



Asian Cities Climate Resilience

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A participatory approach to micro-resilience planning by community institutions

The case of Mahewa ward in Gorakhpur City

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Abstract

Climate change could severely affect cities, especially secondary cities in India, as they become the hub of livelihood opportunities, attracting rapid economic growth and growing population density from the neighbouring areas. Addressing climate change in urban areas requires building resilience to deal with the residual impacts of climate change. Urban climate change resilience can be defined as the ability to withstand and recover from the effects of climate change. Urban climate change resilience planning is closely linked to urban development processes.

This paper focuses on a unique model created by Gorakhpur Environmental Action Group (GEAG)¹, an NGO working in Eastern Uttar Pradesh, as a micro-resilience plan against climate change in an urban context that uses participatory approaches and bottom-up development planning. In cities like Gorakhpur, situated in the flood-prone foothills of the Nepal Himalayas, the key urban systems, agents and institutions that enhance the risks of climate change impacts are linked to natural settings, behavioural patterns and weak governance.

Top-down planning processes without residents' participation largely ignore the local situation and the capacity development needed at the city level. Migration of rural populations in large numbers to urban areas adds new challenges to those faced by municipalities that are already struggling with limited resources and capacities to provide basic services to residents. This paper establishes the need –in cities such as Gorakhpur, which lack basic infrastructural facilities, where governance issues impede the course of development, where top-down functioning of government departments and local authorities are unable to deal with the local complexities –for active community participation and a bottom-up approach to building resilience to climate change, and documents this process.

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Acknowledgement

This paper attempts to capture the participatory processes adopted in developing a micro-resilience plan against climate change. The contents of this paper draw on the experiences of Gorakhpur Environmental Action Group (GEAG), which has been implementing this project in the Mahewa ward of Gorakhpur city. The interventions have taken place as part of the work of the Asian Cities on Climate Change and Research Network (ACCCRN), supported by the Rockefeller Foundation.

The authors are grateful to the Rockefeller Foundation for giving us this learning opportunity, which has resulted in the development of this paper. We express our sincere gratitude towards the residents of Mahewa ward, where the interventions were carried out, for their valuable time and support in sharing information and their experiences. We are also thankful to the ACCCRN Mahewa project team members – namely, Prof. S. S. Verma, Dr Bijay Singh, Ms Pragya Tiwari, Mr Ajay Singh, Mohammad Irfan Khan, Ms Karuna and Mr Satish Tripathi – for their support in compiling this paper and providing the required data and information.

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1. Background

1.1 Climate change and urbanising cities

Globally, more than 50 percent of the world population already resides in cities and urban areas, which have become the primary engines of economic development (UN-HABITAT, 2011). Migration into urban areas is high, as populations respond to the opportunities they present and the pressures inherent in highly uncertain rural, agricultural livelihoods. The fastest rates of urbanisation are currently taking place in the least developed countries, where more than 90 percent of the world's urban population growth is occurring (UN-HABITAT, 2011). In the developing world, population growth and the demographic shift from rural to urban areas are challenging the ability of urban governments and other actors to provide for the basic needs of people.

In common with global trends, India too is witnessing rapid growth in urban centres. Out of a total population of 1.21 billion, approximately 833 million (68.8%) live in rural areas and 377 million (31.2%) in urban areas (GOI, 2011a). The decadal growth of populations in rural and urban areas in 2001-11 was 12.2 percent and 31.8 percent, respectively (GOI, 2011a). The rate of urban population growth far surpasses that of rural population growth, and currently almost one-third of India's population lives in urban areas.

Secondary cities in India are at high risk from the impacts of climate change because they are becoming hubs of livelihood opportunities, attracting rapid economic growth and high population density from the neighbouring areas. But these cities are unprepared for rapid immigration of people, in terms of providing basic facilities to all, and face high disaster risks. Urban centres, industries, informal small-scale businesses and settlements are blooming in an ad hoc manner, without following proper land use planning.

Economic, social and political pressures mean that the urban poor are forced to live in slums and informal settlements that are often built on marginal or dangerous land, which is deemed unsuitable for permanent residential structures, such as steep slopes, flood plains or industrial areas. These populations are even more vulnerable to the impacts of climate change, such as heavy rain, flash floods and landslides.

Addressing climate change requires building resilience – that is, the ability to survive and recover from the effects of climate change. This paper focuses on the attempts by Gorakhpur Environmental Action Group (GEAG) to build a climate-resilient urban community through micro-level planning on the basis of participatory approaches and bottom-up development planning. This is in the Mahewa ward of Gorakhpur city, where development planning is now involving local people in the decision making, planning and implementation processes.

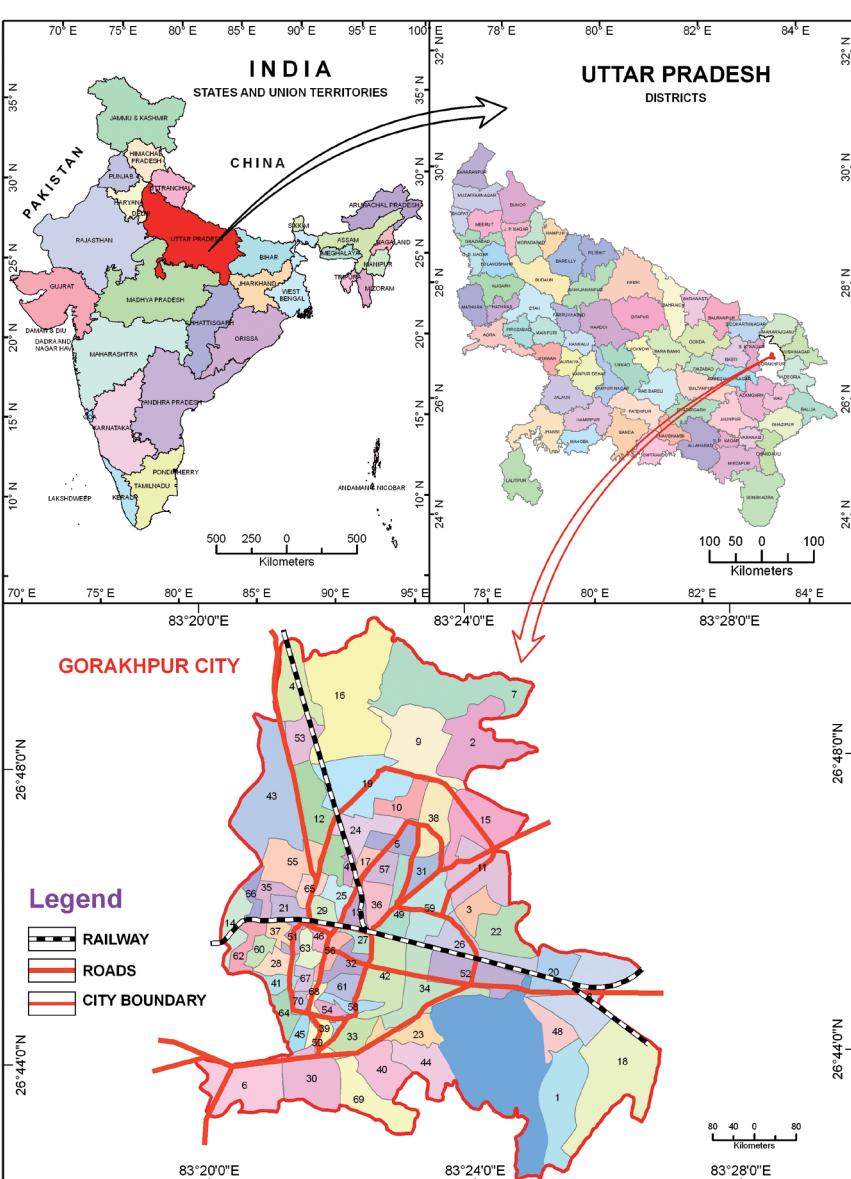
The paper will discuss in detail the process of formation of community institutions at various levels; their participation in the grassroots level actions; their resulting empowerment; and the advocacy initiatives they have taken up with the local Municipal Corporation and District Administration to combat the impacts of climatic changes. The micro-resilience planning process has also involved contributions from community members, which are described in the paper, and the process of mobilisation of resources to address local problems.

In a nutshell, this paper documents an innovative example of how climate change resilience can be built in an urban setting with the participation of community in a set context, and how challenges have been overcome in the process. It is envisaged that the district government will recognise this model will as suitable for wider adoption in other wards of Gorakhpur city. GEAG's experience of the process of building micro-resilience to climate change using participatory methodologies is of relevance to government departments, academics, and policymakers for incorporation into their planning documents and processes, as the need to build urban resilience to climate change becomes increasingly urgent in cities across India.

1.2 Gorakhpur City – An Overview

Gorakhpur is one of the fastest growing cities in the mid-Gangetic, with a population of 671,048 (GOI 2011a), which is spread unevenly throughout the city.

Figure 1: Map of India depicting location of Gorakhpur

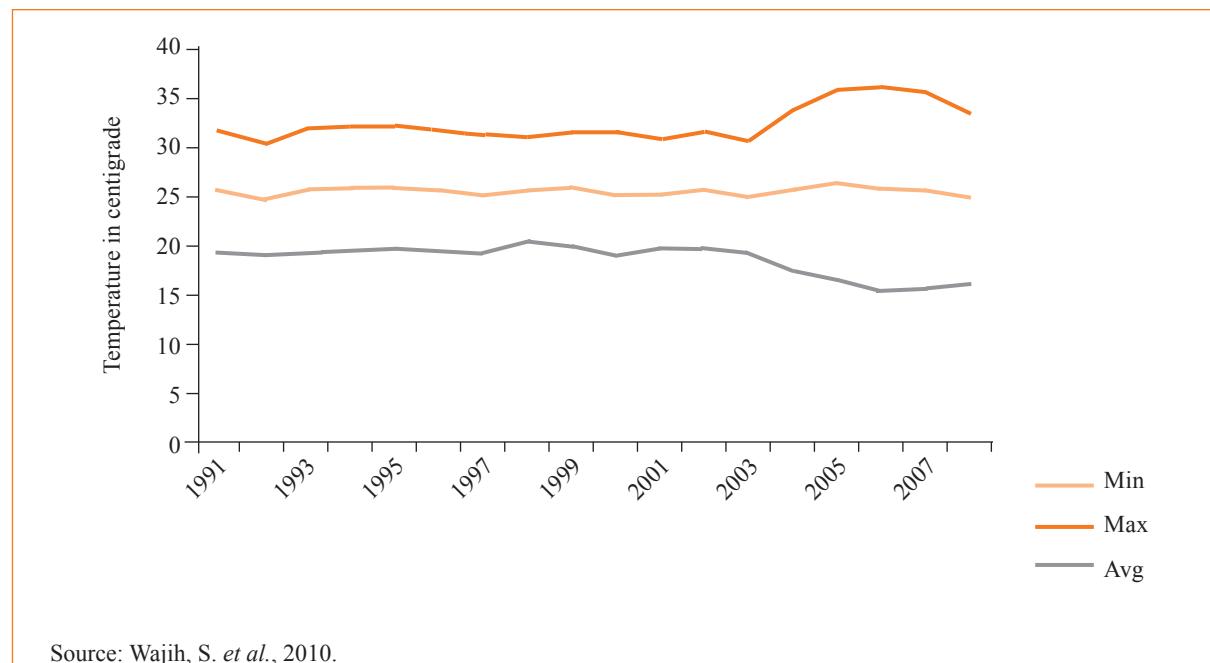


Given its location in the *Terai*¹ region with fertile lands, Gorakhpur district has an agrarian society. More than 53 percent people depend on primary production activities for their livelihoods. Additionally, around 75 percent marginal workers² are also engaged in agricultural activities (GOI, 2011b). Although climate change affects rural and urban areas, the impacts in rural areas are posing newer challenges for the majority of the population who depend on agriculture and are already suffering problems such as increasing input costs, deceleration in agricultural productivity and decreasing net gains.

The small and marginal farmers, who form more than 90 percent (Government of Uttar Pradesh, 2011) of the total farming community in Gorakhpur, are particularly affected because of their smaller and fragmented land holdings, and lower capacity to deal with climate-related uncertainties, such as floods, to which Gorakhpur is prone to. The not-so-favourable policy environment, inadequate resources and capital, and limited access to government schemes add to their vulnerability and food insecurity. This leads to a tremendous amount of frustration among the poor and resource-scarce farmers. It frequently drives them to migrate to urban centres, which often leads to ‘distressed migration’³.

At the same time, the urban population in Gorakhpur is already struggling with poor infrastructure and inadequate basic services. The rapid influx of population from the nearby rural areas has exerted tremendous pressure on its infrastructural capacity, which has not kept pace with population growth. Currently, the capacity of natural, social, institutional and infrastructure systems to provide water supply, sanitation and drainage is over-stretched. Climatic changes will greatly exacerbate existing challenges directly and indirectly, causing temperatures and humidity to increase in urban core areas, and resulting in changes in the variability and intensity of extreme weather events.

Figure 2: Temporal variation in temperature (°C) in Gorakhpur



Source: Wajih, S. et al., 2010.

Historically, Gorakhpur always had a moderate climate. The past few years, however, have seen a rapid alteration and unexpected changes. Coupled with rapid population growth, this has led to deterioration in the environment generally and specifically in the city. The variations in the temperature, even within 5-10 years, are quite evident. The average

¹ The Terai ('moist land' or 'foothill') is a belt of marshy grasslands, savannah and forests at the base of Himalaya range in India, Nepal and Bhutan. The Terai zone is inundated yearly by the monsoon-swollen rivers of the Himalayas.

