of action, including roles and responsibilities of responders to ensure rapid mobilisation during disasters.

Disaster preparedness based on a Disaster Risk Assessment (DRA) should include a communication strategy and mechanisms, mock drills–especially in slums, informal market areas, and among gig workers–and training for community members. This should also include the setting up of a City Emergency Operations Centre (CEOC). Floods, cyclones and heatwaves generally occur over time and allow some time for preparation, whereas landslides are often sudden, depending on rainfall intensity, and require preparedness measures that can be activated at very short notice.

Emergency response based on early warning therefore includes the following major activities: coordination with the District Disaster Management Authority (DDMA) and SDMA; dissemination of warnings; evacuation and relocation to safe relief camps; emergency response and relief measures; and the supply of food, potable water, and medical and hygiene needs.

Learning unit 5.2: Enabling environment

Policy framework

The recently amended Disaster Management (Amendment) Act, 2025 mandates the establishment of Urban Disaster Management Authorities (UDMAs). Apart from the UDMA, central schemes, such as the Aapda Mitra scheme, can be leveraged for effective response. Under this scheme, identified community volunteers are trained in basic skills for disaster response, including basic rescue and relief tasks during an emergency. The National Disaster Management Authority (NDMA) is upscaling the scheme pan-India to train 1 lakh volunteers across 350 selected districts that are highly vulnerable and prone to floods, cyclones, landslides, and earthquakes. ULBs must seek support from the NDMA to access these trained volunteers during emergencies.

In current practice, immediate response in cities is carried out by ULBs with support from first responders such as fire, police and medical services. The state and central government supplement the efforts by providing logistical and financial support, and deploying the State or National Disaster Response Force (SDRF or NDRF), Armed Forces, Central Armed Police Forces (CAPF) and other specialised agencies mandated to respond to particular types of disasters.

Responders

Responders are involved in a wide range of activities across all three periods of a disaster – the warning period, the disaster, and post-disaster relief. These activities can be broadly categorised into early warning, emergency operation and coordination, search and rescue, shelter, medical assistance, and finance (Figure 22). Primary responders include community persons, the fire and police departments, NGOs, paramedics, and religious organisations. These are typically city-based entities. Secondary and tertiary responders are drawn from state and national government respectively, and include the State Disaster Response Force (SDRF), District Disaster Response Force (DDRF), State Red Cross Society, and Civil Defence at the state level, and the NDRF, Armed Forces, India Meteorological Department (IMD) and Indian Red Cross Society (IRCS) at the national level.

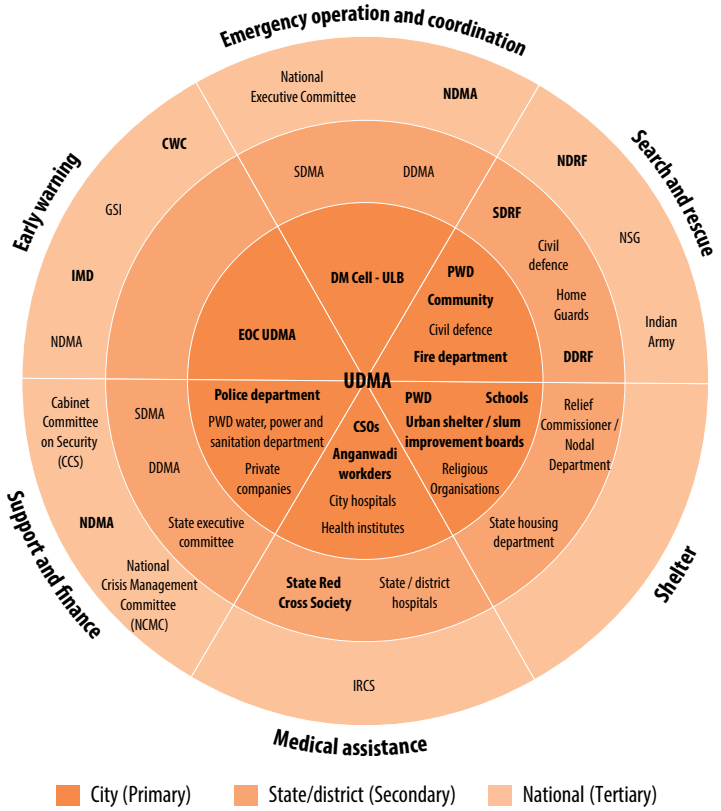


Figure 22: Stakeholder map of responders

The Fire and Emergency Services (F&ES) department plays a crucial role as one of the first responders during the golden hour in cities. It is therefore imperative that ULBs adequately equip and develop the capacities of the F&ES and provide continuous training to fire staff in the use and maintenance of equipment. Such training should also be provided to other first responders.

Use of IT systems in disaster response

The National Disaster Alert Portal (Sachet) provides a common platform for the dissemination of multi-hazard alerts. ULBs should be familiar with how alerts reach their jurisdiction through this portal.

The Common Alerting Protocol (CAP)-based Integrated Alert System integrates all alert-generating, approving, and disseminating agencies on a single web-based platform, to facilitate the automatic dissemination of alerts to a geo-targeted area over multiple media and in regional vernacular languages (Figure 24). The main Alert Generating Agencies (AGAs) are the IMD, Indian National Centre for Ocean Information Services (INCOIS), Forest Survey of India (FSI), Central Water Commission (CWC), and Directorate General of Reconnoitring and Explosives (DGRE), while the Alert Disseminating Agencies (ADAs) are telecom service providers (TSPs), television, radio, mobile apps, social media, and coastal sirens. Cities need to tap into these IT systems and downscale their use within the jurisdiction of the ULB.



Figure 23: Common Alerting Protocol (CAP)-based Integrated Alert System

The Emergency Response Support System (ERSS) is an NDMA-sponsored system for handling emergency signals and providing timely assistance to people in distress, with the help of police, fire and rescue, and health services. It works through a single telephone number 112, or the mobile application '112 India', which can be used to seek help, such as police assistance, ambulance, fire incidents, women and child protection/safety, and location loss, during an emergency. An automated facility for this purpose is being set up in capital cities, called the Public Safety Answering Point (PSAP). This system is more suitable for larger cities that already have an established Integrated Command and Control Centre (ICCC) and/or IT-based administration in place.

Learning unit 5.3: Actions for ULBs related to disaster response[27]

Disaster response comprises five main components: golden hour response, emergency operation, search and rescue, relief camps and supplies, and triage. Each component is described below, along with the actions required of ULBs, the critical aspects that determine its effectiveness, and the actors that support ULBs in delivering it.

Golden hour response

The time period of 72 hours from the disaster event is known as the 'golden hour' and the response within this period is known as golden hour response. An efficient golden hour response attempts to provide support in the first few hours, especially in slum areas and night shelters, to increase the chances of survival of the most vulnerable populations and to reduce damage. Actions related to golden hour response is listed in Table 34.

Table 34: Actions for golden hour response

Actions	Critical aspects	Supporting Actors (in coordination with ULB)
• Inclusive early warning – mainly in slums and squatters • Coordinate with CSOs and community resource persons for prioritising evacuation of most vulnerable people • Alert fire and police departments • Deploy traffic police to manage emergency routes • Engage medical personnel for triage • In case of flooding, immediate distribution of bleaching powder and chlorine tablets (to avoid cascading impacts)	• Early warning and alert systems (CAP) in place • Prompt coordination and command by EOC • SOPs available • Data on vulnerable population and areas	• Fire and police departments • Community responders • NGO/CSO coordination • Medical and para-medical personnel

ULBs should intentionally involve CSOs and community resource persons who work directly with vulnerable groups in the given context, such as organisations representing PwD, minority networks, women's groups and the elderly. These actors possess contextual expertise, trusted relationships and established strategies for effectively engaging and communicating with marginalised or excluded groups. Their participation strengthens the relevance, accessibility and impact of disaster response programming by ensuring that diverse voices are meaningfully included in decision-making and implementation.

Emergency operation

Emergency operations are mainly about prompt action and coordination. They include logistics for the quick arrangement of equipment and supplies, prompt deployment of human resources, and command and coordination with first responders. It also requires constant communication with the DDMA, and, if required, the SDMA and NDMA. Table 35 lists down the actions related to emergency operations.

Table 35: Actions related to emergency operations

Actions	Critical aspects	Supporting Actors (in coordination with ULB)
• Alerting nearest NDRF and SDRF battalions. Further, alert all identified NGOs • Prioritising restoring power and water supply • Ensuring continuity of mobile and internet network, even when there is no electricity • Meeting with petrol pump dealers to ensure stock is maintained • Focus on rapid health assessment of affected community, equal opportunity to access health services and inclusion of female doctors in health teams	• Emergency preparedness plans and protocols in place • Stocks of relief supplies and medicines available • Standard protocols (GESI-integrated) for rescue, relief and rehabilitation; mass casualty management available • Proper functioning equipment and vehicles • Priority areas identified through VRA and GESI assessments	• Fire and police department • Traffic police department • Ward committees • SHGs and RWAs • NGOs/CSOs • SDRF • NDRF

Women-centred emergency operations[28]

Recovery strategies that address the negative impacts of disasters on women include:

- Planning emergency water supplies and rapid restoration of community access to safe water, recognising the additional burdens of work and security risks that women face in collecting water
- Planning for food supplies and labour-saving technology such as cooking equipment (cook-stoves, cookware and fuel), together with compensation for the labour involved in providing meals for displaced communities in camps and shelters
- Ensuring that health, psychosocial support and education services are provided on a mobile basis and restored as a high priority
- Establishing mechanisms to prevent and mitigate gender-based violence (GBV) and harassment, including facilities that accommodate diverse needs and separate, confidential reporting and referral pathways. (Source: Sendai Framework Gender Action Plan, 2024)

Search and rescue

The prime focus of immediate response is rescuing as many people as possible from the disaster. This requires personnel trained, in addition to regular rescue skills, in handling PwD, pregnant women, elderly persons, and children and infants. Uninterrupted communication and coordination with community resource persons, especially in slum areas, is crucial for effective search and rescue (Table 36).

Table 36: Actions related to search and rescue

Actions	Critical aspects	Supporting Actors (in coordination with ULB)
• Immediately engaging trained rescue teams in coordination with the fire department • Prioritising pregnant women, elderly, sick persons, children and PwDs • Arranging an adequate number of buses, vans, and trucks for rescue operations, transportation to relief camps and transportation of relief materials • Alerting the department of forest and wildlife, along with other NGOs, for the rescue of animals and management of uprooted trees	• Priority areas identified through risk and GESI assessments - slums, dilapidated structures, areas with poor access to basic services • Availability of proper functioning equipment and vehicles – ambulance, other essential vehicles, rescue equipment, first aid kits, oxygen kits, life jackets, maps, contact lists, etc.	• Fire and police department • Traffic police department • Ward committees • SHGs and RWAs • NGOs/CSOs • SDRF • NDRF

Relief camps and supplies

Search and rescue are generally followed by the provision of temporary shelter to the homeless, or to those with severely damaged house structures (Table 37). These relief camps should have basic amenities such as water, sanitation, food, and waste disposal, and must incorporate elements of gender and social inclusivity.

Table 37: Actions related to relief camps

Actions	Critical aspects	Supporting Actors (in coordination with ULB)
• Deploying ASHA workers • Sensitising disaster survivors to identify danger signs, usage of delivery kit, identification of symptoms of urinary tract infections and vaginal discharge, referral facilities and care for pregnant women • Appointing men and women officers in each camp to coordinate dissemination of information • Making provisions for raising complaints of non-receipt or discriminatory approach in relief supply, gender-based violence, and redressal system • Disposing of construction waste, natural debris, solid and liquid waste in appropriate ways	• Caution must be taken not to construct these camps in eco-sensitive zones • Needs of women, elderly people, PwD, and children should be considered • Women should not be compelled to share accommodation with men who are not members of her immediate family • Safe and private lactation areas in shelters should be provided, and the availability of lactation supplies should be ensured • There should be personnel/ guards to check for acts of violence (specifically against women)	• District Disaster Management Authority (DDMA) • State Disaster Management Authority (SDMA) • PWD • NGOs/ CSOs

Triage (medical response)

Triage is the sorting of patients according to the urgency of their need for care. As with search and rescue, triage requires paramedic staff specially trained to handle pregnant women, infants, elderly people, and PwDs. The ULB must alert Primary Health Centres (PHCs) and other hospitals to keep emergency bays ready (Table 38). It is vital to determine the order of treatment across categories such as cardiac, orthopaedic, surgical or trauma cases.

Table 38: Actions related to triage

Actions	Critical aspects	Supporting Actors (in coordination with ULB)
• Activating Quick Reaction Medical Teams (QRMT) with resuscitation equipment and lifesaving drugs • Alerting PHCs and municipal hospitals • Coordinating with city hospitals • Engaging identified NGOs • Engaging state Red Cross Society and IRCS • Keeping health condition-appropriate supplies ready • Ensuring proper management of bio-medical waste and animal carcasses	• Medical personnel and hospital staff (both male and female) should be trained in triage, gender- and age-sensitive issues, handling pregnant women, children, and PwD. • Standard operating protocols for medical operations should be ready and available – linked with local climate or disaster plans • Inventory of essential medical supplies should be kept ready and available • Properly functioning ambulance, rescue equipment, first aid kits and oxygen kits should ke ready	• ASHA workers • Paramedics • Self-help groups (Red Cross-trained personnel) • NGOs/CSOs

MODULE 6: Post-Disaster Planning

Learning objectives

This module aims to elucidate the fundamentals of post-disaster actions and the role of ULBs in post-disaster recovery. It inculcates the importance of loss and damage assessments in post-disaster planning, including rapid damage and loss assessments and post-disaster needs assessment (PDNA). The module further instils the need for inclusivity, equity, early engagement, psycho-social support, and capacity development for post-disaster planning.

Learning Unit 6.1: Fundamentals of recovery, reconstruction and rehabilitation

Recovery and reconstruction are a state-driven process. The current policy framework in India does not provide direct control of recovery actions to urban local bodies (ULBs). This module aims to elucidate the scope for implementing recovery actions available to city officials and to train them in specific aspects of disaster recovery, reconstruction, and rehabilitation.

Recovery, reconstruction and rehabilitation

Recovery is the restoration of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. The aim of recovery is to return to normalcy, and its duration typically ranges from months to several years. Recovery should not simply restore previous conditions. Instead, recovery investments should improve resilience and reduce future risks. Lessons learned from disaster events should inform future planning, infrastructure design, and governance systems.

Reconstruction is medium- and long-term rebuilding and sustainable restoration of resilient critical infrastructure, services, housing, facilities and livelihoods. **Rehabilitation** focuses on restoring the normal functioning of communities and includes physical rehabilitation, economic rehabilitation, social rehabilitation, mental health and psychosocial support.

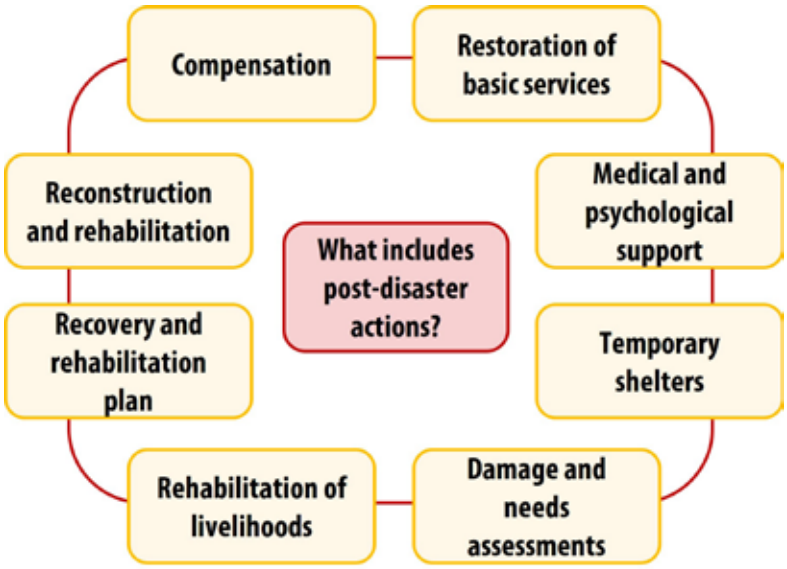


Figure 24: Components of post-disaster actions[29]

All measures undertaken during rehabilitation, reconstruction and livelihood restoration should aim to reduce future exposure and vulnerability. The link between rehabilitation and mitigation is therefore critical for preventing future hazards from becoming major disasters.

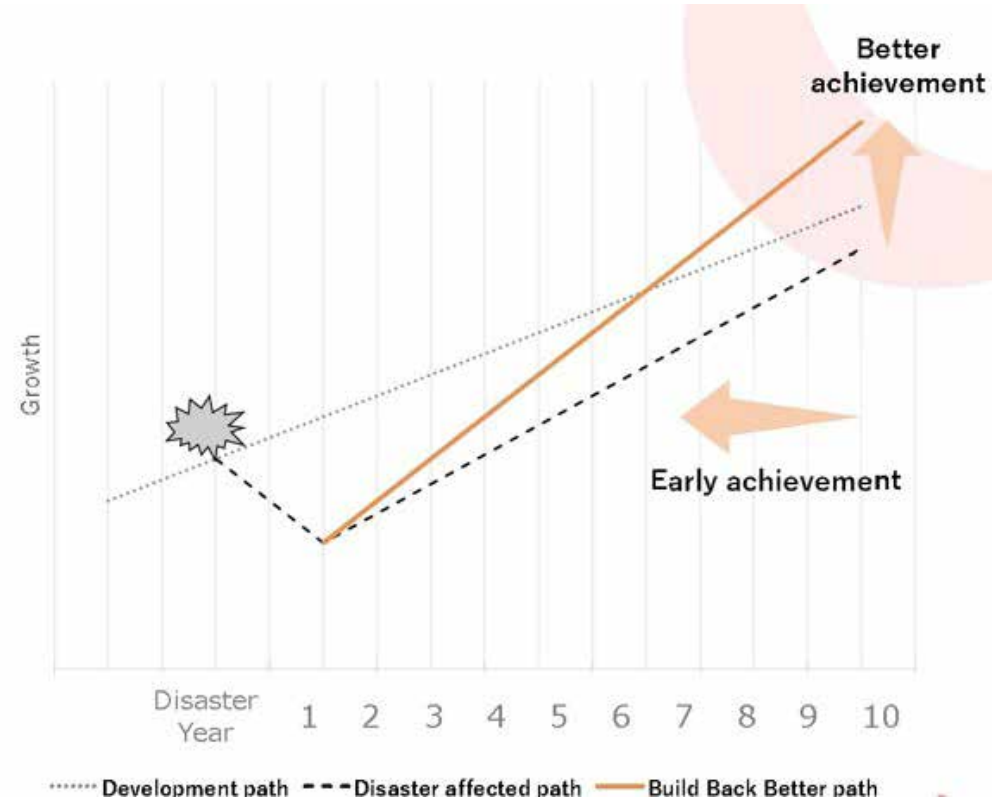
The time required for recovery depends on the scale of damage and disruption to property, livelihoods, the economy, infrastructure and natural assets.

Build back better

'Build back better' refers to the use of the recovery, rehabilitation and reconstruction phases to increase the resilience of communities by integrating disaster risk reduction (DRR) measures into the restoration process. Its principles encompass increasing resilience through robust buildings and infrastructure that emphasise adaptability, undertaking an inclusive and participatory approach that prioritises the needs of the most vulnerable and marginalised, incorporating nature-based solutions and circularity principles, and promoting innovation, accessibility, and equal opportunities through smart technologies.

Rehabilitation and reconstruction based on the 'build back better' principle entails:

- Disaster risk assessments (including vulnerability assessment), GESI analysis, and system fragility analysis, among others. Capacity and vulnerability assessments are especially useful in guiding targeted interventions and resource allocation during recovery, rehabilitation, and reconstruction
- Mainstreaming assessment results into disaster management and development plans
- Dissemination of risk information to the public and key stakeholders, including the departments of fire, police and public works



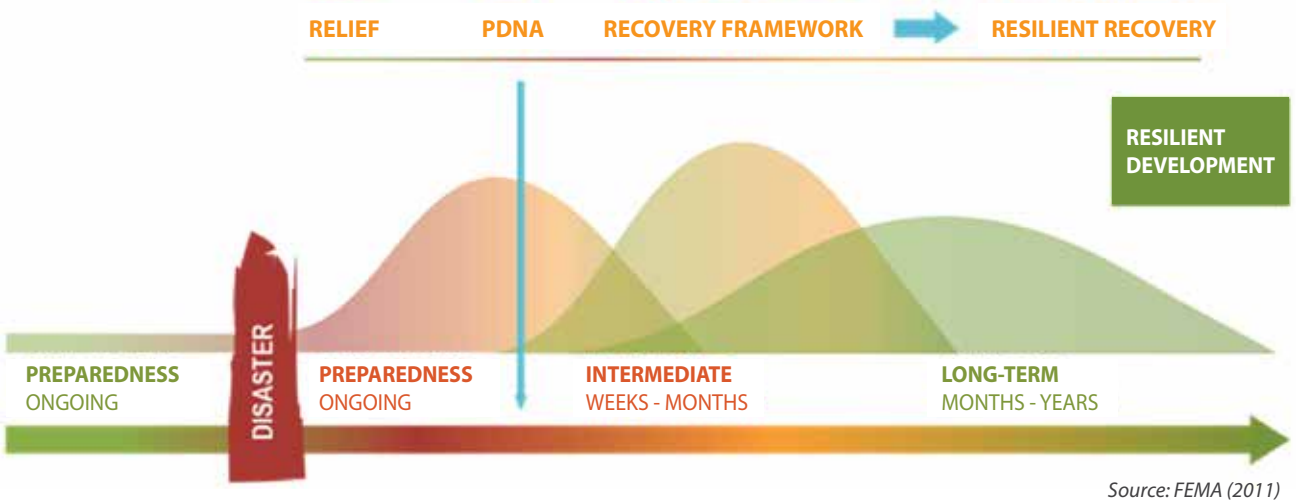
Source: Build Back Better Plan In response to the Kahramanmaraş Feb. 6 Earthquakes, KahramanmaraşMetropolitan Municipality, JICA, 2024

Figure 25: Build back better path

The 'build back better' path aims not only to restore growth to its pre-disaster trajectory, but to exceed it, achieving better outcomes earlier than a standard disaster-affected recovery path would allow (Figure 26).

Link between response, recovery and preparedness

Recovery begins soon after the emergency response phase ends, and long-term rehabilitation efforts overlap with the mitigation and preparedness phase of the next disaster management cycle (Figure 26). Sustaining this continuity from relief, through the PDNA and the recovery framework, to resilient recovery and development is essential for effective long-term outcomes[30].



Source: FEMA (2011)

Figure 26: Transition from relief to recovery

Difference between response and recovery[31]

Recovery is achieved only when pre-disaster levels of production, services, and personal income are restored, and full reconstruction of destroyed assets across all sectors is achieved. While providing temporary shelter is emergency response, rebuilding destroyed houses is part of reconstruction. Similarly, setting up temporary schools in tents or alternative premises is part of response, whereas re-establishing schools and education centres is recovery. In terms of livelihoods, re-establishing commercial areas, market systems and businesses is recovery and rehabilitation.

This distinction represents a strategic entry point for GESI-responsiveness, provided that recovery measures actively draw on gender and social assessment findings to embed inclusivity within new infrastructure, for example, by improving accessibility for PwD where it previously did not exist[32].

Phases of recovery

Recovery is generally undertaken in three phases: early, mid-term, and long-term. The time required to achieve recovery varies across sectors, depending on the severity of the disaster impact. The early recovery stage is within 1-2 years after the disaster and is a transitional phase from response to recovery. The mid-term recovery stage normally includes the duration between 2-5 years, where planning for recovery is undertaken, including initial implementation. The third stage is the long-term phase, which may last from within 5 years to more than 10 years. Long-term recovery includes reconstruction of resilient infrastructure, housing stock, markets and improved urban systems while integrating DRR principles.

This module primarily addresses the short- and mid-term phases.

Scope of post-disaster planning and action for ULBs

The recovery phase is predominantly governed by the state through the NDMA, SDMA and DDMA. City authorities need to know when, and under what circumstances, to seek support from the state. This depends on the scale of impact of the disaster. ULBs should expect to be consulted by the state in the preparation of the recovery and rehabilitation plan.

Loss and damage assessment is conducted at the state or national level. It is an exercise generally beyond the capacity of a ULB, on account of the manpower, technical and financial resources required. It is therefore important for ULBs to understand the scope of activities they can undertake to conduct a similar assessment at the city level.

Areas that can be dealt with by
ULBs, through the Disaster Resilience Core Team (DRCT) or UDMA, in recovery



Housing and slum rehabilitation	Critical infrastructure	Livelihoods	Health	Education

Learning unit 6.2: Phase-wise Actions for Recovery[33]

Post-disaster recovery has three broad aspects:

- **Physical:** Reconstruction of damaged infrastructure (critical infrastructure such as water, sanitation, sewerage, waste, power and communication, and roads), and of residential, public, semi-public and heritage buildings
- **Social:** Psycho-social aspects of personal, family and community functioning and wellbeing
- **Economic:** Livelihoods, productive activities and market services

Loss and damage assessment provides a credible basis for recovery and reconstruction planning that incorporates DRR measures. Early recovery and loss and damage assessment should take place simultaneously, to allow effective planning for mid- and long-term recovery.

Role of ULBs in the early recovery stage

Temporary shelters

- Identifying agency(s) to design and construct customised shelters
- Pre-identifying suitable locations, not in hazard-prone or eco-sensitive areas
- Coordinating planning and design in consultation with the community, considering locally available materials, the functional needs of the community, minimum hygiene standards; gender, age and disability factors, and the site's exposure to climate hazards

- Constituting community task forces from among disaster-affected families, for providing food through community kitchens and for supporting education. Equity and inclusion considerations should be applied here to ensure fair and meaningful representation. The task force should include representatives from different sections of society, including women, elderly people and marginalised groups. Efforts should be made to involve this task force in decision-making and planning, to build back better and ensure that their needs are met. This is important for promoting locally led adaptation and is also essential for long-term recovery.
- Arranging for efficient governance systems, such as entitlement cards and identification cards
- Stockpiling necessary relief equipment and tools

The use of educational institutions for establishing temporary relief camps should be discouraged.