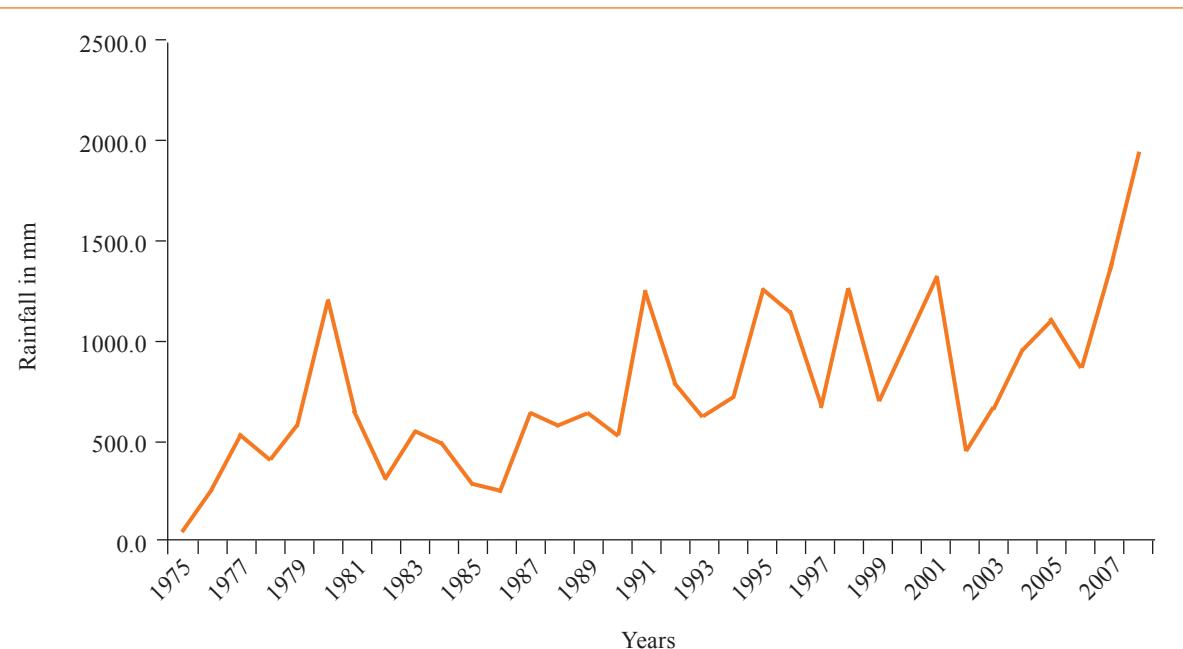
² Defined by the Census of India as workers who work for fewer than six months of the year.

³ Distressed migration means migration by the poor and vulnerable against their will because of natural disasters and shocks.

temperature in Gorakhpur is 25.68°C, but during the summer months, the average maximum temperature shoots up to 31.95°C, whereas the average minimum is above 19.57°C as shown in Figure 2. There has been an increase of 9.51 percent in the maximum average temperature during 2003-08, while the annual minimum average temperature has recorded a decreasing trend.

The city's annual average rainfall is 119.2 cm and during the past decade, the city has experienced significant variations in rainfall as shown in Figure 3. (Wajih, *et al.*, 2010.)

Figure 3: Rainfall variation in Gorakhpur



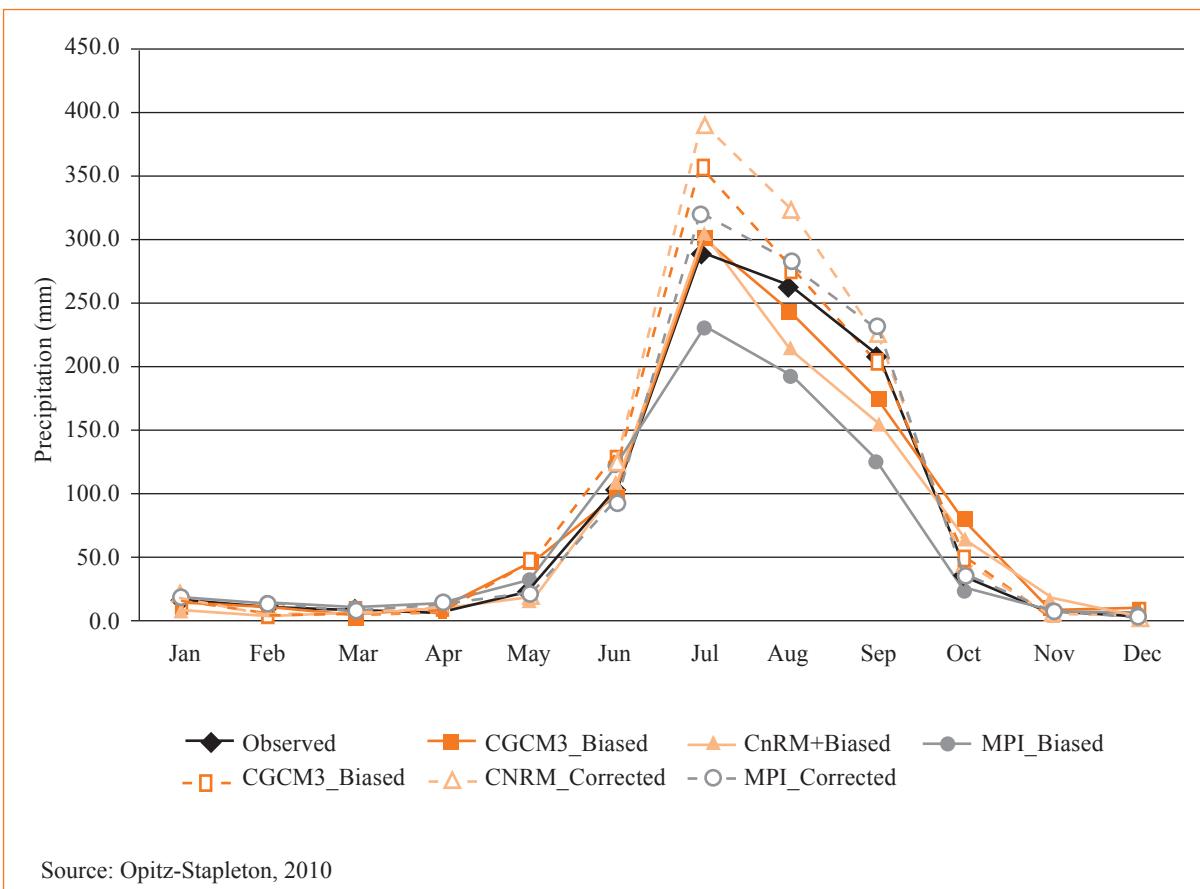
Source: Wajih, S. *et al.*, 2010. Towards a Resilient Gorakhpur

Though these shifts in temperatures and rainfall are not necessarily the outcome of CO₂-induced anthropogenic climate change, they are evidence of present changes in climate patterns that are affecting the peoples' lives. People understand these patterns of climate change in their own ways. Such awareness eases the introduction of the concept of climate change in the stakeholder engagement process.

1.3 Climate risks in Gorakhpur city

Gorakhpur is a low-lying area in the foothills of the Nepal Himalayas, on the banks of the river Rohin at its confluence with the river Rapti and in eastern part of the middle Gangetic plains. The topography is largely plain with a marginal gradient/slope from north to south, and the elevation is higher in the west than the east. This creates a bowl-like structure that allows for inward drainage. Gorakhpur is therefore prone to frequent flooding, waterlogging and other water-related problems caused by extreme precipitation, topographical attributes, improper development and poor solid waste management.

Figure 4: Future rainfall scenarios in Gorakhpur



Climate projections (2046-65) predict that maximum temperatures are likely to increase in all four seasons in Gorakhpur. The fluctuation in temperatures and its potential impact on precipitation could have significant impacts on local agriculture and urban water management for Gorakhpur. The increased temperature could change the pattern of occurrence and incidences of water- and vector-borne diseases.

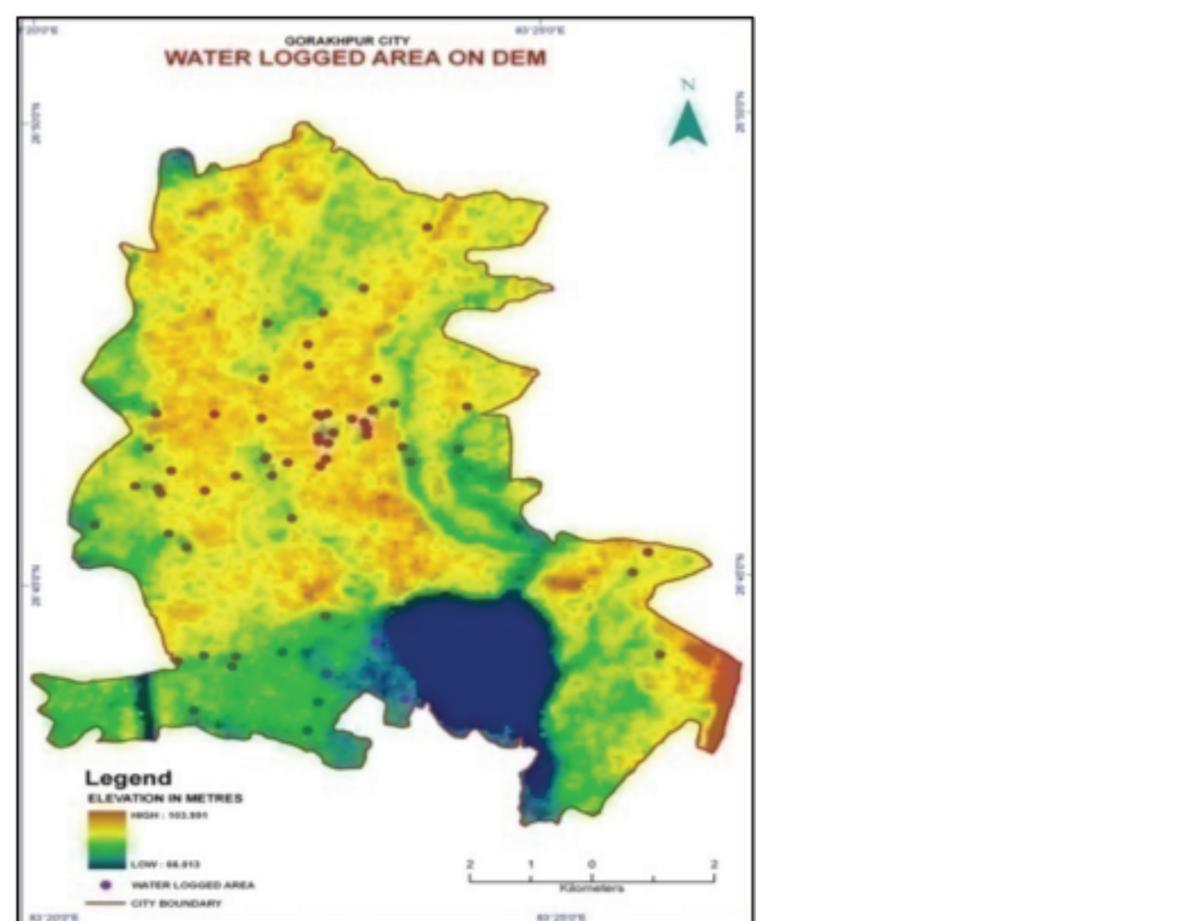
The projections also show a high increase in rainfall in the rainy season, as shown in Figure 4. A potential impact of climate change will be a higher intensity of rainfall during a shorter period. This will result in increased flooding, inundation and waterlogging in low-lying areas, more so if the wetlands into which the run-off flows are degraded or filled in as a result of natural processes such as siltation or human induced activities.

The vulnerability assessment process identified three significant risk factors that have added to the overall vulnerability of the city in the last two decades. These are discussed below.

Waterlogging

Unplanned developments, poor infrastructure, localised underground sewerage, and lack of solid waste management are contributing to the city's waterlogging. The city vulnerability assessment showed that 18 percent of the city—especially the southern, western and central areas – faces acute waterlogging. Water stagnates for more than three to four months at a stretch, and leads to a deterioration health conditions and increased health hazards. Figure 5 shows the areas in the city that are prone to waterlogging.

Figure 5: Areas prone to waterlogging in Gorakhpur city



Source: Verma, S.S., 2009. Geohydrological Study of Gorakhpur City

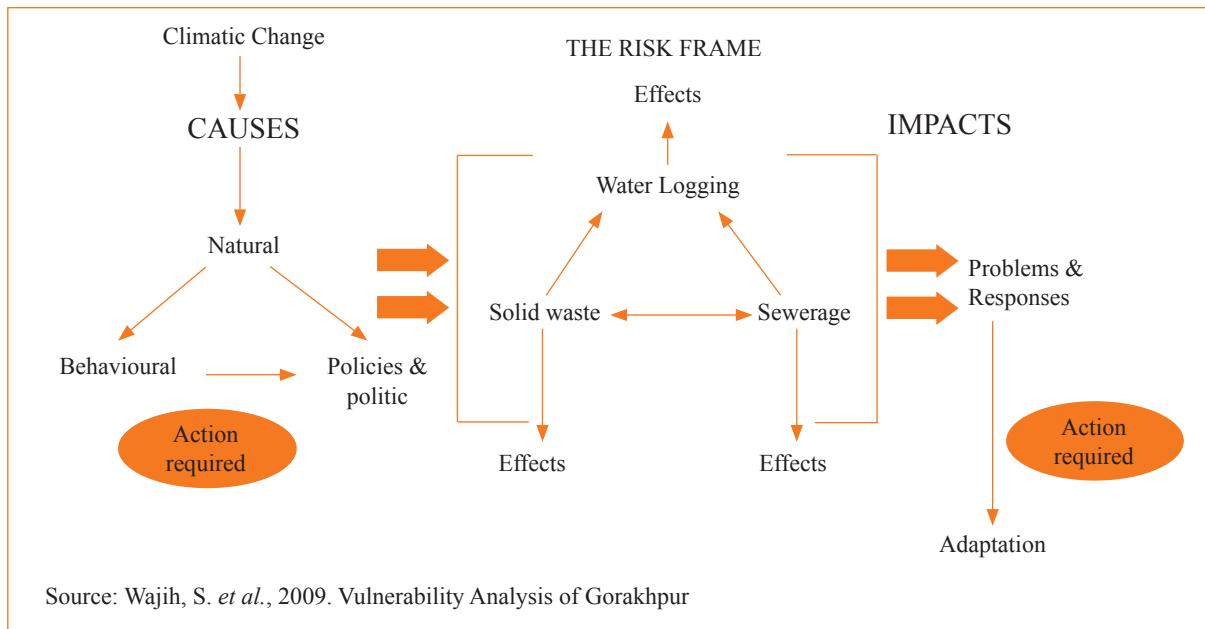
Sewerage and sanitation

The coverage of sewerage network in Gorakhpur is very poor. Just 22 percent of the total area is provided with an underground sewer network (a total length of about 55kms). There is no sewerage treatment plant in the city. Grey water is directly ejected into the river or water reservoirs, which leads to further pollution and increased siltation of the river bed. Open drains are badly damaged and packed with silt and garbage because of improper or no maintenance. Grey water generally flows through open drains, reducing their carrying capacity drastically.