Restoration of basic services

- Coordinating with line departments such as Public Health Engineering (PHE), Public Works Department (PWD), electricity, and transport
- Prioritising the restoration of water supply, repairing pipelines and treatment plants, and providing temporary water tanks
- Setting up temporary toilets, with provision for PwDs and separate sections for women, wherever necessary
- Identifying and repairing access roads, including special tracks for PwDs
- Deploying additional personnel for waste management

Restoration of basic services must consider GESI factors throughout, for example, safety (locations that are secure, with clear and lit pathways at night to minimise the risk of harassment and assault), proximity to shelters for groups such as older persons and children, and accessibility for PwD.

Medical support

- Deploying medical personnel in PHCs with experience handling pregnant women, elderly people and children
- Engaging NGOs trained in psycho-social support
- Arranging essential medical equipment and medicines, with additional provision for elderly people, PwDs and pregnant women
- Restoring Anganwadi centres

Early community engagement

- Commissioning NGOs, CSOs and SHGs, such as women's groups and groups working with children, elderly people and PwDs, that are experienced in post-disaster community engagement
- Focusing on mental support, hygienic practices, support for women in household activities, and education of children
- Encouraging communities to hold social gatherings, religious congregations, mass prayers and festivals, facilitated and supported by NGOs and professionals

To ensure equitable participation, it is essential to include women's organisations and networks of PwD, older persons, and other relevant groups, and strengthen their capacities where needed to enable meaningful engagement.

Livelihood support

- Harnessing provisions available with the state/UT on employment generation programmes, such as MGNREGS and NULM, and dovetail these with the disaster situation
- Partnering with NGOs to identify alternative livelihood opportunities and related skills

Loss and damage assessment (early recovery phase)

Loss and damage assessments are undertaken to determine the resources, time, and finance required for recovery. Their purpose is to:

- Identifying recovery priorities drawing on GESI and other socio-economic assessments relating to community needs and damaged infrastructure
- Identifying external technical support requirements
- Determining financial assistance for recovery
- Conducting Social Impact Assessments (SIA) to ensure the needs of vulnerable and marginalised groups are identified
- Assessing impacts on environmental resources to identify restoration and conservation needs

Box 7: Loss and damage assessment in the Indian context: the Post-Disaster Needs Assessment

- The 15th Finance Commission recommends that a disaster event - large, medium or small must be assessed through a PDNA
- The PDNA forms the basis for allocation from the SDRF/ NDRF
- The PDNA is undertaken at the state or national level
- Cities must nonetheless support state and national government in the successful implementation of PDNAs

Loss and damage parameters for urban areas

Loss and damage assessment in cities can be organised around economic and non-economic parameters, as shown in Table 39.

Table 39: Loss and damage parameters for urban areas[34]

Economic (ELD)		Non-Economic (NELD)		
Income	**Physical assets**	**Individual**	**Society**	**Environment**
• Economic growth • Business and trade • Livelihood	• Infrastructure • Property	• Loss of life • Mental wellbeing	• Displacement/ migration • Socio-economic inequality • Social cohesion • Cultural heritage	• Health system • Biodiversity/ ecosystem

Economic loss and damage (ELD): income, physical assets and non-economic loss and damage (NELD): individual, society, environment

Rapid loss and damage assessments in Indian cities

- ULBs should commission rapid post-disaster assessments, covering both economic and non-economic loss and damage
- Assistance from the state government can be sought based on the results of the rapid assessment report, which can also help substantiate the PDNA

Possible role of the DRCT/UDMA in loss and damage assessment

- Undertaking rapid damage assessments, using participatory methods to capture local experiences
- Supporting sectoral assessments
- Developing a Disaster Recovery Framework
- Providing the foundation for localised solutions

ULBs must make use of advanced technologies such as drones, app-based systems and artificial intelligence

Role of ULBs in the mid-term recovery stage (Reconstruction and Rehabilitation)

The reconstruction and rehabilitation (R&R) phase (mid-term to long-term) primarily includes compensation for damage to housing and livelihoods, reconstruction and re-establishment of damaged housing, public infrastructure and social services, and rehabilitation of livelihoods and the overall economic base. R&R must ensure environmental sustainability throughout, including the sustainable use of natural resources for reconstruction and livelihoods, minimising loss of vegetation cover and biodiversity, prohibiting the selection of residential sites in hazard-prone areas, sustainable extraction of groundwater, and proper disposal of solid and liquid waste (Table 40). The UDMA is expected to support, supervise, and monitor reconstruction and rehabilitation activities across these sectors.

Table 40: Consideration for the mid-term recovery stage, by sector

Housing	Health	Education	Critical infrastructure
• Disaster-resilient design alternatives • Use of locally available materials • Support from NGO/ CSO or other external organisations in facilitating reconstruction work and supporting the authorities • Compensation for residential damage	• Community-based programmes such as mobile health clinics and community-based first aid training • Regular counselling through PHCs to strengthen the mental health of women and children	• Awareness of disaster preparedness, such as school earthquake safety programmes • Innovative adaptation measures, such as boat schools for children to continue attending classes during flood seasons	• Prioritisation of critical infrastructure and the most vulnerable areas, based on a Climate Risk Assessment (CRA) • New infrastructure based on climate risk assessment, selecting low-risk areas • Use of resilient design and materials • Retrofit old infrastructure with DRR integration

Ecosystem considerations

During recovery, ecosystem damage should be included within loss and damage assessments. Reconstruction should avoid encroachment into wetlands, hillslopes, coastal regulation zones and other environmentally sensitive areas. Green infrastructure, sustainable material sourcing and ecosystem restoration should form an integral part of recovery planning.

Needs of marginalised and vulnerable groups

Vulnerable groups warrant particular attention in recovery planning because they are among the most impacted, are more likely to be displaced, and have limited access to resources and mobility. They also have difficulty participating in, or being represented in, recovery planning. Moreover, they face difficulty in restoring livelihoods.

The recovery process should evaluate the risk faced by these groups and their likelihood of displacement and must ensure their equal participation in post-disaster recovery programmes.

Some measures for the rehabilitation of vulnerable and other disadvantaged groups, identified through the GESI assessment, are set out below.

Health and wellbeing

- Setting up one multi-purpose community centre per slum cluster
- Reactivating Anganwadi centres and old-age homes within the shortest possible time
- Ensuring measures to support PwDs, including provision of facilities such as wheelchairs and walking sticks, and health care
- Paying due attention to health, nutrition and hygiene in the long-term rehabilitation package for women and children

Mainstreaming social safety net programmes[34]

- Distributing food vouchers or free food
- Initiating direct feeding programmes to prevent malnutrition
- Undertaking school-based food programmes to encourage poorer children to attend school
- Creating public works programmes for emergency relief, and short-term works to rebuild schools, houses, clinics, water and irrigation networks, and roads
- Using microfinance, credit and savings groups created for social protection and entrepreneurship

Livelihoods and employment

- Meeting and discussing local resources, capacities, and possibilities for post-disaster employment
- Creating awareness of various government schemes for employment and promoting self-employment

Informal sector

- Promoting skill development through vocational training, focusing on the informal sector
- Identifying alternative livelihood opportunities, focusing on marginalised groups
- Strengthening SHGs
- Reconstructing and restarting local markets
- Engaging with the private sector wherever possible

Psycho-social support (PSS)[35]

PSS is a process of facilitating resilience that helps individuals, families and communities bounce back from the impact of crises, and deal with such events in future. ULBs must seek support from organisations such as local, national and international NGOs, Anganwadi workers, state and central mental health hospitals, spiritual organisations and civil society and community-based organisations for providing PSS. Activities that can be undertaken are:

- Open local PSS/mental health centres to assist through the entire recovery period
- Organise collective community actions, such as clean-up activities, religious ceremonies and community kitchens
- Create safe spaces for children, equipped with play-kits, storybooks and toys/games
- Assist in tracing community and family members, and support reunification

Long-term recovery phase

Long-term recovery is a part of city development. It includes:

- Integration of DRR principles and the CRA with city-level plans, disaster management plans and master plans
- Land-use planning based on climate risk assessment
- Building resilient infrastructure, with DRR integration based on build back better principles
- GESI incorporation
- Addressing environmental issues related to emissions and long-term sustainability
- Capacity development of key stakeholders

ULBs should monitor the progress of disaster-resilient development on an ongoing basis, so that long-term recovery investments continue to build the city's resilience to future disasters.

MODULE 7: Governance for Disaster Risk Reduction

Learning objectives

This module elucidates major activities for DRR based on different capacities of ULBs. It discusses the composition and roles of a disaster core team. It helps in understanding the basic implementation process for GESI- and EbA-based DRR for different capacities of ULBs. The module also deals with micro-resilience planning and monitoring.

Disaster management in India: Institutional structure

Disaster management in India follows a multi-tier institutional framework established under the Disaster Management Act, 2005. The framework promotes coordinated action across the national, state, district, and local levels to support disaster prevention, mitigation, preparedness, response, recovery, and reconstruction (Figure 27).

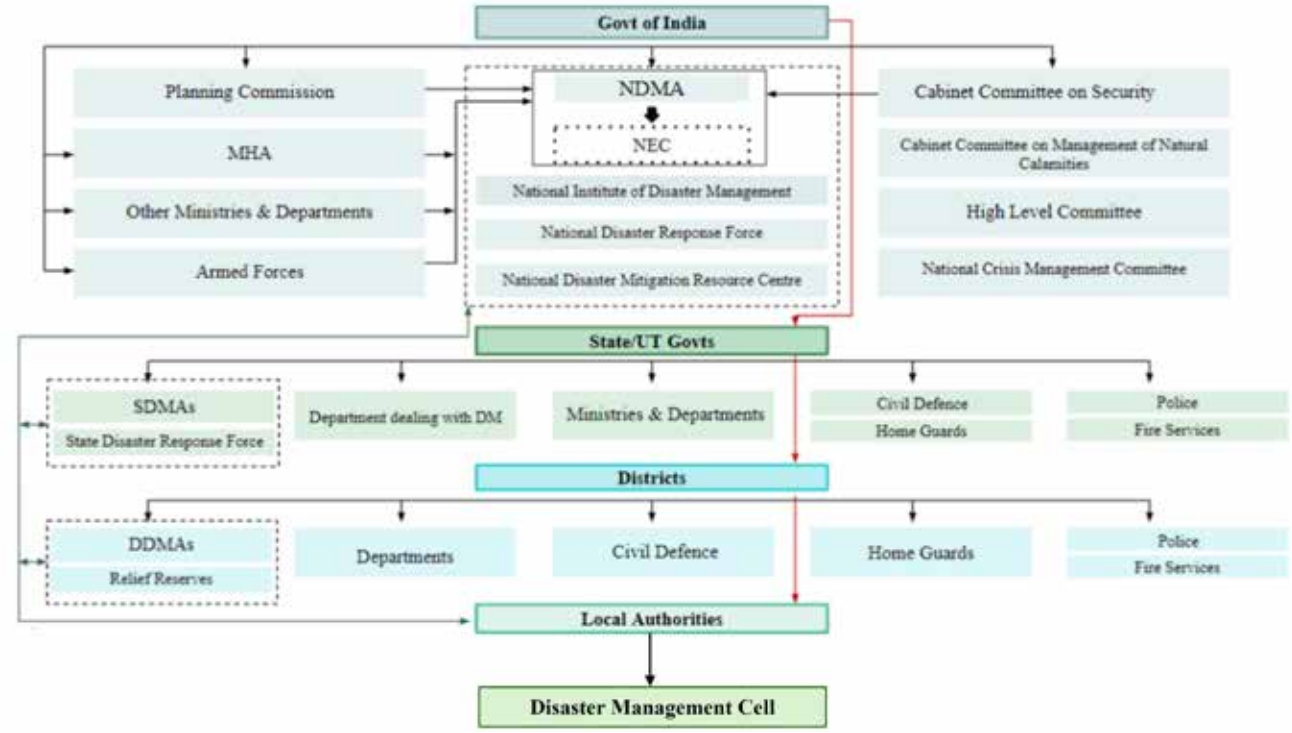


Figure 27: Disaster governance in India[37]

At the national level, the National Disaster Management Authority (NDMA), under the Ministry of Home Affairs (MHA), Government of India, is the apex body responsible for laying down policies, plans and guidelines for disaster management. The National Executive Committee (NEC) assists the NDMA in coordinating and monitoring the implementation of disaster management policies and plans. Technical and operational support is provided by institutions such as the National Institute of Disaster Management (NIDM), National Disaster Response Force (NDRF) and the National Disaster Mitigation Resource Centre (NDMRC). Disaster management is further supported by the line ministries, armed forces and national crisis management mechanisms.

At the state level, State Disaster Management Authorities (SDMAs) are responsible for preparing state disaster management plans, coordinating implementation and strengthening disaster preparedness and response. State departments, State Disaster Response Forces, Civil Defence, Home Guards, police and fire services support disaster management activities.

At the district level, District Disaster Management Authorities (DDMAs) coordinate disaster management planning and implementation, with support from district departments, Civil Defence, Home Guards, Police, Fire Services, and relief reserves. At the local level, Urban Local Bodies (ULBs) and other local authorities play a critical role in implementing disaster risk reduction measures, integrating resilience into development planning, coordinating emergency response and engaging communities. The Disaster Management (Amendment) Act, 2025 further recommends the constitution of Urban Disaster Management Authorities (UDMAs) for state capitals and municipal corporations to strengthen city-level disaster management planning and coordination.

The effectiveness of this institutional framework depends on strong coordination among government departments, technical institutions, emergency services, communities, and other stakeholders to support a comprehensive, multisectoral approach to disaster risk reduction and climate resilience.

Learning Unit 7.1: Key Actors and Actions

At each stage of the disaster management cycle, ULBs are expected to undertake tasks that span five aspects of governance: planning, coordination, operations and management, finance, and monitoring. These tasks are summarised by phase below.

Essential criteria for effective DRR in cities

Cities can use the checklist below to self-assess their institutional readiness against three broad capacity levels (Table 41). Level 1 corresponds to urban areas with a basic level of preparedness (low population, low resources); Level 2 to urban areas with a preferred level of preparedness (medium population, moderate resources); and Level 3 to urban areas with a desirable level of preparedness (high population, relatively higher resources). ULBs can mark each item against their current status as they build capacity over time. This is based on MCR 2030 framework

Table 41: Essential criteria for effective DRR in cities, by institutional capacity level

	Criteria	**Level 1- Urban areas with basic level of preparedness** (low population, low resources)	**Level 2 - Urban areas with preferred level of preparedness** (medium population, moderate resources)	**Level 3 - Urban areas with desirable level of preparedness** (high population, relatively higher resources)
Institutional Structure	Disaster Resilience Core Team	■	■	■
	Climate Cell			■
Planning	Disaster risk assessment (including vulnerability assessment)	■	■	■
	Disaster management plan		■	■
	Climate action plan			■
	Standard operating procedures (SOPs)			■
Structural Measures	Early Warning Systems	■	■	■
	Integrated command-and-control centre (ICCC)			■

	Criteria	Level 1- Urban areas with basic level of preparedness (low population, low resources)	Level 2 - Urban areas with preferred level of preparedness (medium population, moderate resources)	Level 3 - Urban areas with desirable level of preparedness (high population, relatively higher resources)
Non-structural measures	Dissemination and outreach, carrying out inclusive response and recovery	■	■	■
	Innovative climate finance mechanisms		■	■

The tasks listed in the above matrix are for ULBs with different levels of institutional capacity for climate-induced disaster management. There are additional capacities of ULBs that need to be considered, such as staff strength, sectoral technical expertise, and financial resources. It is recommended that the level of capacity of a city align with its stage of reporting under Making Cities Resilient (MCR) 2030.

Disaster Resilience Core Team (DRCT)

Urban areas need a core group for planning, implementing, and monitoring disaster-related actions. This can take the form of a department, cell, committee or core team. For urban areas without a dedicated disaster management entity, a Disaster Resilience Core Team (DRCT) should be formed, headed by the Commissioner (as discussed in Module 2).

Composition

The DRCT must have representation from all relevant departments. It should have at least 50% representation of women and other vulnerable groups, and representation should extend to leadership roles, to ensure the active and meaningful participation of marginalised groups. This will also help ensure that solutions are locally led. The DRCT must include two permanent officials - one for institutional anchoring, and another for activities related to the Emergency Operation Centre (EOC). However, there must be a nodal officer to oversee the daily functioning and operations. It is recommended that the DRCT be flexible enough to accommodate new entities identified through stakeholder consultations.

Role of the Disaster Resilience Core Team

- It should be the single-point source for all issues related to disaster management.
- It must undertake preparation of the disaster management plan, including a comprehensive disaster risk assessment.
- It should communicate the disaster management plan to different stakeholders.
- The DRCT must ensure the integration of different municipal departments, especially those responsible for local ecosystem maintenance and for strengthening vulnerable communities.
- It should act as the command-and-control agency between administration and field units.
- It must undertake monitoring of activities and incorporate learning from past events.

Where an ecosystem influencing the city's resilience is located outside the city's jurisdiction, for instance, in adjoining forest land under district or state authority, integration should still be ensured, for example, through coordination with the District Forest Officer. Similarly, departments, such as the groundwater board, irrigation department or agriculture department, may not have jurisdiction that overlaps with the city boundary, but they strongly influence the city's roles

and responsibilities in infrastructure and service provisioning and should be engaged accordingly.

For ULBs that already have a disaster management body, it is recommended to augment and upgrade its role by including all the functions and actions mentioned above.

Stakeholders[38]

The DRCT should map all the key stakeholders for implementing actions related to disaster resilience (Figure 29 and 30). This includes stakeholders from the city and other tiers of government, private parties, academia, R&D institutes, and the community. The primary objective of stakeholder mapping is to understand the impact and influence of the disaster resilience initiative beyond the core group. DRCT formation and stakeholder mapping are iterative processes; a stakeholder identified as needing integration into the DRCT may only emerge after its formation.

The DRCT/UDMA should also engage with NGOs, CSOs, CBOs and SHGs in different phases for different activities (see Module 2).

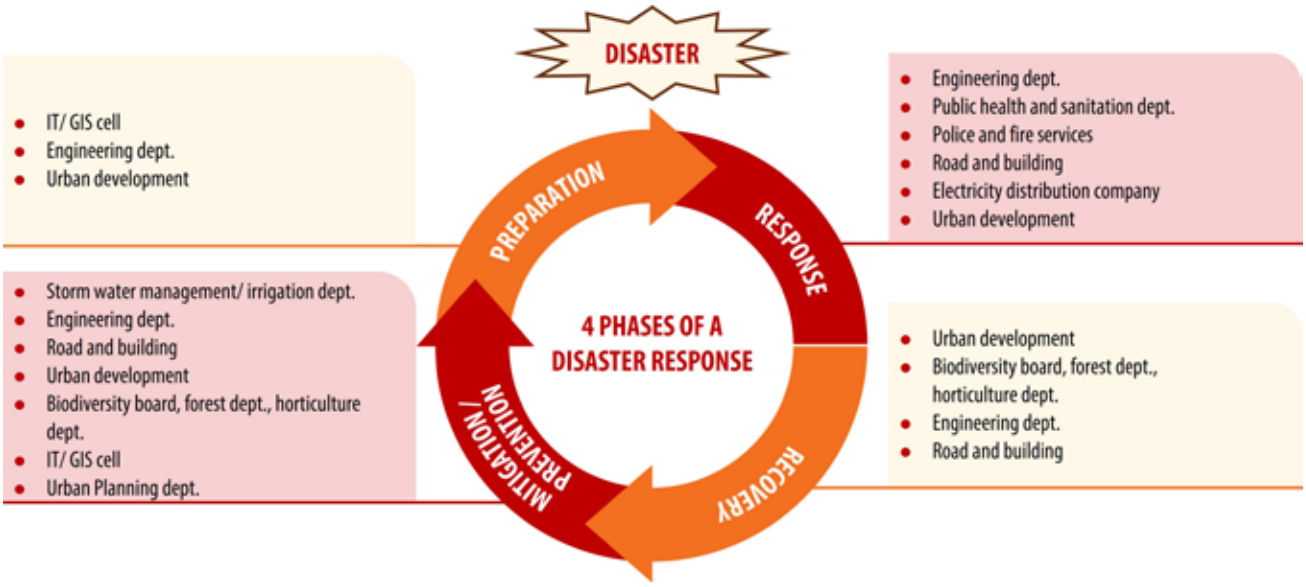


Figure 28: Departments proposed for engagement by the DRCT/UDMA across the four phases of disaster response

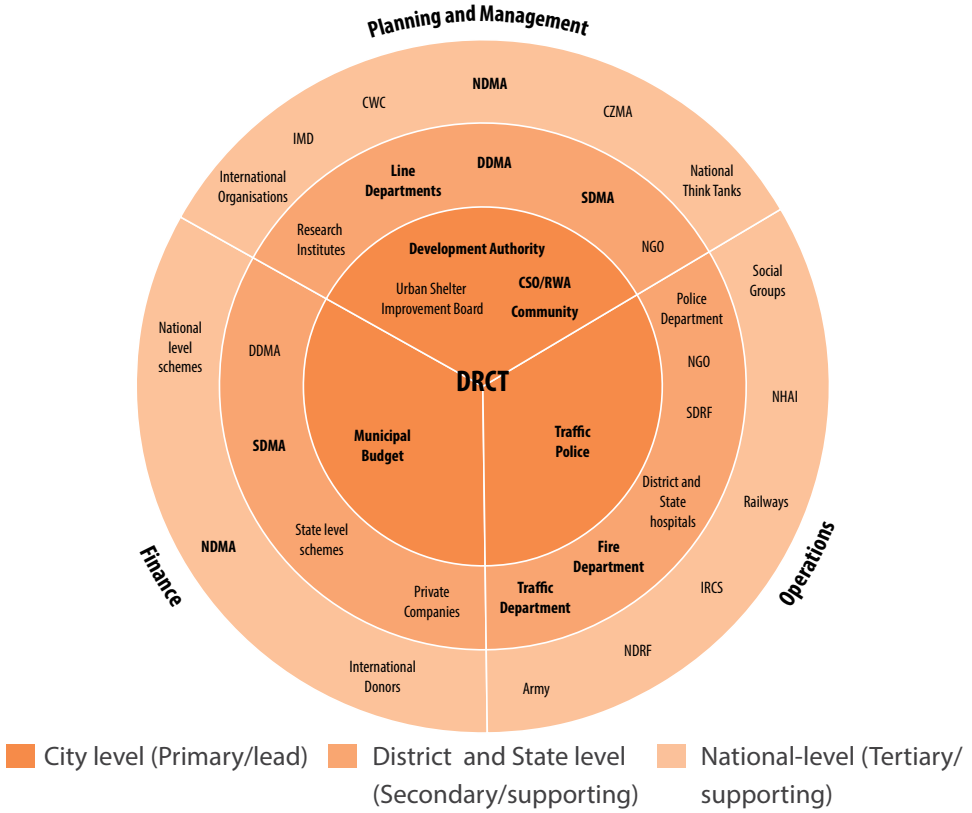


Figure 29: Stakeholder map for DRR planning and implementation in urban areas[39]

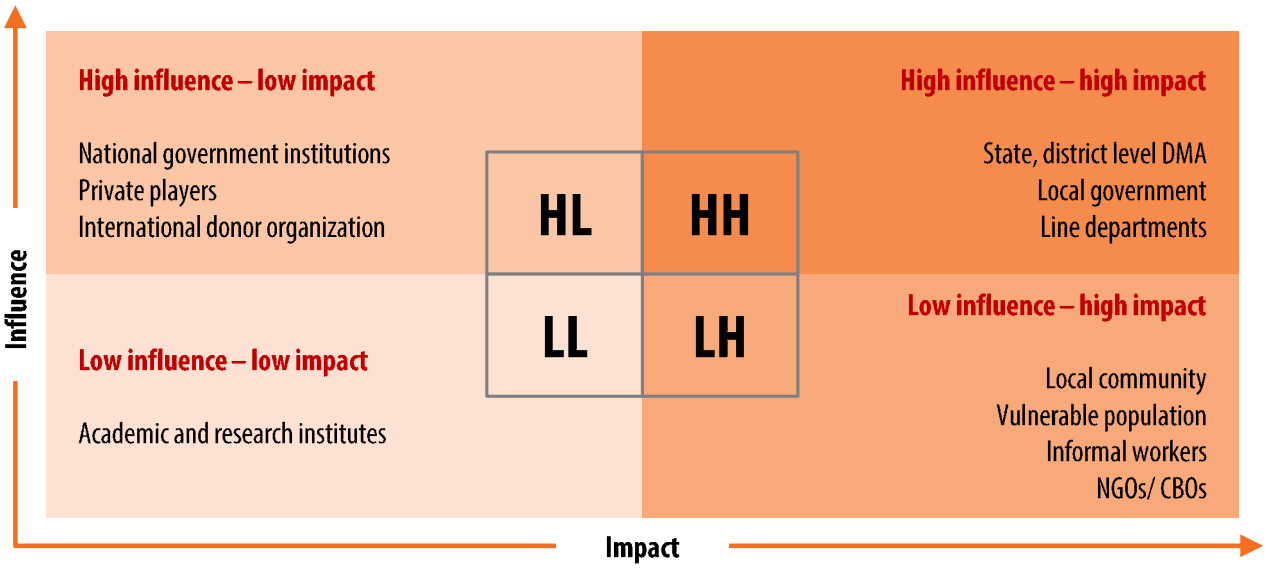


Figure 30: Example impact-influence matrix for stakeholder prioritisation

Detailed tasks of ULBs, by phase and capacity level

The detailed activities along with a broad implementation process for different levels of ULB capacities is provided below[40]. The activities and the implementation process are based on the institutional capacities discussed in Table 41 above. All activities below should be anchored by the DRCT/UDMA.