Solid waste management

An additional risk factor in the city is poor management of solid waste, especially plastics. The municipality has no solid waste management plans. Collection of garbage from streets and homes is irregular. A lack of formal dumping sites means that the waste generated in the city is disposed of along roads or used as land-filling material in low-lying areas. The prevalent use of plastic bags is one of the major causes of water stagnation in the city, because they blocks drains. Prolonged waterlogging, together with poor solid waste management, has caused an increase in the incidence of vector-borne diseases, as well as contamination of groundwater. Malaria and dysentery have historically been problems, and occurrences of diarrhoea, hepatitis, fluorosis and Japanese Encephalitis have risen acutely in the last five to seven years.

Figure 6: The Risk Frame



The risk factors prevailing in Gorakhpur have increased the vulnerability of the city to climate change. The risk frame for the city shown in Figure 6 was prepared as part of the vulnerability assessment, and was validated by representatives from various social and economic sectors. The risk frame explains the inter-connectedness of three major identified risks, with waterlogging being the main risk, aggravated by the contribution of solid waste and sewerage.

1.4 Vulnerability assessment and city resilience strategy – Context and drivers

Since 2009, Gorakhpur has implemented resilience building initiatives as part of the Asian Cities Climate Change Resilience Network (ACCCRN), funded by the Rockefeller Foundation. The process included carrying out a vulnerability assessment, which led to the development of the City Resilience Strategy. GEAG has been the implementing agency throughout this process.

GEAG conducted the vulnerability assessment in conjunction with the Gorakhpur Municipal Corporation (GMC), the local city government. The assessment helped in understanding the potential impacts of climate change on the city, and in turn provided key inputs in developing the city resilience strategy. The assessment also provided critical bottom-up community information, which was synthesised with top-down expert analysis of local climate hazards and future climate change projections. The assessment involved primary data collection through filling in community and household questionnaires, and focus group discussions.

The development of the City Resilience Strategy followed the assessment. The City Resilience Strategy is a broad local-level guidance document that provides the context, evidence and analysis to justify actions to strengthen urban resilience to climate change. GEAG prepared the resilience strategy documents for Gorakhpur, with inputs and review from the City Steering Committee (CSC). This strategy was prepared using qualitative assessments and participatory techniques.

1.5 Players in the process

GEAG is the implementing agency of the process of piloting resilience building in Mahewa ward. Other technical and strategic partners support it in this process under the ACCCRN initiative, as outlined in Table 1.

Table 1: Technical and strategic partners in Gorakhpur's resilience building activities

Technical partners	Strategic partners
<p>ARUP: technical agency responsible for planning the Mahewa drainage system, implementing it in identified pilot areas, reviewing the city's Master Drainage Plan (feasibility study), and tracking progress along with GEAG; and identifying major concerns over third-party impacts and advising on how to address them.</p>	<p>Gorakhpur Municipal Corporation (GMC): service provider, also responsible for the scaling-up of interventions at the city level.</p>
<p>Institute for Social and Environmental Transition (ISET), International: ISET's technical support consists of the following:</p> <ul style="list-style-type: none"> ■ Climate information: consolidating and tracking emerging climate science information on the Gangetic basin, particularly the Gorakhpur region, and summarising this in a format that can be used for planning at the local level. ■ Local planning using climate information: direct support to integrate climate information into the ward-level planning process in Mahewa. ■ State level policy guidance: supporting advocacy for the programme with state officials, and guiding the interface with policy issues and opportunities at the state and national levels. ■ Documentation support: in relation to resilience planning results and use of climate information. 	<p>District Disaster Management Authority (DDMA): in charge of flood resilience planning, housing and sanitation.</p>
<p>SEEDS India: technical support consisting of:</p> <ul style="list-style-type: none"> ■ Retrofitting of existing primary school in Mahewa to show appropriate construction technology. ■ Construction of a low-cost model house. ■ Construction of model raised community toilet. ■ Technical support for decentralised storm water management in the ward. 	<p>Agriculture Department, Government of Uttar Pradesh: provides input facilitation and links for climate-resilient agriculture.</p>
	<p>Poorvanchal Grameen Bank: provides micro-finance, loans for resilient houses, toilet construction, and agricultural inputs.</p>
	<p>Radio Mantra: local radio channel that shares experience and provides advocacy at the city level.</p>
	<p>Mahanagar Paryavaran Sanrakshan Manch (City Environment Protection Forum): city-based citizen's forum on environmental issues that provides advocacy and works as a pressure group.</p>
	<p>Media: Disseminate experience and advocacy at the city level.</p>

2. Understanding vulnerability for resilience building actions – the process

the challenges of increased urbanisation and impacts of climate change highlight the fact that as the city builds its long-lived infrastructure and other systems in the coming decades, the impacts of unavoidable climate change must be given due consideration. To support dense populations and high levels of interaction, the city requires inputs from ecological systems, different social organisations, structures that facilitate and mediate interaction and exchange, and complex infrastructures that include links to transport, finance, communications and supply networks.

2.1 Urban Climate Change Resilience (UCCR) Framework

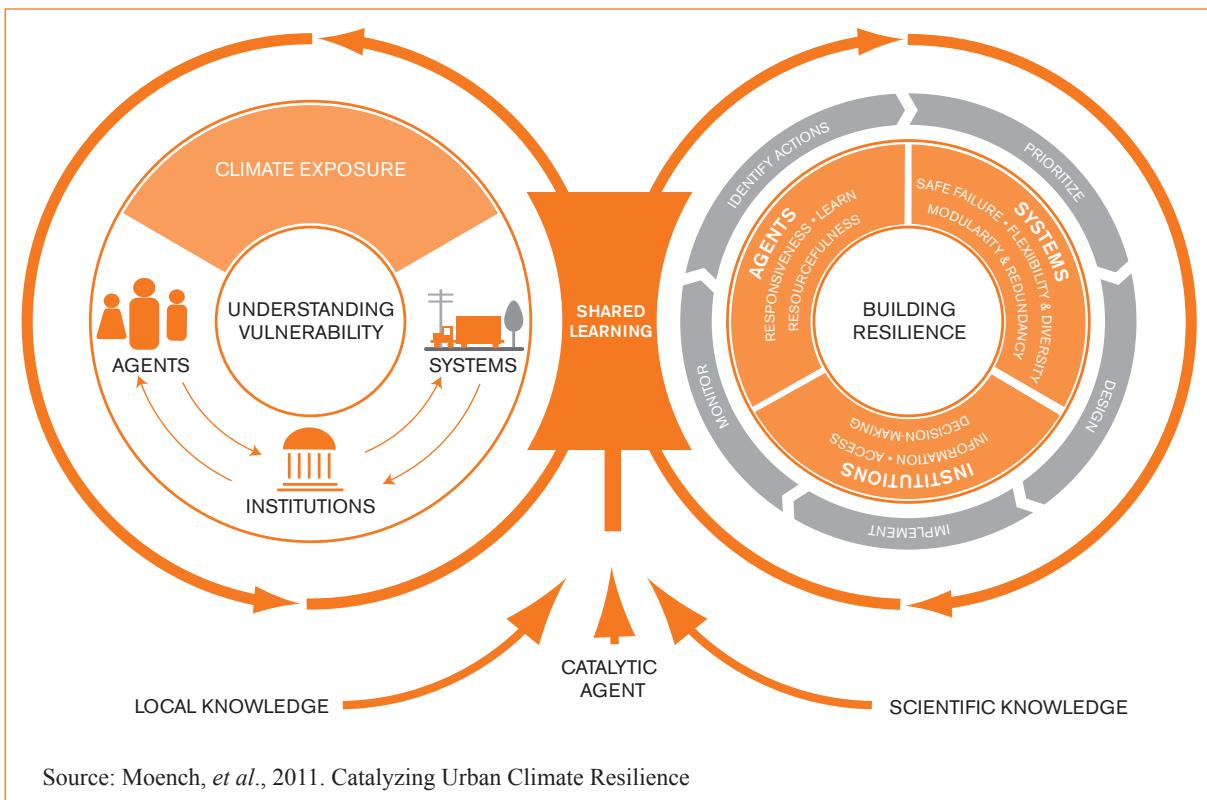
The Urban Climate Change Resilience (UCCR) framework, developed by ISET, provides a conceptual framework for assessing vulnerabilities and risk. It identifies resilience strategies and creates an open, inclusive learning process to find specific measures and processes that address the uncertainties of climate change through action and implementation.

The UCCR Framework as depicted in Figure 7 is founded on an understanding of the links between agents, systems, and institutions. The value of the conceptual framework is in putting these three components together in a way that allows local stakeholders to draw up strategies, conceive and implement actions that build climate resilience.

The left-hand loop of the framework helps in **understanding vulnerability** and clarifies factors that need to be included in the diagnosis of climate vulnerability. It structures the systematic analysis of vulnerability in ways that clearly identify the entry points for responding to vulnerability. The right-hand loop of the framework supports strategic planning to **build resilience** to climate change, prompting new and practical ways of thinking about the challenges of adapting to climate change.

The entry point into the resilience building process is at the bottom of the diagram, where arrows indicate inputs of local knowledge, scientific knowledge, and a ‘catalytic agent’ that initiates the process. This agent (in this case, GEAG) is intended to be a broad-based, high-capacity organisation that can provide training and methodological support to local NGOs or other organisations that will directly engage local communities.

Figure 7: The Urban Climate Change Resilience Framework



The UCCR Framework is implemented through shared learning dialogues (SLD). SLDs draw on participatory engagement and research techniques. In these dialogues, local knowledge is solicited and relevant international knowledge is also introduced. The dialogues are structured to ensure that learning goes both ways, and are held iteratively to allow for increasingly detailed and informed engagement (see Reed *et al.*, 2013).

Under this framework, vulnerability is explored through the process of understanding the present vulnerability of three components –**agents, systems and institutions** –and understanding their interconnectedness and the impact that climate change is projected to have.

Box 1: Key elements of the UCCR Framework (Moench, *et al.*, 2011)

Agents refer to people and their organisations, whether as individuals, households, communities, private and public sector organisations, or companies. Agents have different sets of assets, entitlements and power. Their ability to access systems, and thus their vulnerability and resilience, is differentiated on this basis.

Systems are a combination of ecosystems and infrastructure systems. Ecosystems provide the basic foundational needs (water, air, food) and are mediated and complemented by physical infrastructure (transport, water distribution, drainage, power, and communications) that are central features of urban areas.

Institutions refer to the rules, norms, beliefs or conventions that shape or guide human relations and interactions; and access to and control over resources, goods or services, assets, information and influence. Although institutions shape agents, equally agents shape institutions, thus opening the possibility of change.

Urban vulnerability is high where systems are fragile, agents are marginalised, institutions confine rather than enable responses, and exposure to climate change is high. The institutional factors that contribute to resilience are those that ensure that underlying systems are resilient, that agents have access to the benefits from systems, and that agents are enabled and guided so that actions may be rational at an individual or organisational level.

2.2 Vulnerability assessment

GEAG made its vulnerability assessment of Gorakhpur in 2009, on the basis of the UCCR framework. It aided in understanding the following:

- Potential impacts of climate change.
- Identifying what systems are exposed to the impacts of climate change, and how impacts on those systems may then affect other systems.
- Identifying which groups, areas, and sectors are most vulnerable and how they may be affected.
- Identifying the different factors that make groups vulnerable, directly (e.g. exposure to hazards) and indirectly (e.g. decreased agricultural production leading to increase in food prices and food insecurity).
- Assessing how critical ecosystem services and functions could respond to continued human pressures because of climate change.
- Assessing the capacities of organisations and groups to adapt.
- Informing the development of resilience strategies.

The vulnerability assessment was based on the analysis of primary data collected through community and household questionnaires, participatory methodology tools and SLDs, across different sections of population spatially and socio-economically. Secondary data was also used.

Agents

Gorakhpur experiences rapid in-migration of people into the city from neighbouring areas, with hopes and aspirations to make a better living. This is often a result of reduced agricultural productivity and the embedded frustrations in farming, such as rising costs. This influx of people, who are generally illiterate, from rural and backward areas, has led to the growth of slums in the city. The urban poor living in these slums are vulnerable, living on low incomes combined with poor access to information and services. The slums have mushroomed in the most fragile and at-risk areas of the city, which are the first to be affected by rains and floods.