Level 1 – Basic	
Preparedness	1. **Form a Disaster Resilience Core Team** 2. **Undertaking** baseline assessment, disaster profiling, **climate and disaster risk assessment including vulnerability assessment** (in consultation with key stakeholders) 3. **Coordinate with** department of fire, police, transport, environment, slum improvement, housing, PWD, state climate department 4. **Establish early warning systems** – for slum areas, informal market areas, night shelters 5. Organise trainings for officials on preparation of DRR action plans, risk and vulnerability assessments, gender and social inclusion. 6. Ensure **mock drills in slum areas** with active participation of women 7. Identify and engage with NGO/CBOs for relief and response in slum areas, informal market areas and night shelters; experience in gender-sensitive relief works
Response	1. Warning dissemination to slums, informal markets in local language 2. Ensure availability of equipment specific to PwDs, pregnant women and senior citizens with search and rescue teams 3. Ensure proper disposal of corpses, clearing of debris and management of biomedical waste from relief camps
Recovery	4. **Updating master plan and building codes with risk information** 5. Disaster management helpline number

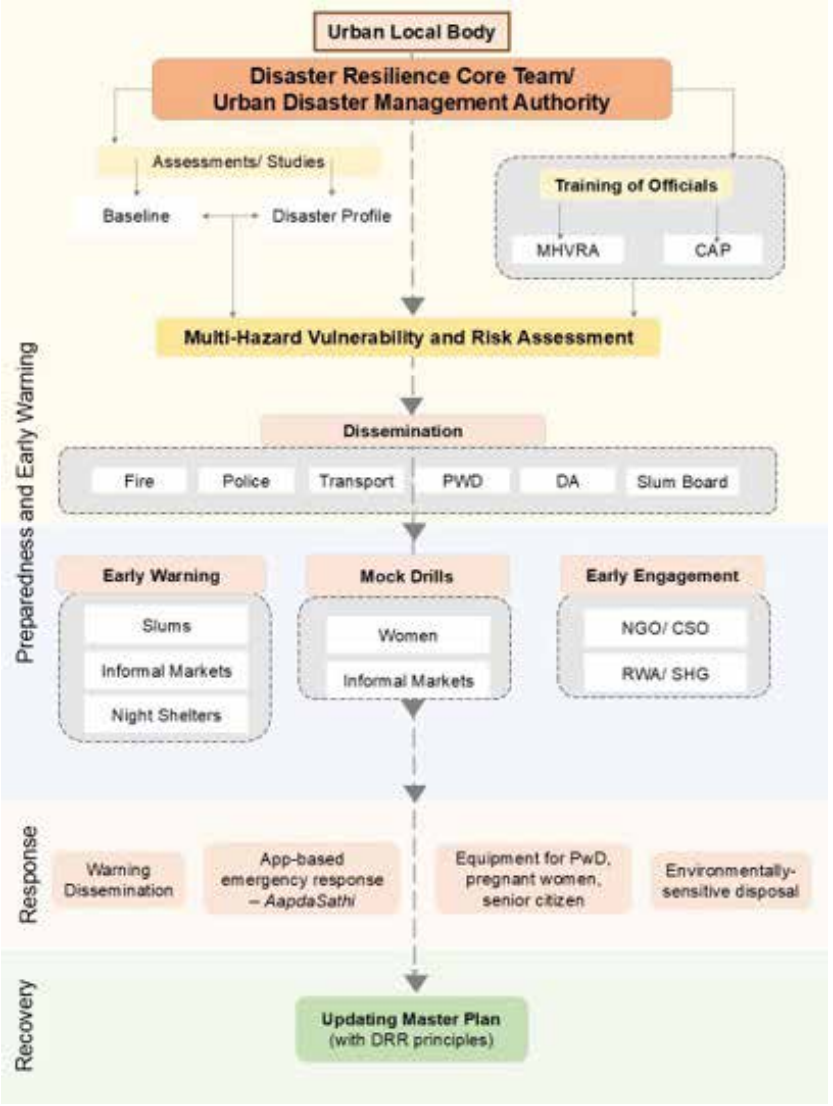


Figure 31: Level 1 - Activities and implementation process

Level 2 – Preferred (Basic +)	
Preparedness	1. **Existing disaster management team or body to integrate GESI and EbA concepts into disaster risk assessments and DRR action plans.** 2. **Establish Climate Cell and develop climate action plan and monitor flood and landslide prone zones** 3. **Disseminate risk information** through the ULB website to different stakeholders. 4. **Organise trainings** on gender-sensitive response to disasters, multi-stakeholder engagement, identification of nature-based solutions, rapid loss and damage assessment 5. Issue notice to keep supplies and response equipment ready and mobilise staff (para-medical personnel trained in gender-sensitive triage, assistance for PwD) 6. **Engagement with RWAs, SHGs,** special focus on women members for information dissemination;
Response	1. Specific advisories for slum areas 2. Engage with SHGs to communicate early warning to communities
Recovery	1. **Rapid loss and damage assessment** 2. Deploy trained para-medical personnel and NGOs for PSS 3. Engage with private sector for reconstruction and rehabilitation (focusing on informal markets)

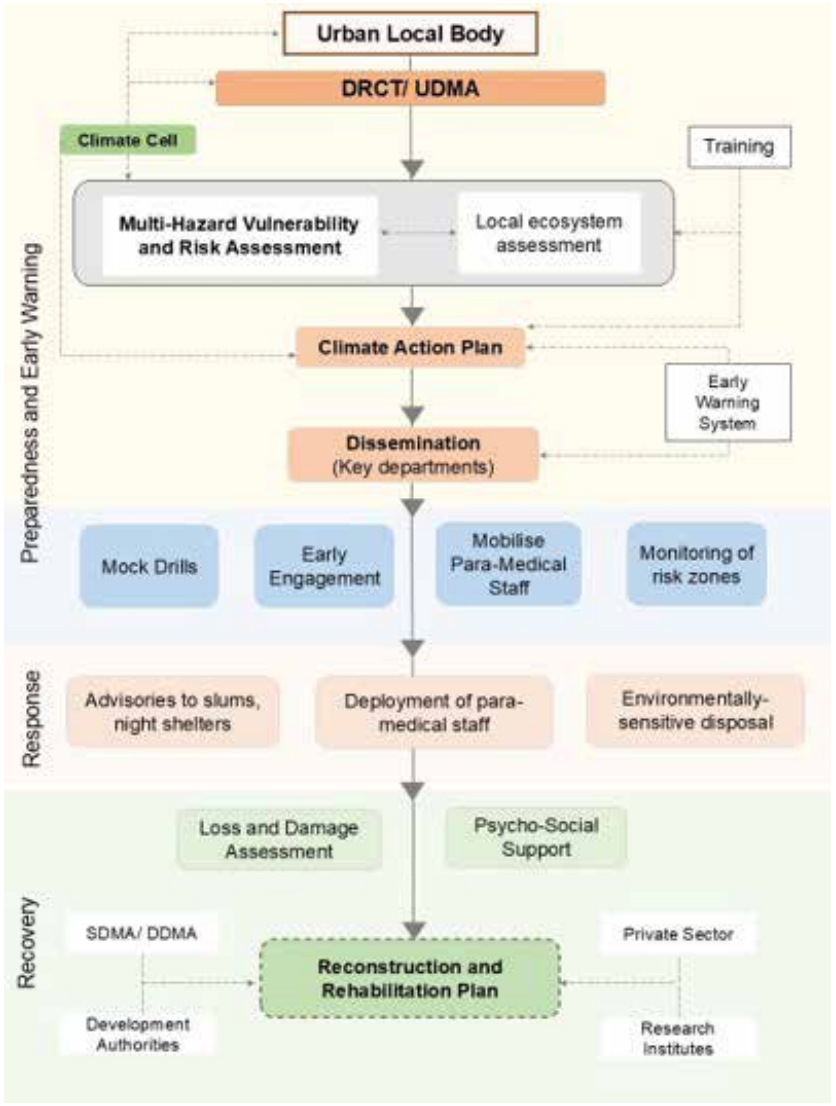


Figure 32: Level 2 - Activities and implementation process

Level 3 – Desirable (Preferred +)	
Preparedness	1. **Prepare city disaster management plan** 2. **Install weather monitoring stations and use the data** for modelling and forecasting through the climate cell for decision support. 3. **Establishment of city-level emergency operation centre (EOC) to carry out emergency functions** 4. **Conduct disaster resilience assessment with a focus on gender and social inclusion** 5. Organise trainings on climate finance and budgeting, GESI analysis, ecosystem-based adaptation; PDNA, reconstruction and rehabilitation planning based on **capacity and training needs assessment of officials** 6. **Engage with private players** who can support in disaster relief and reconstruction works
Response	1. Provide health condition appropriated food, medicinal supplies and shelter, gender-sensitive clothing
Recovery	2. **Prepare inclusive reconstruction and rehabilitation plan** 3. Ensure conservation of urban ecosystems 4. Environmentally sensitive reconstruction

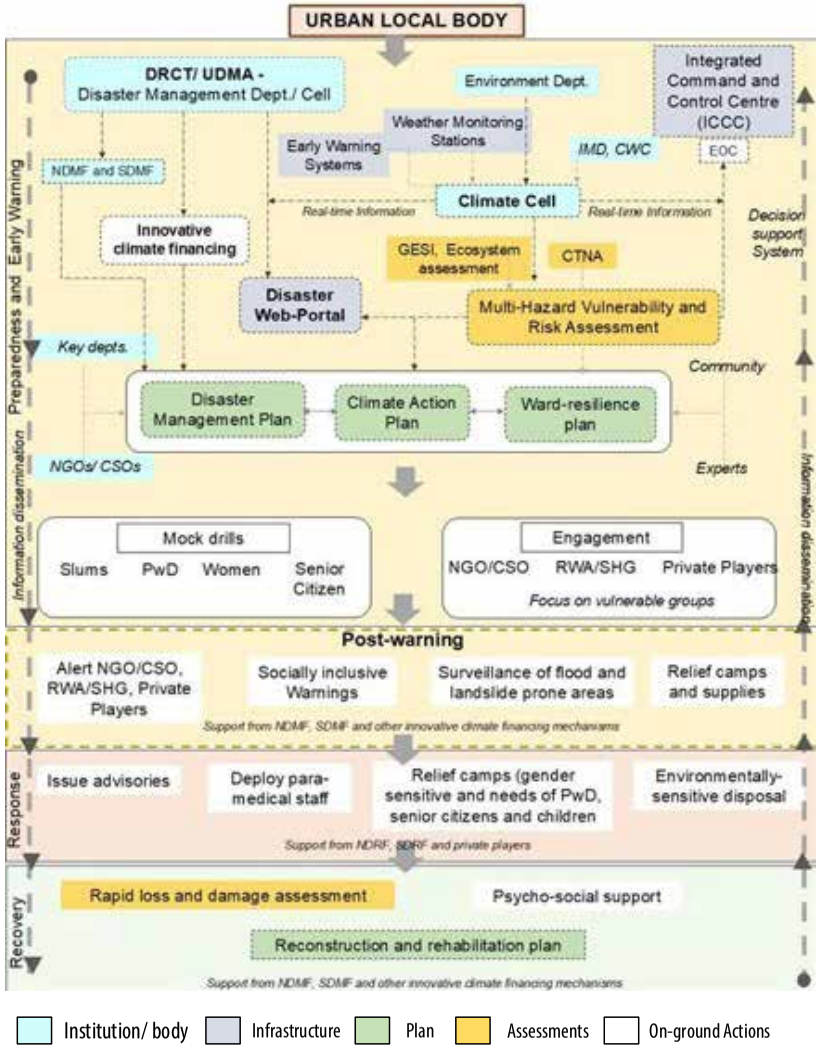


Figure 33: Level 3 - Activities and implementation process

It is important that the Multi-Hazard Vulnerability and Risk Assessment (MHVRA) and other plans that are developed and disseminated, as shown in the figure above, consider how best to communicate their key messages and results, thinking about 'knowledge translation'. This dissemination should be comprehensible and usable by ULBs, meaning these plans need to be tailored to the requirements of different audiences to ensure they are used and well understood, for example, by line departments such as the fire and police departments, slum boards or the PWD.

Community-led micro resilience planning

Ward-level resilience planning entails disaster management at the lowest administrative level of a city. It calls for effective decentralised planning, using a participatory bottom-up approach. Micro-resilience planning is a community-led process, based on people's priorities, needs, knowledge and capacities. It leads to increased disaster resilience by considering granular details with regard to risk information, community needs, infrastructure status, and hyper-local conditions. Therefore, building capacities of ward-level functionaries for participatory micro-resilience planning is a step towards holistic disaster resilience planning.

The basic process of community-led micro-resilience planning includes the following steps[41]:

- Priority ward identification based on the Disaster Risk Assessment (see Chapter 5)
- Focus Group Discussions (FGDs) with local communities, including RWAs and SHGs, with separate FGDs for each vulnerable group
- Community-led mapping of critical hotspots and challenges, e.g., at the building, infrastructural or governance level
- Identifying localised, impactful solutions
- Aggregating challenges and solutions at the ward level
- Synchronising with city-level actions and allocating a budget for priority interventions
- Training the community on tracking the progress and functioning of micro-level interventions

Learning Unit 7.2: Operationalising the DRCT

Mainstreaming DRR into city plans

Mainstreaming DRR into city plans is one of the key actions that the DRCT must undertake for long-term resilience. DRR should be incorporated into existing city-level plans, such as the master plan, sanitation plan and mobility plan. In doing so, the DRCT/UDMA can draw support from existing bodies, such as the ICCC and weather monitoring stations. It must plan to minimise adverse impacts on vulnerable groups and safeguard the local ecosystem. Some enablers for mainstreaming DRR include available assessments and risk information, including information on the most vulnerable population and high-risk areas, the presence of a nodal body for disaster management, a network of early warning systems, and a separate municipal budget for disaster management. On the other hand, a lack of risk information, insufficient funds for disaster preparedness and mitigation, and inadequate technical expertise can be major barriers for mainstreaming DRR. A lack of understanding of disaster preparedness among the decision-makers and lack of political will are other barriers.

Communication

A clear communication strategy is much required for implementing disaster resilience operations efficiently. The ULB must identify the target audience, establish the key messages, prepare the plan of activities for communication, decide the appropriate mediums of communication (especially for the vulnerable groups and slum areas), and mobilise human and financial resources. An example of a communication plan is given in Module 2.

Capacity strengthening: Training topics for ULB officials at different phases

To facilitate a paradigm shift from response to preparedness, capacity strengthening is essential for ULBs. These primarily include structured training on risk assessments, DRR planning, gender and social inclusivity, communication, and monitoring. The specific topics related to preparedness and inclusivity are provided below:

Assessment and planning for DRR	Gender and social inclusivity
• Undertaking capacity and training needs assessment for GESI- and EbA-based DRR actions • MHVRA, including GESI aspects • Climate action planning, including mitigation and adaptation • Disaster management planning - Integration of GESI and EbA • Loss and damage assessment in cities (assistance in state-level PDNA) • Preparation of the reconstruction and rehabilitation plan - Incorporation of GESI and EbA-based DRR • Micro-resilience planning	• Ensuring adequate participation of marginalised groups in relief distribution and camp management • Providing gender-sensitive relief supplies and services • Establishing protection mechanisms against gender-based violence • Maintaining dignity and privacy throughout response operations • Training of health staff in PHCs

ULBs can also leverage Centrally Sponsored Schemes (CSS) for undertaking capacity development activities. For example, the National Cyclone Risk Mitigation Project (NCRMP) can be tapped to provide training on various disaster response skills, such as first aid, search and rescue. Similarly, the Aapda Mitra scheme can provide assistance for basic skills required in responding to a community's immediate needs in the aftermath of a disaster.

Monitoring and learning

Monitoring can be undertaken by the DRCT with support from various experts. ULBs must ensure they include GESI experts, or individuals with relevant experience in the design of GESI-related performance indicators. An indicator on 'disaster resilience' should assess the readiness of cities/ULBs to tackle disaster events and mitigate loss and damage by taking action. This can include:

- Disaster risk assessments
- Developing city disaster management plans aligned with district disaster management plans, and establishing end-to-end early warning systems
- Implementing relevant actions to reduce risk

A **learning loop** and 'build back better' approach can be developed by capturing post-disaster reconstruction that potentially contributes to future disaster mitigation, evacuation and response activity that can strengthen future early warning systems and mock drills and the efficiency of mitigation measures, to inform the design of preparedness and response systems. This learning loop can be structured as a four-step monitoring process, moving from formulating indicators through to reporting and review, as shown in Figure 34.

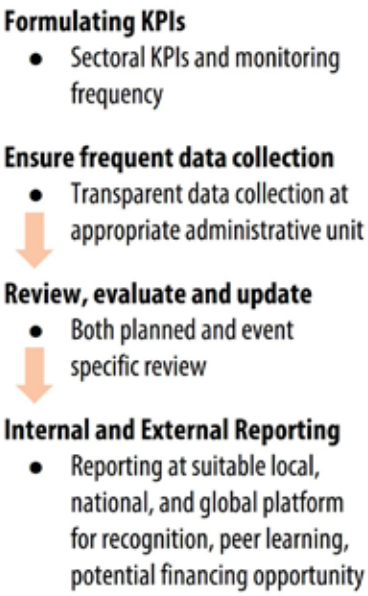


Figure 34: Monitoring process

Indicative monitoring plan

Table 42 sets out an indicative set of monitoring indicators and reporting frequencies across the key aspects of disaster governance. ULBs can adapt this list and track progress against each indicator as part of their own monitoring plan.

Table 42: Indicative monitoring plan

Aspect	Indicators	Progress (% of achievement)	Frequency
Emergency response systems and infrastructure	Climate cell established		One-time
	Disaster management department established		One-time
	Early warning systems established and maintained		Annually
	Automatic weather systems (AWS) installed - maintained		Annually
	Radar-level transmitters installed and maintained		Annually
	Emergency equipment available (numbers)		Quarterly
	Personnel recruited		Annually
Risk information	Baseline surveys (including updating) and reporting complete		Once in 2-3 years
	Disaster profiling complete		Once in 2-3 years
	MHVRA report prepared, published and updated		Once in 2-3 years
	Capacity and training needs assessment conducted		Once in 2-3 years
	Disaster resilience plan prepared and updated		Once in 2-3 years
	Dissemination to ward councilors done		Annually
Preparedness	Monitoring of risk zones		Annually
Mitigation measures	City disaster management plan prepared, published and updated		Once in 2-3 years
	Key stakeholders identified with clear roles and responsibilities		Once in 2-3 years
	Mock drills for vulnerable groups		Annually
DRR integration	Loss and damage information documented		Post-disaster
	City plans, byelaws updated with DRR components		Once in 2-3 years
	ULB officials and ward councilors trained in various topics		Annually
Engagement	Meeting with relevant NGOs, CSOs, research institutions and private players		Once in 2 years
	Community engagement		Biannually
Dissemination	Disaster management portal created		One-time
	Disaster emergency helpline and App created and advertised		One-time; advertised biannually

MODULE 8: Disaster Finance

Learning objectives

The main objectives of this module is to develop an understanding of the financing requirements of all stages of the disaster management cycle. It equips the participants with the knowledge of modalities for pre-, during-, and post-disaster financing.

Context

The Sendai Framework for Disaster Risk Reduction 2015–2030 identifies the mobilisation of finance as one of its four priorities for action[42]. Yet most disaster spending globally, and in India, remains reactive. Globally, only around 2 per cent of the USD 76 billion spent on disaster crisis financing in 2022 was pre-arranged[43], meaning the overwhelming majority of funds are raised only after a disaster has already struck.

Disaster finance in India: An overview

Where funds for relief operations exceed those available to the state through the State Disaster Response Fund (SDRF), central assistance is provided through the National Disaster Response Fund (NDRF). However, there is no specific provision for direct allocation to cities. Hence, ULBs must continue to access disaster finance by routing requests through the state government.

Local body grants

Grants of Rs 8,00,000 crore in total have been recommended for local bodies over the five-year period (Rs 4,40,000 crore for rural and Rs 3,60,000 crore for urban local bodies). The urban share has risen from 36 per cent under the 15th Finance Commission to 45 per cent under the 16th. Of this, 80 per cent is basic (untied/tied) and 20 per cent performance-linked. ULBs must have audited accounts and a functional State Finance Commission to access these funds. Special Infrastructure Grants and Urbanisation Premium Grants have also been recommended specifically for ULBs[44].

Principles of disaster risk financing

Effective disaster finance follows a layered financing strategy, matching the source of funds to the frequency and severity of the risk being covered:

- **Retention:** High-frequency, low-severity events are best absorbed through budgetary reserves and contingency funds held by the ULB or state.
- **Contingent financing:** Medium-severity events are met through pre-arranged contingent credit lines or drawdown facilities that can be accessed quickly once a trigger is met.
- **Risk transfer:** Low-frequency, high-severity or catastrophic events are transferred to the market through insurance, reinsurance or catastrophe bonds, since the cost of retaining this risk on the public balance sheet would otherwise be prohibitive.

This layered approach follows the wider distinction between ex-ante instruments (arranged before a disaster, such as insurance, contingency funds or catastrophe bonds) and ex-post instruments (arranged after a disaster, such as budget reallocation, emergency loans, or donor appeals). ULBs should progressively shift the balance of their disaster finance planning towards ex-ante instruments, since these are typically faster to disburse, more predictable, and less disruptive to ongoing development spending.

Learning Unit 8.1: Financing disaster preparedness

ULBs must assess the financing needs of pre-disaster initiatives while considering all relevant costs like capital, operational, and maintenance expenses. They must explore the financials of ongoing similar projects through tender documents, work orders, Detailed Project Reports (DPRs), etc. ULBs need to discuss financing needs and options with private players, other ULBs in the region, domestic and international financing entities, as required and relevant. Long-term financial assistance for mitigation can also be obtained by budgeting for climate actions recommended under a city's Climate Action Plan (CAP), for example, the City Resilience and Climate Action Plans (CRCAPs) prepared for Vijayawada and Ahmedabad.[1.1]

Pre-disaster initiative finance landscape in India: sources and instruments

India's pre-disaster finance landscape comprises three broad instruments: access to funds through national programmes, direct budgetary allocations, and mechanisms to leverage private finance. These instruments are generally suited to long-term, stable-period initiatives, and are not always disaster-specific, but nonetheless contribute to disaster resilience.

How to access grant-in-aid

Table 43 outlines how ULBs can access key grant-in-aid schemes described in Module 4.

Table 43: How cities can access key grant-in-aid schemes

Fund	How cities can access
National Disaster Risk Management Fund - National Disaster Mitigation Fund	• Submit detailed proposals to the State Disaster Management Authority • Review and approval routed through the state to the central government, or directly by the state • Fund channelisation from state to cities; or centre to cities through the State Disaster Mitigation Fund (SDMF), on a cost-sharing basis between central and state government
National Adaptation Fund for Climate Change	• Submit requirements to the state department for accessing NAFCC funds • Only state departments and central ministries are eligible to submit proposals for accessing NAFCC
Mangrove Initiative for Shoreline Habitats & Tangible Incomes	• Approach the state forest department for specific requirements • Funds are released to the State Forest Department for implementation, or the state share of funds could be used
Amrit Dharohar	• Approach the state wetland authority, or the Ministry of Environment, Forest and Climate Change

Other sources of funds are multilateral and bilateral funds such as UN entities, World Bank, ADB and other development institutions with a banking business model. ULBs should be aware of the major institutional channels within these categories, so that they can build the technical case through bankable, well-documented projects for inclusion in national and state proposals.

Some key channels are the **Green Climate Fund (GCF), Global Environment Facility (GEF), World Bank Catastrophe Deferred Drawdown Option (Cat DDO),** and **Coalition for Disaster Resilient Infrastructure (CDRI).** Some indicative examples of multilateral and bilateral support relevant to Indian cities include:

- The GFDRR Multi-Donor Trust Fund, which has provided a grant of USD 0.3 million for urban resilience investments in hazard-prone states
- Coastal community resilience funding under the Green Climate Fund (GCF)
- The GoI-UNDP Disaster Risk Reduction Programme, with a value of USD 6.235 million

Many multilateral funds, including the GCF, mandate that all funded projects be gender-responsive and respect the rights of women and indigenous people, underscoring the need for rigorous GESI analysis and integration in any funding proposal that ULBs put forward.

Learning Unit 8.2: Financing Disaster Response

Financial assistance for disaster response is structured around the magnitude and urgency of the need:

Immediate (short-term)	Immediate allocation for response
Urgent (medium-term)	Funds made available without fail
Important (long-term)	Subsequent funding for prevention and mitigation

Allocation for response should be made within the city-level budget itself, and this allocation should be based on disaster risk assessments.

Recommended utilisation of central and state funds for response

The National Disaster Risk Management (NDRM) Fund and the State Disaster Risk Management (SDRM) Fund are each divided into a Response Fund (80 per cent) and a Mitigation Fund (20 per cent). Within the Response Fund, a recommended utilisation split applies across response and relief, recovery and reconstruction, and preparedness and capacity development, as shown in Figure 35.

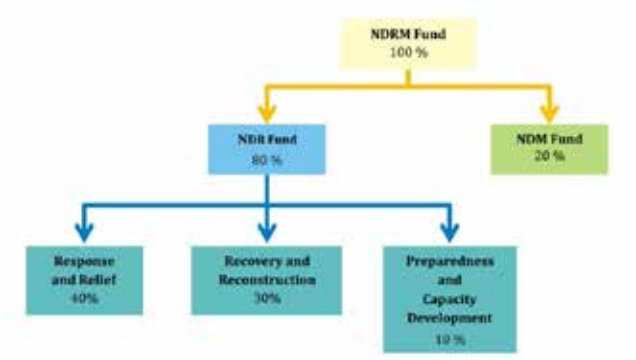


Figure 35: Proposed utilisation of the allocation to the Government of India



Figure 36: Proposed utilisation of the allocation to the state or Union Territory

The National Disaster Risk Management (NDRM) Fund is split 80:20 between the National Disaster Response (NDR) Fund and National Disaster Mitigation (NDM) Fund; within the NDR Fund, 40 per cent is allocated to response and relief, 30 per cent to recovery and reconstruction, and 10 per cent (i.e. 8 per cent of the overall NDRM Fund) to preparedness and capacity development[45].

The State Disaster Risk Management (SDRM) Fund follows the same 80:20 split between the State Disaster Response (SDR) Fund and State Disaster Mitigation (SDM) Fund, and the same response/recovery/preparedness distribution within the SDR Fund.

Beyond public budgetary sources, a growing set of market-based instruments is becoming relevant to Indian cities, particularly as climate-induced disaster losses rise. These innovative and market-based disaster risk financing instruments include parametric insurance, catastrophe bonds, green bonds, and blended finance.

Learning Unit 8.3: Financing Disaster Recovery

Finance for recovery in India

The major sources of funding for recovery in India are:

- NDRF-SDRF: The response fund available through the National Disaster Response Fund and State Disaster Response Fund, at national and state level
- Flexi-funds: A flexible fund component within centrally-sponsored schemes that can be used to undertake restoration activities
- Externally aided projects: Mobilisation of resources from external agencies for reconstruction and rehabilitation, for example through the World Bank

Following a disaster, governments face the challenge of determining its overall impact to estimate the cost of recovery and reconstruction. The basis for funding is the Post-Disaster Needs Assessment (PDNA) or a rapid assessment, which determines the extent of losses and quantifies the resources needed for specific recovery and reconstruction activities.