The migration of people to the city has also resulted in varied socio-economic categories of residents. There are various mechanisms by which different economic groups deal or cope with the situations aggravated by climate risks; those in high-income groups have a higher capacity. The major impacts fall on the middle- and especially low-income groups.

Public participation in governance of resources and development of the city is largely limited to municipal elections, at which corporators – who head ward-level committees – are elected. Actual involvement of informed residents in planning and governance of city, however, is limited. Lack of ownership of issues and the indifferent behaviour of communities are the results of such missing priorities. The people of Gorakhpur show indifferent attitudes towards problems like stagnant water, waste water evacuation, electricity supply and drinking water.

In the areas that middle-income groups dominate, their indifferent attitude makes the seriousness of the problems worse. Additionally, no organisations are present at the city, ward or neighbourhood levels that can take the responsibility of providing adequate services or solutions to these problems.

Systems

Unplanned developments, poor infrastructure, localised underground sewerage, lack of proper solid waste management, are all risk factors that contribute to the vulnerability of the city. Open and green spaces are shrinking to accommodate development infrastructure. Water bodies are filled in for construction sites, which affects the ecological balance of the city.

Communities' resilience towards climatic changes depends on basic hazard-reducing infrastructure that supplies essential services such as roads, housing, drinking water, waste management, electricity, transportation and telecommunications. Infrastructural developments have not kept pace population growth, and this has affected the service delivery system and added to the vulnerability of the people, especially the urban poor.

Institutions

Gorakhpur city suffers from a lack of good governance. The capacity to coordinate and execute decisions that would allow for efficient delivery of services for the city people is insufficient. This is an impediment to building urban climate change resilience.

The whole framework and methodology of Gorakhpur city's development is based on a top-down, linear approach. The lack of participation from residents' groups or communities that are facing the problems results in a lack of understanding of these problems, and in faulty policies as a consequence. The top-down approach is ill-suited to deal with the complexities of local realities because the impacts and responses to them are inherently local.

The GMC, the apex body responsible for development of the city, lacks sufficient resources to carry out the development processes. Moreover, the lack of accountability and vision from the local administration is a major restriction to the proper implementation of development programmes. The Gorakhpur Master Plan 2021, published by the Town and Country Planning Department, Uttar Pradesh and Gorakhpur Development Authority (GDA), has not been enforced strictly and non-compliance is leading to unplanned developments, thereby increasing the gravity of risks associated with waterlogging and solid waste.

The ineffective implementation of well-planned and long-term development policies contributes to various problems in the city. Although the GDA is preparing a 20-year development plan, it has not considered various aspects such as rain, temperature and pollution.

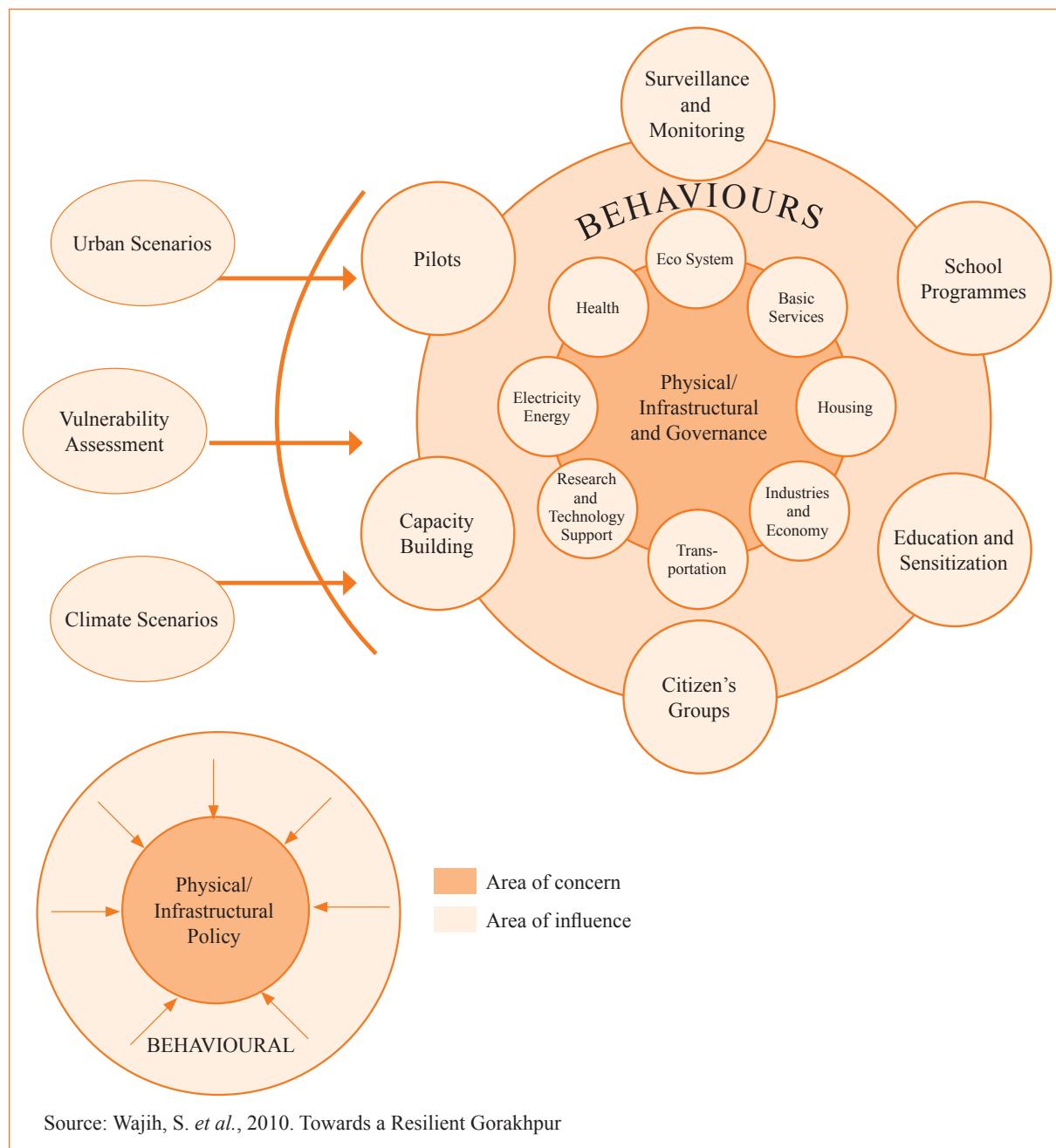
Lack of inter-departmental convergence is another barrier in the proper implementation of well-planned schemes in the city. The problems and solutions are interlinked and can only be addressed with departmental convergence. The plans fail largely because of a lack of integrated planning.

The results of the vulnerability assessment were integrated to draw an informed resilience approach for the city of Gorakhpur in dealing with climate variability and change.

Developing resilience of systems and of people is a gradual and long-term process that requires an intense interplay between these two components (systems and people) of the urban resilience framework. In the case of Gorakhpur, it was essential to have an integrated approach to achieve resilience, and so an evolving city resilience strategy was developed. The strategy, as depicted in Figure 8, focused firstly on climate change-problems that are of higher concern for city residents and managers. The strategy emphasised capacity development to address the technical, institutional, social and cultural dimensions: firstly, of the problems that had been selected as an initial strategic focus; and secondly, on the additional problems and the capacities required to address them.

2.3 City Resilience Strategy

Figure 8: City Resilience Strategy



The outer circle shown in Figure 8 emphasises people's behavioural aspects. It prioritises actions and is expected to address the inner core (physical, infrastructural and governance issues) and make them more responsive, transparent and accountable. The behavioural aspects may be considered as the **circle of influence** and the robustness of this area is expected to gradually reduce the **circle of concern**—in other words, the larger (stronger) the area of influence, the smaller will be the area of concern.

The approach to resilience planning in Gorakhpur has been to focus on the behavioural aspects and to address the physical, infrastructural and governance factors with the participation of sensitised, informed and concerned residents. Hence, it is imperative to invest in capacities, surveillance and monitoring, an informed and active residents, and responsible governance to build climate change resilience.

2.4 Vulnerabilities of the poor

The vulnerability assessment and resilience strategy development processes that GEAG led helped to identify the following nine vulnerable sectors in Gorakhpur. It highlighted the areas under each sector that should be considered to strengthen resilience. The CSC, along with GEAG, was actively involved in identifying these vulnerable sectors.

Table 2: Vulnerable sectors

#	Sectors	Areas to strengthen resilience
1.	Housing	Effective master-planning and proper enforcement
		Awareness among residents
		Water harvesting
2.	Industries and commerce	Environmental impact assessment measures
		Effective monitoring of waste treatment
		Organised housing for industrial workshops
3.	Basic services	Drinking water quality monitoring and awareness
		Effective drainage system according to geo-hydrology of city
		Decentralised community-owned solid waste management
		Community sensitisation and education
4	Transportation	Planned transport systems for city
		Public transport system to be enhanced
		Compressed natural gas (CNG) vehicles to be introduced
5	Energy/electricity	Alternative energy sources
		Conversion to compact fluorescent lights in private and public places
6	Health	Effective health surveillance systems
		Preventive health measures
		Community sensitisation and education
		Drinking water quality
7	Household-based livelihoods	Drainage system
		Insurance mechanisms
		Design of homes for proper storage of agricultural products
8	Ecosystems	Conservation of water bodies
		Plantation and public land to be protected
		Community sensitisation and education
9	Urban planning	Master plan

These identified vulnerable sectors were shared at CSC meetings, and five sectors were prioritised for further interventions: sewerage and drainage; sanitation and solid waste management; water supply; health; and housing.

2.5 Potential for participatory processes

Urban climate change resilience planning is closely linked to urban development processes. In cities like Gorakhpur, situated in the flood-prone foothills of the Nepal Himalayas, the key systems, agents and institutions associated with increased risk from the impacts of climate change are linked to natural settings, behavioural patterns and weak governance.

Top-down planning processes without residents' participation largely ignore the local situation and capacity development needed at the city level. In-migration to urban areas adds new challenges for municipalities that are already struggling with limited resources and capacities to provide basic services.

The vulnerability assessment and the City Resilience Strategy strongly advocate a bottom-up approach to planning and service delivery. The 73rd Constitutional Amendment in India has provided ample scope for decentralised planning and governance in rural areas and there are a range of encouraging results.

The same political will has not been shown, however, in taking up the corresponding 74th Constitutional Amendment meant for urban areas. This has led to the limited adoption of appropriate methodologies and people-led disaster management and climate adaptation processes. It has also affected transparency and participatory governance.

Experience has shown that people's participation is often central to development processes. Similar to the rural decentralised planning under the 73rd Constitutional Amendment, planning processes and governance in urban areas can be decentralised through a bottom-up approach as outlined in the 74th Constitutional Amendment. This can be achieved by developing community institutions, ward-level micro-planning and implementation of activities that local community – especially the poor and marginalised have –prioritised, with community-led monitoring of the process. Such a community-led process, which is based on people's priorities, needs, knowledge and capacities, will empower people to plan for and cope with the impacts of climate change.

The urban poor in the city who are in-migrants may struggle to lead a decent life. Their access to and control over services is often hindered, and informal settlements lack basic services. Therefore, their participation in the planning and decision-making processes becomes even more crucial. Once they are part of the process, their access to basic services and control over them increases, with broader implications for their lives.

It is also important to recognise that climate change impacts are one of many natural, social or economic problems that affect vulnerable community members; others include unemployment, increasing food prices and ill-health. Interventions that focus solely on climate-related risks are unlikely to reflect community priorities. Development and planning for building resilience should take into consideration those expressed needs and priorities of communities that aim to reduce poverty and enhance livelihoods, as well as reduce vulnerability to climate change impacts.

This kind of holistic planning can only be done through an approach that encompasses the wider community and involves it in the entire planning and development process. Empowerment of people and their participation in development and resilience building processes can ensure sustainability. Communities can take ownership of their problems as well as the solutions, and this change in mindset can ensure that processes continue and are maintained.

Thus, active participation from local communities, and bottom-up approaches are a pre-requisite for building resilience to climate change in a city such as Gorakhpur, which lacks basic infrastructure, where governance issues impede the course of development, and the top-down control of government departments and local authorities is unable to deal with local complexities.

3. Participatory processes in building climate change resilience

Gorakhpur has led the way with an experiment in community-led participation for urban climate resilience planning. City planners and policymakers have realised the limitations of a top-down approach to urban planning. Historic methods have failed to address specific community needs and overlooked the potential for mobilising local resources and capacity to solve problems. Taking past shortcomings into account, city planners and policymakers have placed increasing emphasis on a participatory approach to develop sustainable and long-lasting solutions.

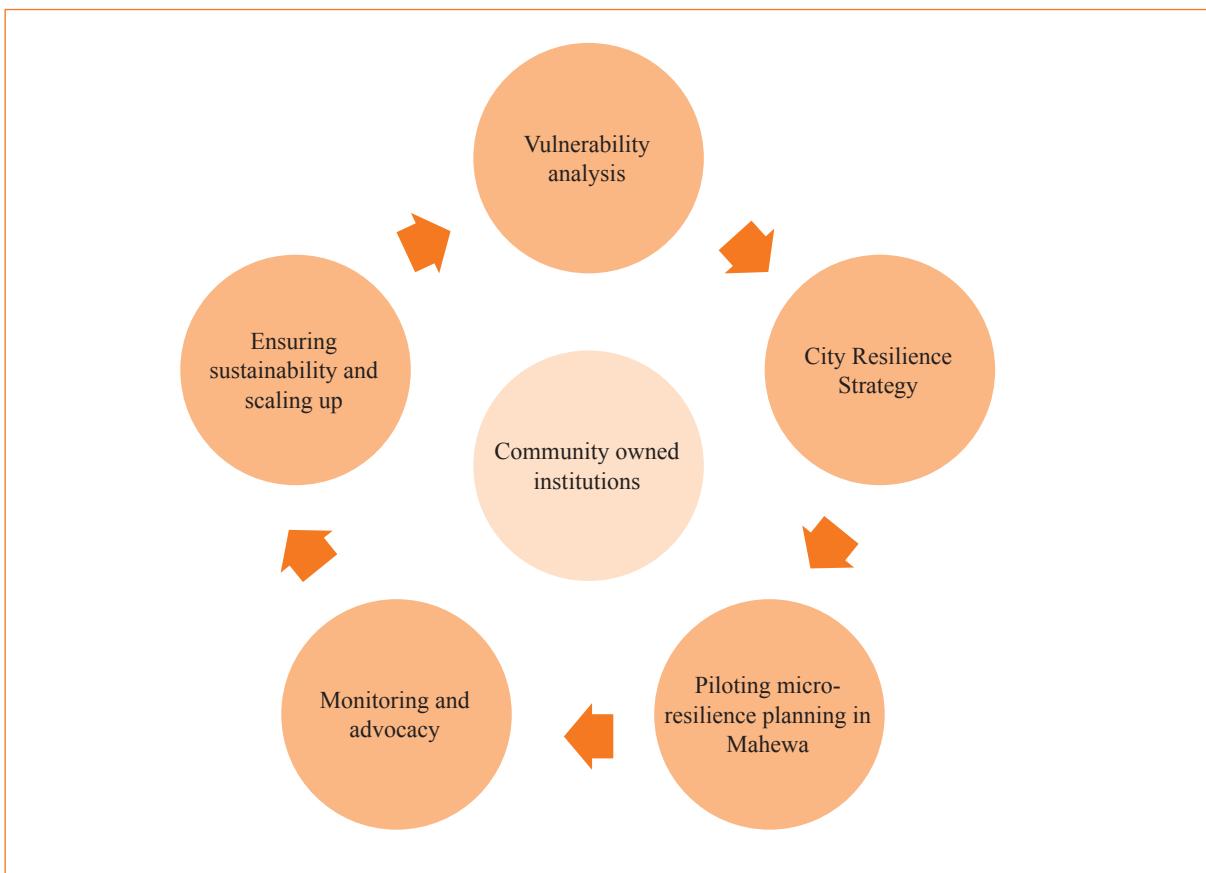
In Gorakhpur, an area prone to floods and serious waterlogging, where top-down approaches to governance have worsened the situation, the process of building urban climate change resilience was adopted with the participation of the community and other stakeholders. The process was cyclical in nature and one step led to the evolution of the next, as shown in Figure 9. People's participation was at the core of every step, and various tools and methodologies were adopted to create an enabling environment for building participatory urban resilience.

3.1 Participatory approaches to vulnerability assessment

The vulnerability assessment in Gorakhpur used primary data compiled through community and household questionnaires, supported and validated by consultations at the city level to pinpoint, prioritise, and rank the physical risks according to intensity that Gorakhpur residents face. SLDs were the main participatory tool that GEAG used to engage local stakeholders in the vulnerability assessment process, and integrate knowledge of climate change from outside experts with local knowledge of development issues. The use of ongoing, iterative SLDs provided a backbone to support and guide the diagnostic process of mapping Gorakhpur's vulnerabilities.

This process of shared learning facilitated secondary data collection with key stakeholders such as the GMC, Jal Nigam (water works), the electricity department, GDA, Gorakhpur University, and the Gorakhpur Medical College. Bilateral consultations were conducted with the city mayor, city members of the State-level Legislative Assembly, the municipal commissioner (Executive Head of GMC), and former engineers from water and electricity departments. Group consultations were subsequently held with key stakeholders, which included academics, engineers, NGOs, journalists and residents.

Figure 9: The Resilience Cycle



The **City Steering Committee (CSC)** was formed with 12 members from government departments, research institutions, and the medical college, along with other key stakeholders. Following the CSC's formation, GEAG held an SLD with a larger group (including CSC members, elected representatives from municipal wards, and representatives from the private sector, among others). The objectives were to identify and prioritise vulnerabilities in Gorakhpur and the most vulnerable areas/communities in the city.

Concurrently, sections of the city were mapped according to socio-economic unit – ***low-income group (LIG), middle-income group (MIG) and high-income group (HIG)*** – based on visual observation of satellite images of residential areas and subsequent validation through field visits.

Combining these results with secondary data, the vulnerability assessment analysed four main categories: vulnerability of infrastructure and services (including calculation of current demand and demand deficiencies for different socio-economic groups); social issues of health and education; institutional challenges of addressing vulnerabilities; and economic consideration of losses associated with disasters (with particular attention to differential impacts on income groups).

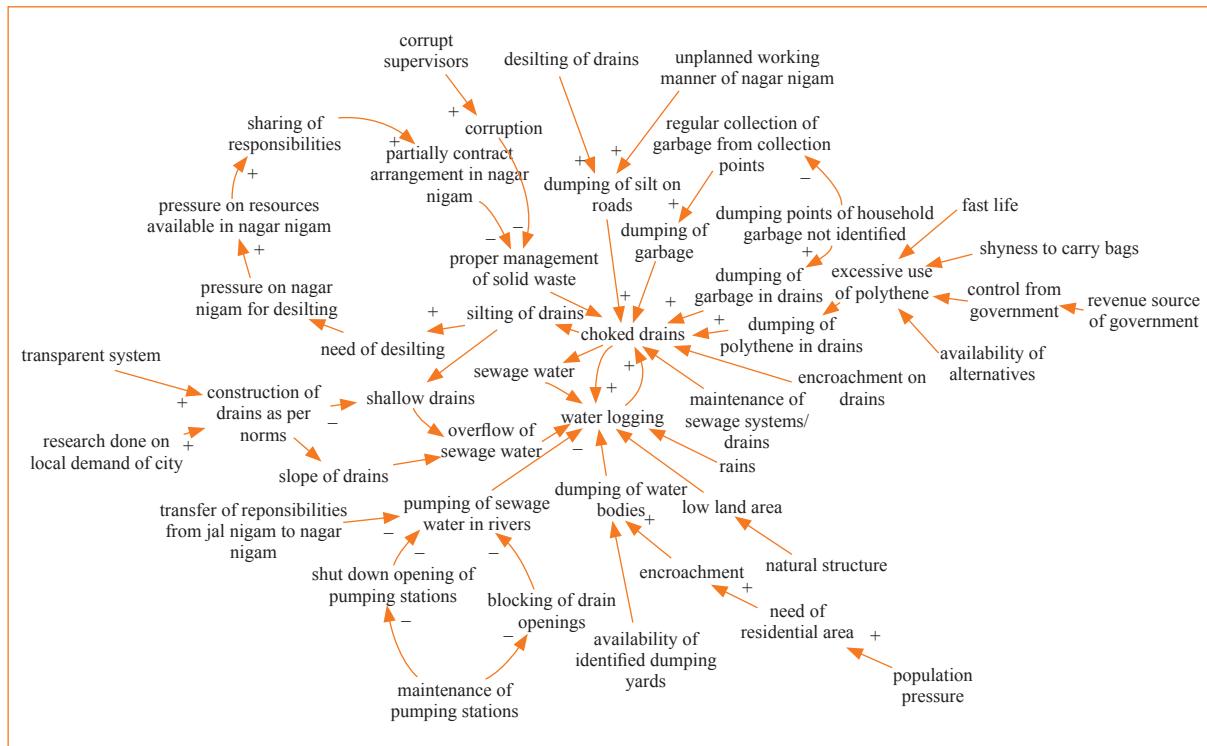
Based on this information, 20 percent of the city's wards (14 out of a total of 70 wards) were selected for further study. The four criteria used in ward selection were: i) number and intensity of risks in each area; ii) coverage of various socio-economic groups; iii) severity of current impacts on economic activities; and iv) diversity of the area. A series of **participatory learning and action (PLA)** techniques were used to engage with the community and assess risks.

Table 3: Participatory learning and action (PLA) tools used in the vulnerability assessment of Gorakhpur

Objective of PLA	Tools	Information collected
Situation analysis	Transect walk; satellite images; social mapping; service mapping	<ul style="list-style-type: none"> ■ Nature of houses: single house (separate), two-storey, multi-storey, rented/own house, flats, wall type (bricks, stone, mud/earth), etc. ■ Socio-economic status of community: socio-economic class identification, inter-class variability, etc. ■ Available services in area: health, Public Distribution System¹ (PDS), education, toilets, sanitation, etc. ■ Major risks in area: waterlogging, sewage, solid waste management, drinking water, electricity, etc.
Trend analysis	Trend diagram; focus group discussion	<ul style="list-style-type: none"> ■ Changes in physical area over a period of time: constructions, settlement pattern, etc. ■ Changes in services and choices over a period of time: livelihood choices, health, education, PDS, etc.
Preference and choices	Preference ranking and scoring; matrix; chapati (venn) diagram	<ul style="list-style-type: none"> ■ Preference of different services and causes: livelihood, health, education, PDS, toilets, electricity, etc. ■ Prioritisation of problems associated with services: access and availability ■ Distance of services: distance at which education, medical, PDS services are available ■ Distances from risks: waterlogging, sewage, solid waste, etc. ■ Opinions about service providers: Municipal Corporation, Electricity Board, Jal Nigam, etc.
Problem analysis	Causal loop diagram; problem tree; focus group discussion; seasonality of problems	<ul style="list-style-type: none"> ■ Structure of problems: waterlogging, sewage, solid waste management, etc. ■ Interconnections and mutual contributions: linkages between different risks

¹ The Public Distribution System (PDS) is a food security system. Established by the Government of India under the Ministry of Consumer Affairs, Food, and Public Distribution and managed jointly with state governments in India, it distributes subsidized food and non-food items to India's poor.

Figure 10: Causal loop diagram used to analyse drainage problems



Defining climate change vulnerabilities from residents' perspectives

In the first instance, the 70 wards of Gorakhpur city were divided into seven zones on the basis of police station jurisdiction. Within these zones, 17 risks/problems were identified through a process of community participatory dialogue, which GEAG organised, and were rated/graded on a scale from 1 to 5 (least to most severe) based on the intensity of risk/problems.

The process of assessing risks with the community was very interesting, because the problems that were highlighted through the participatory discussions were locally rather than scientifically defined. The standards for measuring the severity of these problems were defined by the community members as below:

Waterlogging/accumulation

- If waterlogging lasts for more than 3 days
- If water enters 25% of the houses
- If drains remain blocked

Sewerage and sanitation

- Lack of underground sewer system
- Irregularity in unblocking and repair of sewer system

Solid wastes disposal

- No waste disposal facility
- Frequency of waste disposal

Drinking water

- In summer, pumping stations do not function properly
- Filth/dirt from water taps
- Leaks from pipes
- Water not purified by municipal corporation
- No pressure in water supplied by municipal corporation

The assessment concluded that Gorakhpur is vulnerable to waterlogging because of its natural topography, with low slope gradients and large low-lying areas. Land pressures and increasing encroachments are shrinking the city's natural water bodies and during the monsoon and post-monsoon months, 20%-30% of the city is highly waterlogged. Unmanaged solid waste and sewerage disposal contribute to waterlogging. Sewerage, solid waste disposal and waterlogging affect the quality of drinking water, so drinking water was taken as a cross-cutting risk.

GEAG shared the results of the vulnerability assessment, along with climate projections and their implications for Gorakhpur, with the CSC through another SLD. Furthermore, the data from this process informed the design and choice of Gorakhpur's sector studies and pilot projects, which were funded as part of ACCCRN and implemented by GEAG.

The sector studies and pilot projects were designed to allow further engagement around the assessment findings. The studies explored key areas of vulnerability for which information was lacking and helped to determine the degree to which the existing systems could respond to varying climatic conditions (Box 2). Pilot projects provided a platform to develop — based on the vulnerability assessment findings — and test small-scale resilience building activities, with clear identification of vulnerable people, locations and sectors within the city (Box 3). Moreover, it was felt that sufficient justification of findings from these pilot projects would help to achieve stakeholder buy-in at a later stage, including from the GMC, GDA and local citizens.

Box 2: Sector Studies

1. **Saving a Dying Lake – The case of Ramgarh Tal in Gorakhpur, Uttar Pradesh:** The study documented the encroachment and pollution of the largest lake in Gorakhpur over the past half century, and the associated loss of ecosystem services, including potable water and drainage, issues that will have growing consequences under climate change.
2. **Servicing the City – Migrant Workers and Deprivation in Gorakhpur, Uttar Pradesh:** This study evaluated the in-migration of manual workers and other essential service providers to Gorakhpur. The study addressed the causes of migration, the dynamism of social deprivation in source and destination, and the living conditions of migrants.
3. **Geo-hydrological Study of Gorakhpur:** An assessment of the geo-hydrological condition of Gorakhpur and the role it plays in creating or mitigating physical and anthropogenic problems, such as waterlogging, solid waste and sanitation, deterioration of surface and ground water quality.

Box 3: Pilot Projects

4. **Decentralised Solid Waste Management through Community Participation:** 200 households were engaged in implementation of decentralised, community-based solid waste management. This project provided livelihoods creation, ecosystem benefits in the form of greater recycling and composting of waste, and reduction in flooding and waterlogging from waste-blocked drains.
5. **Campaign on ‘No More Polythene’:** Building on the solid waste management study, GEAG produced and distributed a series of four-page leaflets to communicate the challenges associated with sanitation and waste in Gorakhpur. The leaflets encouraged residents to change their waste disposal and recycling habits, and to actively participate in demanding better services from the city government.
6. **Ramgarh Lake Conservation Campaign:** The Ramgarh Lake sector study led to a campaign to raise community awareness of the risks to the lake.