Municipal budgets

Municipal budgets should be the primary funding source for restoring essential municipal services, with additional funds tapped from the SDRF or NDRF as required. There is, however, no existing formal mechanism for ULBs to receive funds directly from the NDRF or SDRF. ULBs must therefore seek the SDMA's support for financial assistance, for both loss and damage assessment, if needed, and recovery activities. This can be based on a rapid assessment of losses and damages carried out by the ULB.

The ULBs must consider the following:

- Estimation of financial needs must be based on both economic and non-economic loss and damage.
- Traditional rapid appraisal methodologies and techniques, such as transect walks, surveys and interviews, are effective approaches for deriving estimates of financing needs.
- Discussions with other ULBs, state and district disaster management authorities and industry players must be undertaken.
- Needs assessment should focus on equity and inclusivity to achieve just recovery outcomes.
- Exploring domestic, international and private financing opportunities, as required and relevant, must be explored.

Additional sources of funding for recovery, reconstruction and rehabilitation, including convergence with development schemes, relief funds, CSR, NGOs/CSOs, and insurance and risk transfer (Table 44).

Table 44: Additional sources of funding

Source of funds	Brief description
Convergence with ongoing National and State-level Development Schemes	• National flagship programmes allow flexible funds up to 15 per cent of total outlay for each programme • State governments can mobilise these flexible funds
Relief Funds	• Special funds channelled from private and corporate contributions
Corporate Social Responsibility Window for DRR and Recovery	• In addition to CSR financing, technical and professional expertise offered by private companies, such as engineering and management services
Non-Governmental and Civil Society Organizations	• Provide financial, technical and coordination support
Insurance and Risk Transfer (microinsurance for informal sector, lower income groups)	• Feasible when risk pools are large, data on damage and loss is available, payouts can be estimated with reasonable accuracy • Penetration of insurance is very limited and mainly concentrates in providing coverage to destruction of assets but not to production losses (PDNA handbook)

Recommendations for Urban Local Bodies

- Since there is no specific provision for direct central or state allocation to cities, it is recommended to build sustained working relationships with the SDMA and DDMA to ensure timely access to SDRF/NDRF and PDNA-linked financing.
- Updated, geo-tagged asset and exposure registers should be maintained. This is foundational both for accessing performance-linked grants under the 16th Finance Commission and for supporting future insurance or catastrophe bond underwriting
- Bankable, well-documented DPRs for mitigation and resilience projects should be developed to strengthen access to the grant-in-aid schemes described in this module and in Module 4
- Multi-year capital investment plans aligned with the 16th Finance Commission's 2026-31 disaster management and local body grant cycle should be built.
- ULBs should explore regional risk pooling with neighbouring ULBs to lower the cost of insurance or contingent credit facilities.
- It must be ensured that GESI analysis is embedded in every financing proposal, particularly where multilateral funds such as the Green Climate Fund make this a condition of funding.

Conclusion

Indian cities stand at a point where the cost of inaction on climate-induced disaster risk is no longer abstract. As set out in the introduction to this manual, urban areas represent a concentration of people, assets and economic activity that magnifies the human and financial cost of every climate-induced disaster.

This manual has been developed to help Urban Local Bodies (ULBs) meet that challenge, not through a single intervention, but through a structured, cumulative process that builds resilience across the full disaster management cycle. Modules 1 and 2 grounded participants in the core concepts of disaster risk reduction and resilience, national and global frameworks. Modules 3 to 6 provided participants knowledge and skills related to pre-, during, and post-disaster planning, including disaster risk assessments, preparedness and mitigation, inclusive response and relief, and sustainable reconstruction and rehabilitation. Modules 7 and 8 dealt with the governance and finance mechanisms required for planning and implementing DRR actions.

Translating this knowledge into practice will require sustained commitment from ULBs, states and the national governments. One key action for ULBs for taking this work forward is to establish or strengthen the Disaster Resilience Core Team/Urban Disaster Management Authority, with mandated representation of women and other vulnerable groups. Undertaking risk assessments and mainstreaming DRR into city plans and policies is another high-priority area. For sustained DRR actions, cities must align municipal budgeting and capital investment planning with the 16th Finance Commission's 2026-31 disaster management and local body grant provisions, and move progressively towards a layered financing strategy that includes contingency reserves and risk transfer. They should also ensure that inclusivity and ecosystem considerations are embedded at every stage of the disaster management cycle. To increase the robustness of the DRR process, ULBs need to invest in community-led resilience planning, recognising that local knowledge and leadership are core determinants of resilience outcomes. Finally, ULBs need to monitor the DRR actions and their progress, establishing a structured post-disaster learning loop.

The guidance in this manual is intended to support ULBs at every stage of the DRR process, but its real value will be realised only through consistent institutional commitment, adequate and well-directed financing, and genuine, sustained engagement with the communities that cities exist to serve.

Endnotes

1. Adil, L., Eckstein, D., Kunzel, V., and Schafer L. (2025). *Climate Risk Index 2026: Who suffers most from extreme weather events?*. Germanwatch e.V. Retrieved from: https://www.germanwatch.org/sites/default/files/2025-11/CRI%20summary%20EN%202026.pdf

2. Integrated Research and Action for Development (IRADe). (2020). *Developing Disaster Resilience Action Plan Gangtok City, Sikkim: Stakeholder Consultation Proceedings 30th September, 2020.* Integrated Research and Action for Development (IRADe). Retrieved from: https://irade.org/Workshop_Proceedings_.pdf

3. NITI Aayog. Asian Development Bank. (2022). *Cities as Engines of Growth TA-9508: Strengthening the States for broad-based urban development*. Retrieved from: https://www.niti.gov.in/sites/default/files/2022-05/Mod_CEOG_Executive_Summary_18052022.pdf#:~:text=Cities%20in%20India%20occupy%20just%203.0%%20of,population%20share%20is%20associated%20with%20a%202.7%

4. NITI Aayog. (2021). *Reforms in Urban Planning Capacity in India Final Report*. NITI Aayog. Retrieved from: https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf

5. Nichols, W. (2021). 'Asian cities in eye of environmental storm – global ranking'. *Environmental Risk Outlook 2021*. Verisk Maplecroft. Retrieved from: https://www.maplecroft.com/insights/analysis/2021/ero-2021/asian-cities-in-eye-of-environmental-storm-global-ranking/

6. Azhar, G. S., Mavalankar, D., Nori-Sarma, A., Rajiva, A., Dutta, P., Jaiswal, A., Sheffield, P., Knowlton, K., Hess, J. J., & Ahmedabad HeatClimate Study Group. (2014). 'Heat-related mortality in India: excess all-cause mortality associated with the 2010 Ahmedabad heat wave'. *PloS one*, *9*(3), e91831. Retrieved from: https://doi.org/10.1371/journal.pone.0091831

7. Oppenheimer, M., M. Campos, R.Warren, J. Birkmann, G. Luber, B. O'Neill, and K. Takahashi. (2014). Emergent risks and key vulnerabilities. *In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1039-1099. Retrieved from: https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap19_FINAL.pdf

8. Tamura, M. (2022). 'Climate Change Risk and Adaptation', in Ito, T., Tamura, M., Kotera, A., Ishikawa-Ishiwata, Y. (eds) *Interlocal Adaptations to Climate Change in East and Southeast Asia*. SpringerBriefs in Climate Studies. Springer, Cham. Retrieved from: https://doi.org/10.1007/978-3-030-81207-2_1

9. Gupta, A.K., Mani, N., Sarkar, B.B., Singh, S., Katyal, S. (2019). *Developing Disaster Risk Resilient Cities.* Gorakhpur Environmental Action Group (GEAG), Gorakhpur (UP), National Institute of Disaster Management, New Delhi, India and United Nations Children's Fund (UNICEF), India. Retrieved from: https://nidm.gov.in/PDF/pubs/capres_DDRRC.pdf

10. Kaur, A., and Abdullah, S. (2022). *Disaster Resilience Training Manual*. Climate Centre for Cities, National Institute of Urban Affairs in association with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Retrieved from: https://niua.in/c-cube/sites/all/themes/zap/assets/pdf/URBAN%20PLANNING/UPGCB4-resilience.pdf

11. Kanda, M., Bindal, M.K., Murty, C.V.R., Juvvadi, D.P., et al. (2022). *A Step by Step Guide towards Developing Disaster Resilience in States and UTs of India.* Delhi: National Institute of Disaster Management. Delhi. Retrieved from: https://nidm.gov.in/PDF/Modules/NIDM_StepbyStep22.pdf

12. Graveline, M.K. and Germain, D., (2022). 'Disaster Risk Resilience: Conceptual Evolution, Key Issues, and Opportunities'. International Journal of Disaster Risk Science 13: 330–341. Retrieved from: https://link.springer.com/content/pdf/10.1007/s13753-022-00419-0.pdf

13. Making Cities Resilient 2030. (2023). UNDRR. Retrieved from: https://www.unisdr.org/campaign/resilientcities/assets/home/documents/MCR2030%20in%20English.pdf

14. Government of India. (2005). The Disaster Management Act, 2005 (Act No. 53 of 2005). Ministry of Home Affairs. Retrieved from: https://www.mha.gov.in/sites/default/files/2022-09/The%2520Disaster%2520Management%2520Act%2C%25202005%5B1%5D.pdf

15. United Nations Office for Disaster Risk Reduction. (2024). *Disaster Resilience Scorecard for Cities Addendum for Gender Equality & Intersectionality*. United Nations Office for Disaster Risk Reduction. Retrieved from: https://mcr2030.undrr.org/media/99258/download?startDownload=20261007

16. UNISDR, UNDP and IUCN. (2009). *Making Disaster Risk Reduction Gender-Sensitive Policy and Practical Guidelines*. Geneva: UNISDR, UNDP and IUCN. Retrieved from: https://www.unisdr.org/files/9922_MakingDisasterRiskReductionGenderSe.pdf

17. World Bank. (2021). *Inclusive Resilience: Inclusion Matters for Resilience in South Asia*. Washington, DC: World Bank. Retrieved from: https://documents1.worldbank.org/curated/en/219851614941632074/pdf/Inclusive-Resilience-Inclusion-Matters-for-Resilience-in-South-Asia.pdf

18. CDKN. (2023). Gender in Climate Action Training Pack: A Resource for Practitioners. Accessed [2024]. Retrieved from: https://cdkn.org/resource/resource-gender-in-climate-action-training-pack-a-resource-for-practitioners

19. Sudmeier-Rieux, K. *Ecosystem Approach to Disaster Risk Reduction*. European and Mediterranean Major Hazards Agreement (EUR-OPA). Retrieved from: https://www.preventionweb.net/media/12223/download?startDownload=20261007

20. Secretariat of the Convention on Biological Diversity (2019). *Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information*. Technical Series No. 93. Montreal: Secretariat of the Convention on Biological Diversity. Retrieved from: https://www.cbd.int/doc/publications/cbd-ts-93-en.pdf

21. Adapted from UN Women. (2021). *Basics of Mainstreaming Gender into Climate Change and Disaster Risk Reduction Policies*. UN Women Regional Office for Asia and the Pacific.

22. Brown, S., Budimir, M., Upadhyay Crawford, S., Clements, R., and Sneddon, A. (2019). *Gender and Age Inequality of Disaster Risk: Research Paper*. UNICEF and UN Women. Retrieved from: https://wrd.unwomen.org/sites/default/files/2021-11/72229_bls19312unwdisasterriskreport003web%283%29.pdf

23. Kosmus, M., Renner, I., and Ullrich S. (2012). *Integrating Ecosystem Services into Development Planning: A stepwise approach for practitioners based on the TEEB approach*. Germany: GIZ. Retrieved from: https://conservation-development.net/rsFiles/Datei/giz-2012-en-integr-ecosys-serv-in-dev-planning.pdf

24. National Disaster Management Authority. *National Disaster Management Plan*. (2019). New Delhi: National Disaster Management Authority, Government of India. Retrieved from: https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf

25. Kanda, M., op. cit.

26. Modified from Ministry of Urban Development. (n.d.). *Urban Flooding. Standard Operating Procedure.*

27. Adapted from Kanda, M., op. cit. and Ministry of Home Affairs. (n.d.). 'Dos & Don'ts on Disaster Response for use of District Magistrate on Natural Disaster'.