3.2 Putting people at the centre of the City Resilience Strategy

The purpose of the City Resilience Strategy was manifold: to consolidate earlier learning from SLD work on climate and local vulnerability, the vulnerability assessment, sector studies and pilot projects; to disseminate these findings to key decision makers; to reinforce new knowledge, concepts, and strategic planning approaches among core resilience planning stakeholders; to strengthen new coordination mechanisms and partnerships; and to provide a platform for ongoing engagement and learning. Thus, the City Resilience Strategy was a broad local-level guidance document that provided the context, evidence, and analysis to justify actions to strengthen urban resilience to climate change.

The strategy emphasised the promotion of active and conscientious residents as a mechanism for building greater public accountability and improving service delivery. GEAG mainly intended the strategy to be a platform for strengthening governance. As a preparative methodology, qualitative assessments and participatory techniques were used to formulate the strategy, which in turn outlined the pathways for action and specific interventions based on the vulnerability assessment.

The resilience strategy is dynamic, with in-built feedback mechanisms for continuous responses to changes as they occur. Workshops with larger groups, which involved CSC members and vulnerable communities, touched on most of the issues and challenges that relate to Gorakhpur’s growth, which include the governance system, city infrastructure, urban services, population growth, migration and tourism.

The strategy recognises that responding to climate change requires integrated courses of action to address a combination of institutional, behavioural, social and technical issues. This has helped to put people at the centre of the whole process. It has sensitised, mobilised and involved Gorakhpur residents in planning climate change resilience at the neighbourhood, ward and city levels.

The infrastructural and systemic issues that were crucial for building the city’s resilience were addressed through residents’ participation. To create an enabling environment for building resilience and mobilising and organising people in the city, and ensure their participation from the start, GEAG carried out following activities:

- **Community surveillance and monitoring:** Quality of services (e.g. drainage/ waterlogging, drinking water, sanitation), health-/vector-borne diseases, pests and other such factors were studied with residents’ active participation.
- **Participatory pilot interventions:** Towards technical solutions of challenging issues (e.g. drainage of waterlogged areas) and links/scaling with larger city-level interventions (e.g. drainage plan of the city).

- **School programmes:** Raising school children's awareness of the vulnerabilities and resilience of the city in relation to climate change, and the role of residents.
- **Organising residents:** Mobilising, sensitising and bringing together various citizen groups and institutions (trade groups, chambers of industries, service clubs, NGOs, etc.) on a common platform for the city's resilience. The platform works as a 'think tank' and pressure group to lobby the city government on specific measures.
- **Education and capacity building:** Sensitisation, education and building the capacity of various groups/institutions for their active involvement in addressing effective service delivery, technical solutions and organising residents.
- **Developing the city's database resource centre:** Climate- and development-related data are vital in getting people and media involved in the resilience planning process. Unfortunately, the city lacked in this kind of information, which created a hurdle in the whole process. To streamline this, the Hamara Gorakhpur website was launched to act as a central pool of data on Gorakhpur for climate, land use, schemes/programmes. The website is openly accessible to all and has particularly benefitted the media as a source of information.

Through this process of community participation in building the resilience strategy, it became clear that participation of a broad cross-section of the community and the leadership of the CSC through the process contributed to this continuity. Local engagement in the development of the strategy resulted in a much greater understanding of the climate change issues and resilience processes among local residents and stakeholders. The strategy provides an overarching framework informed by visioning exercise, risk assessment, vulnerability analysis, sector studies and pilot projects to demonstrate effectiveness of resilience options.

This process met the expectation of raising broader awareness among diverse audiences and generating initiatives that benefit vulnerable groups; vulnerability assessment, broad community engagement, and resilience initiatives in Gorakhpur focus directly on the issues of poverty and vulnerability.

4. Piloting micro-resilience planning in Mahewa ward, Gorakhpur

Box 4: Overview of Mahewa ward, Gorakhpur

Location: South-west periphery

Total area: 2.8 km²

Population: 8,226 (Census 2001)

Topography: Plain with local variation in height and slope. Western boundary delimited by river Rapti.

Climate risks: Low lying, prone to flood and waterlogging

Community's concerns: Limited access to basic civic services – public health, sanitation, drainage, solid waste management, etc.

The vulnerability assessment, development of the city resilience strategy and implementation of an initial set of activities in the form of pilot projects helped the city and GEAG deepen their understanding on future directions of building resilience against climate change. This led to the generation of a second set of implementation actions, which included ward-level micro-resilience strategic planning.

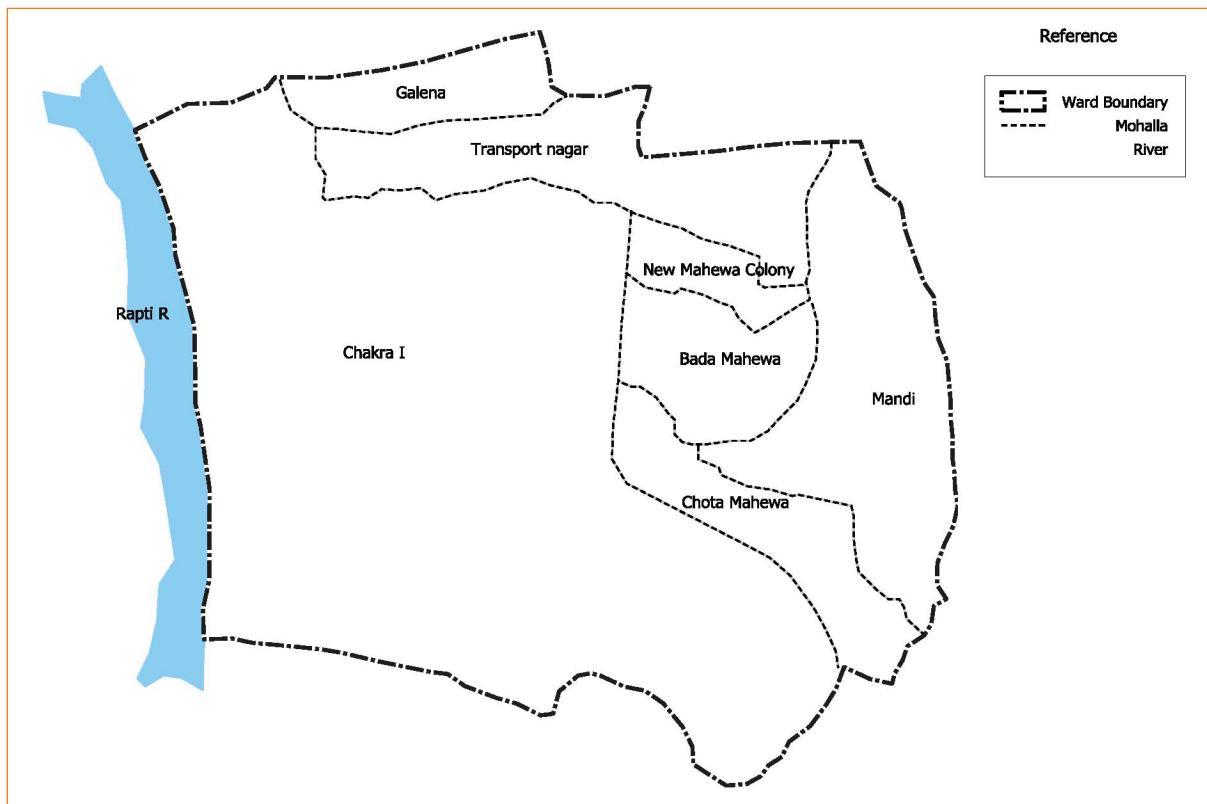
Gorakhpur has 70 Municipal wards of different socio-economic and climatic expositions. Each ward has differential risks to climate and vulnerability of people. The city resilience strategy defined criteria to identify the most climate-affected wards, and address the vulnerabilities of systems and people therein. The underlying assumption was that once the vulnerabilities of the intervention ward were addressed and functional resilience achieved, the municipal corporation could take up resilience planning as a planning management tool for Gorakhpur.

This led to the identification of the criteria below:

- Maximum exposure to climate change impacts, such as excess precipitation, impact of natural disasters, etc.
- Possibilities of infrastructure development and related investments
- Inhabited by large population of urban poor
- Presence of open areas and natural ecosystem

GEAG and the CSC found Mahewa ward to be highly prone to climate change risks, where the municipal corporation had not fully developed basic services, and residents are socio-economically weak.

Figure 11: Mahewa ward map



Mahewa ward best represented the city in terms of its topography and geography (Figure 10) and was suffering from the problems identified in the vulnerability assessment at the city level. Given its location on a gentle slope down to the Rapti river, it is prone to floods and waterlogging. The nature of flooding and waterlogging events has become uncertain in terms of when they may occur, and the depth and duration of water stagnation. Such conditions, coupled with poor drainage and sewerage systems, have aggravated the incidence of water- and vector-borne diseases and contamination of ground water beyond permissible limits.

These problems have worsened the living conditions of the ward's residents. Mahewa comprises lower-income households, with limited access to municipal services, and poor quality infrastructure. The initiatives started with an understanding of the hazards, their causes, and the role of the community, district administration and Municipal Corporation in the ward.

Historically, GEAG had worked in rural settings, and they approached Mahewa in a similar manner as they did their rural work. In rural settings, GEAG could usually organise people to come together to talk, discuss and work through issues, and take action. In the urban setting, however, GEAG found that there was little social capital and low social cohesion within neighbourhoods. The first line of action was to talk with neighbourhood members and identify issues around which people would organise.

Using these issues as catalysts for engagement, GEAG convened and worked with the Mahewa neighbourhoods to build local-level institutions, such as neighbourhood committees, thematic committees and ward-level committees and frameworks for governance. These allowed people to organise themselves, clean and repair blocked drains, clear and plant empty spaces, and set up a composting system for organic solid waste that provided fertiliser for fields.

Before implementing the micro-planning process, however, how to introduce the term '**climate resilience**' was thought through carefully. It was obvious that this term would not be commonly understood by local people or even local municipal officers and government departments, so the issue of resilience had to be framed in a way that everyone could easily understand. While engaging with the community, discussions were framed around issues such as the rise and fall in temperatures in the past decade or changes in rainfall patterns, which people could relate to and share how they have coped with such seasonal changes in their daily lives and livelihoods.

5. Institutionalising micro resilience planning

Institutional relations are central factors that influence the resilience of systems and agents in many ways. The institutional characteristics that contribute to resilience in urban areas are poorly understood.

In Mahewa, the baseline survey that was done before the resilience planning process determined that collaborative actions at the local level were required to address the multiple challenges that the ward faced and accordingly build resilience. The participatory process would ensure that the community's priorities and needs emerged and were addressed.

Thus, the process of community mobilisation and participation in resilience building was initiated. Community institutions were formed at three levels: **neighbourhood, thematic** and **ward**. These institutions were formed with the agreement and participation of the community, with GEAG playing the role of facilitator. The process included people who had local influence, were articulate and were interested in taking part in the committee. Membership was voluntary where people came forward and depending on their subject of interest chose to be in a particular committee. Meetings of all the committees are held on a monthly basis.

The concept of institution building in the case of resilience planning in Mahewa was based on Elinor Ostrom's eight principles of institution building summarised below (Ostrom, 1992). These were adapted for local application in Mahewa.

1. **Clearly defined boundaries:** The three tiers of community institutions that were formed in Mahewa bear clearly defined boundaries (figure 13). The GMC has demarcated six neighbourhoods in Mahewa and these boundaries were used to form six community groups at the **neighbourhood level**. The community groups are mobilised on six commonly-identified problematic themes, which are the operational boundaries for the six **thematic-level institutions**. Lastly, the **ward-level committee** comprises members from the thematic committees and is headed by the ward corporator. All the institutions formed at various levels have set boundaries within which they operate, and the functions of each institution are clear to the members of the institutions.
2. **Proportional equivalence between costs and benefits:** Each institution at each level has clearly defined rules specifying the amount of resource required or to be used for particular work that members plan to do. It is agreed that the monetary benefits gained by any initiative will be used for the benefit of that institution's work.
3. **Collective choice mechanisms:** Every member in the institution has the right to contribute to the decision-making process. In Mahewa's case, collective decision-making is made at three levels: at the constitutional level, where the rules have helped community members to create and constitute themselves as an institution; the collective decision-making process; and at the operational level. At each level, the members' right to take part is protected.
4. **Monitoring:** The institutions have working rules that their members define. The members also help to monitor one another's activities. All members are aware that others are watching them, and that not complying with the rules would be noted and followed by penalties, which creates the incentive to follow the rules strictly.
5. **Graduated sanctions:** The institutions have set rules for the action to be taken if a member breaks a rule. The member is likely to receive graduated sanctions, depending on the seriousness and context of the offence. For example, the

committee members place a red mark on the houses of people who do not give waste to the waste collector, and instead throw into the road, which makes the surroundings dirty. So far, the red mark has been sufficient to motivate people to correct their behaviour. The Committee has decided, however, that if this does not result in a positive change in behaviour, it will impose a monetary fine and put this towards improving services, and operational and maintenance costs.

6. **Conflict resolution mechanisms:** The community has also set procedures for settling disputes in each institution, should the need arise.
7. **Basic recognition of rights to organise:** The rights of the members to organise themselves as institutions through their own rulemaking, and to enable them to work in groups, are protected. User groups are helped to gain recognition as legitimate groups from banks, government administration and judicial bodies.
8. **Nested enterprises:** Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises. Small groups have to be nested within bigger groups or with other bodies to give them the protection and support they need.

The role of these institutions is particularly important in strengthening the adaptive capacities of the agents and in turn, increasing resilience. These institutions will reduce uncertainty and maintain the continuity of interventions in the long run.

5.1 Ward-level institutional structure

The institutional framework established in Mahewa addresses the challenges that climate change poses through an innovative, decentralised urban management solution that uses bottom-up approaches. The process has helped to develop thematic community institutions and ward-level micro-planning, and to implement activities that local communities have prioritised themselves – especially the poor and marginalised. It also links various relevant programmes.

GEAG carried out a comprehensive baseline survey in Mahewa using quantitative and qualitative methods to collect data and information. Participatory tools, such as PLA exercises, were used to gather the required information. The process of conducting the survey, which covered 90 percent of the ward's population, helped to build an initial rapport with the community and gain people's confidence.

The aim of the survey was to assess the risk factors and intensity of impact of climate change in the lives and livelihoods of residents. GEAG conducted six community consultations in the different Mahewa neighbourhoods, and the residents participated with high response rates and support in all the consultations.

The baseline survey informed a set of action points that were required to build resilience to changing climate patterns. These are summarised as below:

- Mobilise community members and unite them around common interests.
 - Design and build low-cost housing in waterlogged areas.
 - Introduce climate-resilient agriculture planning and techniques (e.g. time and space management, multi-tier cropping, crop cycle management, adoption of water-resistant crops, integrated farming, waste recycling and training of farmers, etc.) for waterlogged farm areas using climate information. This information is collected from GEAG's weather station and disseminated through mobile phone messages on a regular basis. Plan decentralised management of storm water drainage system.
 - Design low-cost raised community toilet and establish links with banks for households interested in construction of such toilets.
 - Implement decentralised solid waste management at the neighbourhood level, with community support.
 - Raise awareness about safe drinking water, purification methods, sanitation and disease reduction at the household level.
-

- Liaise with the GMC to enhance connectivity of municipal water supply through local demand.
- Monitor drinking water quality with potable kits, and raise platforms for India Mark-II handpumps to allow access to safe drinking water at times of flood/waterlogging.
- Constitute a ward-level committee, as per 74th Constitutional Amendments Act, with representation from other institutions and active ward residents, to act as the decision-making institution at ward level.
- Constitute common interest group committees on: water and sanitation; community health; climate-resilient agriculture; decentralised drainage system; risk-resilient buildings (primary school, housing and community toilet); and livelihood improvement, specifically for women in slums.

Based on the outcomes of the baseline survey and the perceived needs of community members, the three tiers of self-governing community institutions were established by GEAG to build resilience at the neighbourhood, thematic and ward levels. A participatory process at the ward level, coupled with inclusion of current data on climate trends and change scenarios, ensured that community's priorities and needs, as well as current scientific information, were reflected in the planned interventions.

At the neighbourhood level, a differential strategy was proposed to address diverse patterns of occupation, income, family size and other socio-economic characteristics. Education and awareness on issues related to integrated farming, waste management and flood resilient construction was carried out with families. At the thematic level, community groups were mobilised around issues of common interest, such as health, water and sanitation, drainage, climate-resilient agriculture, risk-resilient building and micro-credit.

At the ward level, the ward-level committee focused on issues such as the provision and maintenance of municipal services, and conservation of natural water bodies. This ward-level committee was also the nodal point for climate scientists and city planning experts to establish relations and ongoing involvement in planning from the start of the resilience process.

Neighbourhood committee

The GMC has demarcated six neighbourhoods, known as *Mohallas*. The baseline survey conducted in these neighbourhoods was a strategic opportunity to build a rapport with community members and gain their confidence. With the initiation of the micro-resilience planning process, GEAG organised open meetings with community members, and a committee of 12 members was formed in each neighbourhood. The committees comprise willing community members who want to implement initiatives to improve conditions in Mahewa.

One of the main tasks of the neighbourhood committees is to carry out needs assessments of problems and identify issues that increase the impacts of climate change. Given that committee members come from the local community, they also function as catalytic agents to mobilise other community members, and raise awareness about problems and how to deal with them. The neighbourhood committees hold monthly meetings to discuss these issues.

Community consultations and the baseline survey identified six issues that contributed to Mahewa's vulnerability. The neighbourhood committees allocated responsibility for each issue to two-member teams. The distribution of issues was done in consultation with all the committee members, and members chose issues based on their interests and expertise.

Thematic committee

Six thematic committees collate the issues and problems of the six neighbourhoods in Mahewa ward. Two members from each of the six neighbourhood committees come together to make up the 12-member thematic committees on:

- Water and sanitation
- Community health

- Climate-resilient agriculture
- A decentralised drainage system
- Livelihood opportunities, especially for slum women
- Risk-resilient building

The thematic committees also meet on a monthly basis to discuss the problems of the ward. For example, the Drainage Committee discusses the drainage problems of all six neighbourhoods and discusses how to improve the situation. The thematic-level committees have established their rules and regulations in consultation with the community members for effective functioning. For example, the Water and Sanitation Committee has set a fee of Rs10 (\$0.162) that community members have to pay for door-to-door collection of solid waste.

Box 5: Key tasks of thematic committees

Climate-resilient agriculture

- Inform farmers about weather forecasts.
- Organise meetings with farmers' groups.
- Disseminate information on new agricultural techniques.

Water and sanitation (WatSan)

- Monitor GMC's tasks.
- Ensure proper dustbins are available for collection of garbage. In case of problems, lobby with the GMC for provision of such facilities.
- Supervise management of solid waste in the ward.
- Raise community awareness about the importance of toilets.
- Raise community awareness about the importance of safe drinking water.
- Support community members in getting water supply connections.
- Raise community awareness about conserving Mahewa's water bodies.

Community health

- Identify health problems in the ward and prioritise them at meetings.
- Meet concerned health department officials regarding prioritised health issues.
- Advocate regular visits by health visitors from health check post.
- Develop relations with health visitors and monitor their functions.
- Organise health camps to ensure good health and better quality of life for community members and raise awareness about related issues.
- Investigate alternative options for better health services.

Decentralised drainage system

- Make efforts to sensitise people and raise awareness on covering drains.
- Lobby with concerned municipal departments to remove silt and repair damaged drains.
- Raise community awareness about stopping throwing waste into drains
- Ensure community participation when drain repairs or construction work are being carried out.

Risk-resilient building

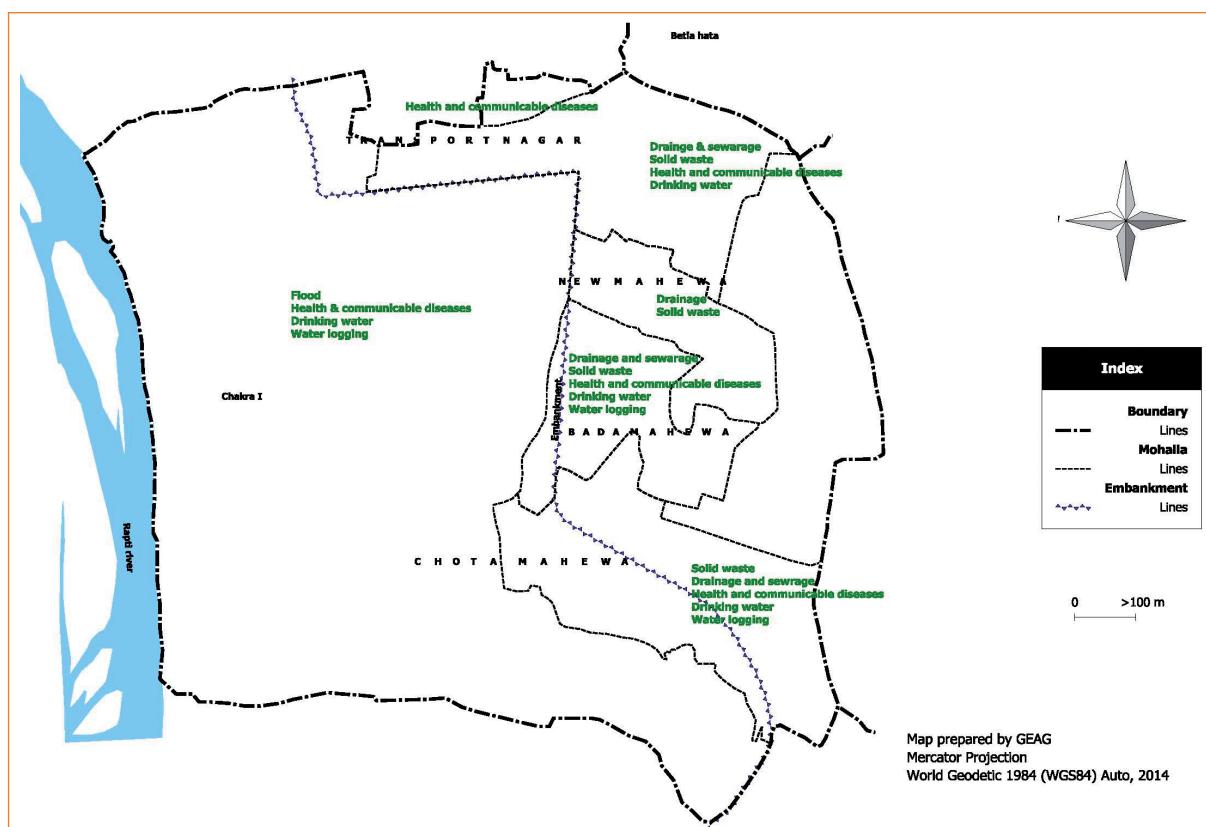
- Selection of public land for construction of a demonstration risk resilient building. Despite consistent efforts with the GMC, land was not made available for this purpose. Hence, the committee chose the land of the poorest resident of Mahewa to build the demonstration house for him to live in.
- Contribution in the construction plan of the building
- Support during the construction of the building

Livelihood opportunities, especially for slum women

- Detailed household survey was conducted
- Needs assessment of slum women was carried out
- Linkage of women with small entrepreneurial activities underway.

Figure 12 highlights the intra-ward problems that emerged in different neighbourhoods of Mahewa.

Figure 12: Mahewa ward: intra-ward problem patterns



Ward committee

Two members from each of the thematic committees form the 12-member ward committee, which the ward corporator heads. The committee implements the plans and actions decided by the thematic-level committees. The ward committee takes stock of the issues under each theme and develops action plans to address them. Based on the problems and need, the ward committee plan shows to generate resources. The ward committee also liaises with government bodies such as Nagar Nigam, the GMC and other elected representatives, whenever their support is required. Regular monitoring is another important task of the ward committee to ensure that actions are properly implemented, and that regular progress updates are shared with the thematic committees.

5.2 City-level institutional structure level and convergence with ward-level institutions

Similar to the institutional framework at the ward level, institutions were also formed at the city level. Six committees on the same issues as in Mahewa were formed, which comprised city residents, academics, doctors and government officials. These committees meet the Mahewa ward committee on a ward basis.

They disseminate experiences from Mahewa to city-level departments and organisations in other wards that are dealing similar problems, and organise exposure visits, thematic platforms to share learning, and publication of information.

Figure 13 shows the convergence between the bodies.

The CSC acts as an advisory body at the ward level, and provides feasible solutions and resources. For example to conduct the health camps in Mahewa, city doctors were mobilised to provide free check-ups for Mahewa residents. This was possible because of the convergence established between the ward-level and city-level committees.

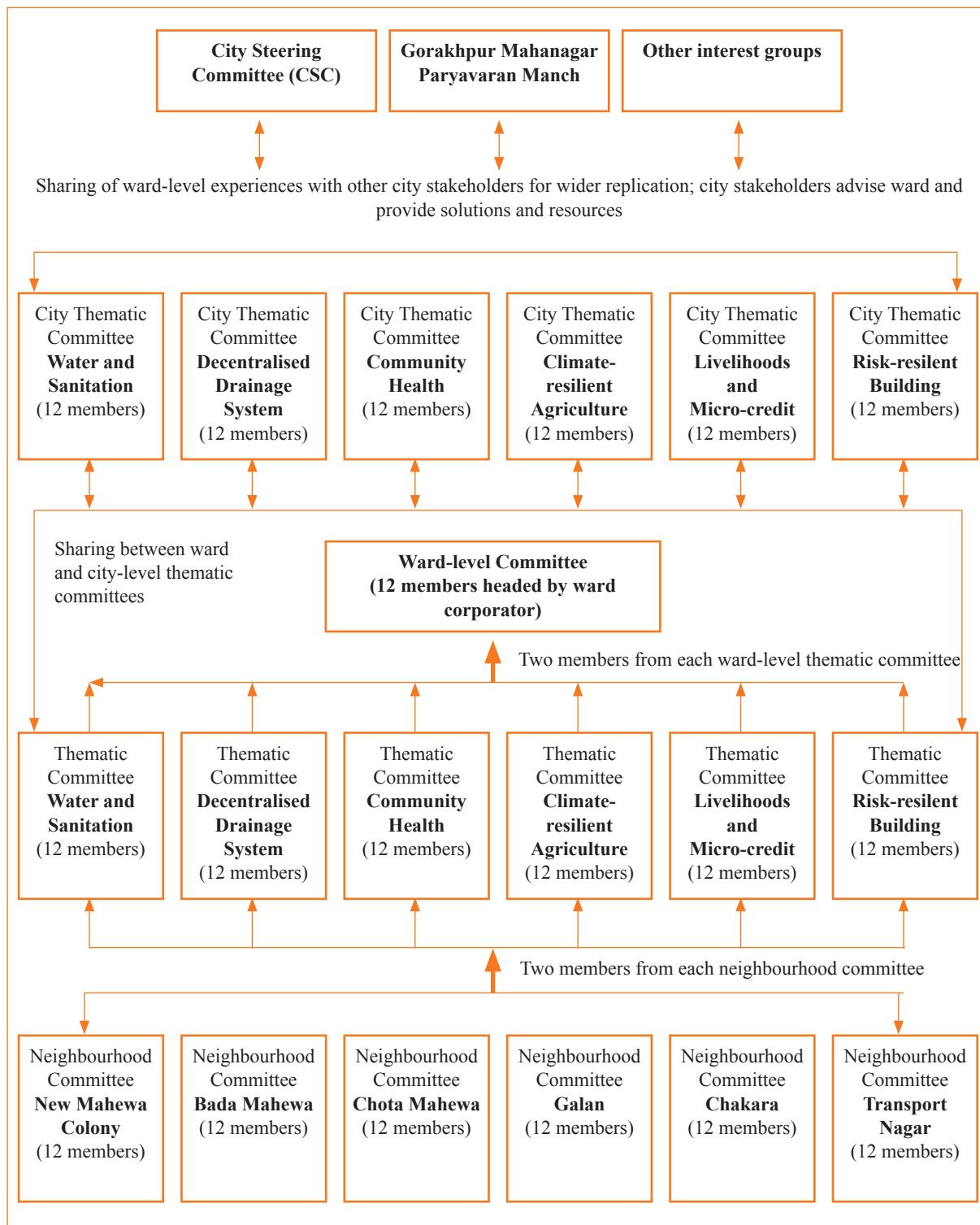
The ward-level committees are in constant dialogue with the city-level committees for advocacy and resource mobilisation through Member of Parliament (MPs), Member of Legislative Assembly (MLAs), Municipal Corporation and government departments –for example, liaising with the agriculture department to subsidise farmers who practise climate-resilient agriculture in Mahewa.