28. United Nations Office for Disaster Risk Reduction, United Nations Population Fund, and United Nations Entity for Gender Equality and the Empowerment of Women. (2024). *Gender Action Plan to Support Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030*. United Nations. Retrieved from: https://www.preventionweb.net/media/94610/download?startDownload=20261007

29. National Disaster Management Authority. *National Disaster Management Plan*. (2019). New Delhi: National Disaster Management Authority, Government of India. Retrieved from: https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf

30. IMC Worldwide. (2019). *Guide to Engaging Local Actors in Disaster Recovery Frameworks*. World Bank. Retrieved from: https://www.gfdrr.org/sites/default/files/publication/Engaging%20Local%20Actors%20in%20Disaster%20Recovery%20Frameworks%20-%20Final.pdf

31. National Institute of Disaster Management. (2019). *Handbook Post Disaster Needs Assessment India*. New Delhi: National Institute of Disaster Management, Ministry of Home Affairs. New Delhi.
32. National Disaster Management Authority. *National Disaster Management Plan*. (2019). New Delhi: National Disaster Management Authority, Government of India. Retrieved from: https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf
33. Kanda, M., op. cit.
34. ICLEI South Asia. (2025). *Assessing & Managing Loss & Damage, Local-level evidence to inform Global-Level Action in Gujarat, India*. Ministry of Foreign Affairs Denmark (DANIDA), ICLEI, UNOPS, GIDR, Transition Research.
35. IMC Worldwide. op. cit. p. 41-42.
36. IMC Worldwide. op. cit.
37. Kaur, and Abdullah, op. cit. p. 16.
38. Gupta, A.K. op. cit.
39. Modified from Ministry of Urban Development. (n.d.). *Urban Flooding. Standard Operating Procedure.*
40. Gencer, E. A. (2017). Local government powers for disaster risk reduction: A Study on Local-Level Authority and Capacity for Resilience. United Nations Office for Disaster Risk Reduction. Retrieved from: https://www.unisdr.org/campaign/resilientcities/assets/toolkit/documents/LG%20Powers%20for%20DRR_2017_Final_20170531.pdf
41. Gupta, A.K. op. cit. p. 40-43.
42. UNISDR. (2015). *Sendai Framework for Disaster Risk Reduction*. United Nations Office for Disaster Risk Reduction (UNISDR). Retrieved from: https://www.undrr.org/media/16176/download?startDownload=20261007
43. Glemarec, Y., Solana, M. & Babinsky, F. (2025). 'Recommendations'. *Synergy Solutions 2025: Closing the Climate and Disaster Protection Gap*. Expert Group on Climate and SDG Synergy.
44. Finance Commission India. (2026). *Sixteenth Finance Commission: Report for 2026-31*. Ministry of Finance, Government of India. Retrieved from: https://fincomindia.nic.in/asset/doc/commission-reports/16th-FC/reports/Vol1-Main-Report.pdf
45. Disaster Management Division. Recommended Utilisation of Central and State Funds for Response.. Disaster Management Division, Ministry of Home Affairs.

Glossary

Term	Definition
Core disaster risk and resilience concepts	
Adaptive Capacity	The ability of a system, community or population group to adjust to climate-induced hazards, moderate potential damage, take advantage of opportunities or cope with consequences.
Anthropogenic Hazard	A hazard originating from human activities that may cause harm to people, infrastructure, livelihoods or ecosystems.
Build Back Better (BBB)	An approach to post-disaster reconstruction that aims to restore and improve infrastructure, services and governance while reducing future disaster risks and vulnerabilities.
Cascading Disaster	A disaster in which secondary impacts emerge from an initial hazard and generate further events, increasing the duration or severity of the overall impact.
Climate-Induced Disaster	A disaster associated with climate-related hazards, such as floods, heatwaves, cyclones and droughts, whose impacts are shaped by exposure and vulnerability.
Compound Disaster	A disaster resulting from two or more extreme events occurring simultaneously or successively, or from a combination of events and underlying conditions that amplify their impacts.
Coping Capacity	The ability of individuals, communities, institutions or systems to manage and overcome the adverse impacts of a disaster using available resources and capabilities.
Disaster	A serious disruption arising from a hazardous event that causes substantial loss of life, human suffering, property damage, infrastructure destruction, livelihood disruption or environmental degradation, exceeding the coping capacity of the affected community or system.
Disaster Management	A continuous process encompassing activities undertaken before, during and after disasters, including prevention, mitigation, preparedness, response and recovery.
Disaster Management Cycle	A framework for organising disaster management activities into four interrelated phases: mitigation and prevention, preparedness, response, and recovery.
Disaster Risk	The potential losses in lives, health, livelihoods, assets and services that may occur in a community or society over a specified future period. It is influenced by hazard, exposure and vulnerability.
Disaster Risk Assessment	A systematic process of identifying and analysing hazards, exposure, vulnerability and capacities to understand disaster risks and prioritise interventions.
Disaster Risk Management (DRM)	The implementation of policies, strategies and measures aimed at reducing disaster risks and managing their impacts.
Disaster Risk Reduction (DRR)	Strategies and actions aimed at reducing disaster risks and vulnerabilities and preventing or limiting the adverse impacts of hazards through prevention, mitigation and preparedness.
Disaster Resilience	The ability of a system, community or society to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner.
Exposure	The presence of people, infrastructure, economic, social or cultural assets in locations that may be adversely affected by a hazard.
Hazard	A natural or human-induced event, trend or physical impact that may cause loss of life, injury, health impacts, property damage, livelihood disruption or environmental degradation.
Hazard Mapping	The spatial representation of areas exposed to particular hazards, such as flooding, heatwaves or landslides, to support risk assessment and planning.

Term	Definition
Mitigation	Measures undertaken to reduce existing disaster risks and prevent the creation of new risks. These include resilient infrastructure, ecosystem protection and risk-sensitive land-use planning.
Multi-Hazard Risk Assessment	An assessment that considers multiple hazards, their interactions, potential triggering factors, secondary hazards, interdependencies between urban systems and differential vulnerabilities among population groups.
Preparedness	Measures undertaken in advance of disasters to ensure that communities, institutions and systems are ready to respond effectively to emergencies.
Prevention	Actions intended to avoid the creation of new disaster risks and prevent hazards from causing adverse impacts wherever possible.
Recovery	The process of restoring and improving livelihoods, infrastructure, services and governance following a disaster, while reducing future risks and vulnerabilities.
Response	Immediate actions undertaken during and immediately after a disaster to protect lives, meet basic needs, reduce suffering and address emergency impacts.
Sensitivity	The degree to which a system, population group or geographical area is affected, either adversely or beneficially, by a hazard or climatic impact.
Vulnerability	The propensity or tendency of people, communities, infrastructure or systems to be adversely affected by hazards, influenced by sensitivity and adaptive capacity.
Gender equality, social inclusion and community participation	
Differential Vulnerability	Differences in the vulnerability of population groups arising from their social, economic, demographic and environmental circumstances.
Equity	Fair treatment of individuals and social groups according to their respective needs. It may require different forms of support to achieve fair outcomes.
Equality	The principle that the behaviours, aspirations and needs of women, men and other social groups are considered and valued equally.
Gender-Disaggregated Data	Data classified by gender to identify differences in exposure, vulnerability, capacities, needs and disaster impacts.
Gender Equality and Social Inclusion (GESI)	An approach that integrates gender equality and the inclusion of marginalised and vulnerable groups into planning, implementation, financing, monitoring and evaluation.
Gender-Responsive Planning	Planning that recognises gender-specific vulnerabilities, capacities and needs and incorporates appropriate measures into policies, programmes and interventions.
Intersectionality	A way of understanding how different forms of inequality and discrimination interact, creating distinctive experiences of disadvantage and risk for individuals and communities.
Marginalised Groups	Population groups that experience social, economic or institutional disadvantages that may limit their access to resources, services, decision-making and disaster support.
Participatory Planning	A planning approach that actively involves communities and other stakeholders in identifying problems, assessing risks, developing solutions and monitoring implementation.
Social Inclusion	The process of ensuring that all population groups, particularly those facing disadvantage, can participate in decision-making and access services, opportunities and benefits.
Vulnerable Population Groups	Groups that may face greater exposure, sensitivity or limitations in adaptive capacity, including children, older persons, PwD, women and marginalised communities.
Ecosystem-based approaches and climate adaptation	
Climate Change Adaptation	Adjustments in natural or human systems in response to actual or expected climate conditions and their effects, intended to reduce harm or take advantage of opportunities.
Co-benefits	Additional environmental, social or economic benefits generated by an intervention beyond its primary objective, such as biodiversity conservation, improved livelihoods and carbon storage.

Term	Definition
Ecosystem-Based Adaptation (EbA)	The use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to climate change and reduce associated risks.
Ecosystem-Based Disaster Risk Reduction (Eco-DRR)	The sustainable management, conservation and restoration of ecosystems to reduce disaster risks and strengthen community resilience.
Ecosystem Services	The benefits people obtain from ecosystems, including provisioning, regulating, supporting and cultural services.
Nature-Based Solutions (NbS)	Actions that protect, sustainably manage or restore natural or modified ecosystems to address societal challenges while benefiting people and biodiversity.
Regulating Services	Ecosystem services that regulate environmental processes, including climate, water, disease, erosion and other ecological functions.
Supporting Services	Fundamental ecological processes, such as nutrient cycling, soil formation and primary production, that sustain other ecosystem services.
Provisioning Services	Products obtained from ecosystems, such as food, freshwater, fuelwood, fibre and biological resources.
Cultural Services	Non-material benefits obtained from ecosystems, including recreational, spiritual, religious and heritage values.
Urban Heat Island Effect	The phenomenon in which urban areas experience higher temperatures than surrounding rural areas, partly due to built surfaces, limited vegetation and human activities.
Watershed Management	The coordinated management of land, water and related natural resources within a drainage basin to support environmental sustainability and reduce risks such as flooding and water scarcity.
Planning, assessment and risk analysis	
Adaptive Capacity Assessment	An assessment of the resources, skills, institutions and other capabilities available to systems or communities to adjust to hazards and cope with their impacts.
Baseline Assessment	The systematic collection and analysis of information on a city's demographic, socio-economic, infrastructural, environmental and institutional conditions to support disaster resilience planning.
Climate Risk Index	An indicator used to represent climate-related risks or impacts. In the manual, it also refers to the composite index developed through the city's climate risk assessment process.
Composite Hazard Score	A combined score used to represent the relative hazard levels of different geographical areas, such as municipal wards.
Critical Infrastructure	Essential infrastructure and services, such as water supply, electricity, transport, sanitation and telecommunications, whose disruption can significantly affect urban functioning and emergency response.
Fragility Analysis	An assessment of the weaknesses and resilience characteristics of urban systems that may affect their ability to withstand and recover from hazards.
Land-Use Planning	The process of allocating and regulating land for different uses, taking into account development requirements, environmental conditions and disaster risks.
Municipal Profile	A comprehensive description of a city covering its demographic, socio-economic, infrastructure, environmental, institutional and other relevant characteristics.
Normalisation	The process of converting values measured on different scales into a common scale to facilitate comparison and combined analysis.
Urban System	An interconnected set of infrastructure, services, institutions, communities and socio-ecological components that support the functioning of a city.
Disaster response and post-disaster recovery	
Damage Assessment	The process of identifying and documenting physical damage to buildings, infrastructure, services, livelihoods and other assets following a disaster.
Early Warning System (EWS)	An integrated system for monitoring hazards, forecasting potential impacts, disseminating timely warnings and supporting preparedness and response actions.

Term	Definition
Emergency Operations	Coordinated activities undertaken during a disaster to manage incidents, mobilise resources, maintain essential services and protect affected populations.
Evacuation	The organised movement of people from areas threatened by hazards to safer locations.
Golden Hour / Golden Period	The critical early period following a disaster during which timely emergency actions can significantly influence survival and disaster outcomes. The manual identifies the first 48–72 hours as the golden period.
Incident Response Team	A designated team responsible for coordinating and carrying out emergency response activities during a disaster.
Relief	Immediate assistance provided to disaster-affected people to meet essential needs, including food, water, shelter, healthcare and other emergency support.
Rehabilitation	Measures undertaken after a disaster to restore essential services, livelihoods and living conditions and support the recovery of affected communities.
Reconstruction	The rebuilding or replacement of damaged or destroyed infrastructure, buildings, services and other assets following a disaster.
Search and Rescue	Emergency operations undertaken to locate, reach and assist people who are missing, trapped, injured or otherwise affected by a disaster.
Triage	The process of prioritising patients according to the urgency of their medical needs so that available emergency medical resources can be allocated appropriately.
Institutional arrangements and disaster governance	
Disaster Resilience Core Team (DRCT)	A multi-departmental team proposed in the manual for institutionalising disaster resilience planning and coordinating disaster-related activities in urban local bodies.
Disaster Risk Governance	The institutional arrangements, policies, responsibilities and coordination mechanisms through which disaster risks are assessed, managed and reduced.
Multi-Stakeholder Engagement	The process of involving relevant government departments, communities, civil society, academic institutions, technical experts and private-sector actors in disaster resilience planning and implementation.
Multi-Sectoral Coordination	Coordination among different government departments and sectors to ensure integrated planning and implementation of disaster resilience measures.
Urban Disaster Management Authority (UDMA)	An institutional authority for urban disaster management, provided for in the manual's discussion of the Disaster Management (Amendment) Act, 2025.
Stakeholder	An individual, group or organisation that has an interest in, influence over or role in disaster resilience planning and implementation.
Disaster finance and implementation	
Disaster Finance	The financial resources, funding arrangements and financing mechanisms used to support disaster preparedness, response and recovery.
Monitoring and Evaluation (M&E)	The systematic collection and assessment of information to track implementation, measure outcomes and identify areas for improvement.
Resilience Investment	Financial investment in infrastructure, services, ecosystems, institutional capacities and other measures intended to reduce disaster risks and strengthen resilience.
Risk-Informed Budgeting	The integration of disaster risk information and resilience priorities into budget preparation and resource allocation.
Structural Measures	Physical interventions, such as flood protection infrastructure, resilient buildings and drainage improvements, intended to reduce disaster risks.
Non-Structural Measures	Policies, regulations, planning processes, awareness programmes, early warning systems and other interventions that reduce disaster risks without relying primarily on physical construction.

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