One of the significant achievements of advocating the Mahewa experiences at the city level has been that the District Disaster Management Authority (DDMA) of Gorakhpur has adopted Mahewa ward as a live model for climate change adaptation and disaster risk reduction.

Another important outcome of this has been the integration of climate resilience aspects in ARUP's City Drainage Plan for Gorakhpur, based on the experiences of decentralised drainage management in Mahewa. This is a significant contribution to the city's planning process, which the city government will consider for approval.

Experiences from the ward are also shared in a continuous learning mode with other city stakeholders, such as the Mahanagar Paryavaran Sanrakshan Manch, the elected corporators in other city wards, and other interest groups.

Figure 13: Convergence between ward- and city-level institutions for micro-resilience planning



5.3 Community initiatives through institutions

Community institutions are taking a lead role in the management of problems in Mahewa. The thematic committees and the ward committee have taken up several initiatives, which have shown results in improving the lives and livelihoods of Mahewa residents. Examples are listed below.

Water and sanitation

The Water and Sanitation committee addresses solid waste management and water quality in Mahewa.

Solid waste management (SWM)

The pilot project on decentralised solid waste management following the vulnerability assessment showed that community participation had a direct bearing on efficient SWM. This was applied throughout the ward.

The municipal authorities had failed to mobilise the community and educate residents on the rudiments of handling waste and proper practices of storing it in their own bins at home and in shops and other establishments. In the absence of a basic facility for collection of waste at source, residents dumped waste on the streets, in open spaces, drains and nearby water bodies, which created insanitary conditions.

Residents assumed that GMC street sweepers would pick up the waste, but it was not the case, because of a lack of good governance in the ward and of financial and human capacities. Moreover, Mahewa's development was not a priority for the GMC and basic services were very poor.

It was felt that this problem could be overcome by raising community awareness and coming up with a plan to manage the solid waste through community participation. A 12-member water and sanitation committee was formed, which used a participatory causal loop diagram (CLD) to understand the variables that made up the problem. The CLD exercise inferred that the problems of SWM, drainage and waterlogging are all interlinked. It also put the causes of the problems into three categories – natural, behavioural and policy related.

The initiative started with an effort to get government land for a waste management site. The choice of government land was disputed, and so community members came forward and offered their land free of charge to establish three SWM units. This was a significant achievement for the whole community.

Each SWM unit has appointed two workers to collect waste door-to-door every morning. They separate biodegradable kitchen waste for composting. The non-degradable waste is given to rag pickers to sell and the remainder is disposed of safely.

In Mahewa, drums are used to convert biodegradable waste in compost. The drums are adaptable and can be relocated during waterlogged periods. The kitchen waste is mixed with a bacterial culture in porous bags, which are then placed in the drums. After 24 hours, a liquid is produced that is siphoned off and used as liquid manure. After 14 days, the remaining waste has been converted into compost.

The water and sanitation thematic committee oversees the whole process, which includes appointing workers, monitoring the waste collection and separation and composting process, as well as looking after the regular sweeping of roads and cleaning of drains by GMC employees.

The committee, in consultation with community members, has fixed a monthly fee of Rs10 that every household pays. This is a small contribution towards making the process sustainable, which is in line with Ostrom's principles. The committee also runs awareness-raising campaigns on sanitation, restricting the use of plastics, and generating resources and funds for SWM sustainability.

The initiative has improved sanitation in the ward, and most of the drains are now free of garbage. Local farmers are using the liquid and solid composts, which have raised the yield capacity of the soil and act as a bio-pesticide to protect crops from pests.

This method of SWM with people's participation has proved to be an effective model for keeping the environment and surroundings clean, which may be adopted by other wards in the city.

Drinking water quality surveillance and awareness

For a long time, the GMC used Mahewa as a dumping ground, because it is a low-lying area, which resulted in severe contamination of groundwater. Community groups revealed that water from the hand pumps was not potable, and would often cause outbreaks of water-borne diseases, especially during the monsoon season.

People in the ward were unaware of the connection between water and ill-health, because of low levels of literacy, poverty and lack of awareness. To make people aware of the unsafe drinking water in their ward, GEAG established a water testing laboratory. Water samples from various sources, such as shallow-and deep-bore hand pumps, piped water and bore wells were collected from different parts of the ward and their physical and chemical attributes tested during pre- and post-monsoon season.

The results were shared at community group meetings and with the ward committee to raise awareness of water quality issues and lobby for safe access to water. In addition, committee members carry out regular awareness campaigns, especially during the monsoon season. Consequently, more than 300 households have adopted preventive measures in their homes, such as filter/reverse osmosis systems. Community members have seen that access to safe water has reduced the incidence of water-borne diseases, diarrhoea, vomiting and fever.

Committee members have consistently lobbied the local administration. A public protest at the water works department (JalKal) compelled the department to improve safe drinking water facilities in Mahewa. The department extended the water supply pipeline by 667m into the previously unserved area of the ward and 35 households registered for new connections.

Residents identified five deep-bore hand pumps that were regularly waterlogged. GEAG provided financial support to build a platform to ensure safe drinking water during floods. The community contributed in kind by providing labour and supervision, and agreed to take on operation and maintenance costs as required. Today, approximately 900 households now have access to clean and safe drinking water because of this initiative, with clear impacts on the health of residents, especially children.

Decentralised drainage system

Lack of drainage infrastructure has been a serious problem in Mahewa. That which existed was poorly maintained, and did not meet the right design standards to provide protection from floods. Storm water drains were blocked with garbage preventing the flow of storm water during monsoons.

"Since the last 10 years, this community was facing acute problems of waterlogging, which used to disturb our lives completely for months. Children's attendance in the school used to get affected and hence their education. This has been a tremendous achievement for us to see a monsoon season without any waterlogging on the roads!"

Mr S.B. Drivedi, New Mahewa Colony

Members of the drainage thematic committee conducted a reconnaissance survey of the whole area and convened a meeting to find appropriate solutions to this long-standing problem. The meeting identified locations that were prone to waterlogging were identified. Following discussions with local people, five sites were strategically chose for retrofitting of the existing drains to help reduce waterlogging after rains.

"Earlier, the entire road used to get waterlogged. There was no outlet for the water to flow away. Sometimes the water used to stay until 2-3 months. I used to face problems in commuting outside. I used to lift my sari and cover my face and wade through the dirty waters. The renovated drains are a blessing for me and this community."

Ms Anuradha Devi, BadaMahewa

The drainage thematic committee organised rigorous meetings with local residents of Mahewa and motivated them to participate in solving this problem. After initial inhibitions and questions, the residents came forward to contribute cash

or to provide labour for construction/repair of the drains at selected points. The committee finalised a plan and estimated budget, and with community support retrofitted 751 metres of drains.

This activity has had a major impact on the residents of Mahewa. The entire area that used to be waterlogged for months at a time every year remained free from waterlogging even during heavy rains (517mm) in September 2012. About 4,000 people have benefitted directly or indirectly. The GMC also built roads and drains in other parts of the ward following requests from the community and corporator.

Climate-resilient agriculture

About 14 percent of Mahewa is agricultural. Small and marginal farmers mostly grow cash crops, such as vegetables for the nearby wholesale market, which are more susceptible to unfavourable weather conditions. At times of flooding and waterlogging, the farmers used to face acute problems from crop damage, which compelled them to sell their land and change their livelihood.

GEAG taught farmers about resilient farming systems for waterlogged conditions, and provided training in time and space management of crops, crop diversification, multi-tier farming systems, and the integration of animal husbandry to mitigate the impacts of climate change and reduce agricultural input costs. The interested and motivated farmers have adopted these resilient farming methods and can grow produce even in waterlogged farms.

“My agricultural land is in a low-lying area in Bada Mahewa, which used to be waterlogged for several months during [the] rainy season. Due to intensive waterlogging, my crops used to get spoilt and I used to suffer huge losses. With the intervention of GEAG, I learnt about new techniques of time and space management in crops, crop diversification and multi-tier farming system. These techniques have helped me to get a good harvest even in times of waterlogging. There is a potential market nearby and I am able to sell my produce, which is mostly vegetables, at a good price.”

“Also, I have understood the harmful effects of chemical fertilisers and pesticides. Now, I use the liquid pesticide, which comes out of the solid waste management unit, and apply [it] in my crops. This has been very effective, as my crops are not infested by certain flies and insects and they are healthier. Moreover, I am able to save money as I do not buy chemical pesticides. I want to learn more and try improved techniques in my crops.”

Ms Indrawati Devi, Model Farmer, BadaMahewa

Ten farmers were taught how to create elevated seed beds in poly tunnels, to raise vegetable nurseries during monsoon periods when their fields are waterlogged, for planting out as soon as the fields are free from water inundation. Climber varieties of vegetable (e.g. sponge gourd and bottle gourd) were planted with of *dhaicha* (*Sesbania aculeata*), which is a good source of green manure. It increases the nitrogen content in the soil and can be used for fuel during the rainy season. The adoption of these climate-resilient farming practices has allowed good yields even during adverse conditions.

Community health

The main causes of outbreaks of water- and vector-borne disease in Mahewa are: poor sanitation; unmanaged solid waste dumped in low-lying areas; poor awareness about health and hygiene; mass defecation in the open; mosquitoes and flies breeding in and around stagnant water; and the use of contaminated groundwater for drinking.

The community health committee was constituted to improve health-related issues in the ward. It has carried out regular awareness campaigns about hand washing, general hygiene, preventive care for various communicable and water- and vector-borne diseases, and immunisation. At health awareness camps, local people were given information, education and communication (IEC) materials on the causes of water- and vector-borne diseases and preventive measures through, and counselled by competent city doctors.

"There were serious concerns when it came to the health of the community members especially infants and children in Mahewa. Waterlogged areas were the breeding grounds for flies, mosquitoes and other insects which used to give birth to many diseases such as diarrhoea, cholera, malaria, etc. Since the waterlogging problem has been solved, we have noticed that incidences of diarrhoea, cholera and malaria have considerably reduced. In general, the health conditions of people have improved as people have become aware that clean surroundings are a must for better health conditions."

Mr Sant Raj Sharma, New Mahewa Colony

Children and pregnant and lactating women were reached by taking information door to door, and routine vaccinations arranged on pre-determined dates. Referrals to specialist doctors were made. About 210 women and adolescent girls were trained in disseminating information about health and hygiene to the entire community.

Risk-resilient buildings

This initiative develops housing for people in flood-prone areas who lack the capacity to build houses for themselves. A low-cost demonstration building is being constructed, with technical support from Delhi-based NGO SEEDS India. A construction training manual is also being developed. The house's design could be considered for future government housing schemes.

Livelihood opportunities for women in slums

A training needs assessment looked at the livelihood opportunities for women in two slums. Adolescent girls who were interested in sewing and stitching were admitted to a charity school that provided free training. And, based on their skills and interests, 40 households were linked with micro-finance institutions for entrepreneurship.

Gorakhpur Rural Banks in the process of approving loans to women showed an interest in animal husbandry, such as raising goats and pigs. At an orientation meeting, the manager of Grameen Banks provided information about banks' schemes and to get the maximum benefit from them. As an outcome of this meeting, common interest groups have been formed to administer financial support from the bank.

These community institutions have gained strength over the course of the past two years and are now on their own. They need occasional support from GEAG, but most of the time, they hold meetings and find their own solutions to specific problems that the ward is facing.

The process of forming community institutions and proposing initiatives that have shown results has increased the confidence levels of committee members, as well as of the residents of Mahewa. They feel empowered, informed and confident about handling their problems systematically. In the event of a problem, they are able to reach out to the GMC with confidence and ensure that corporation staffs deal with the problem promptly.

At the same time, the GMC has started to respond to the needs and issues of Mahewa residents. The uniqueness of the whole initiative lies in its adoption and methodology, building resilience at the local level and making the system responsive and accountable.

The 74th Constitutional Amendment provides for the devolution of planning funds, functions and administration (including the technical expertise of various departments) to municipal corporations. Yet, in practice, the progress of devolution and decentralisation has been slow in India.

The Amendment aims for municipal corporations to perform all functions related to planning and governance, but major institutional restructuring will be required before this is possible. The limited capacities of municipal corporations mean that the implementation of institutional reforms, such as the Amendment, has been delayed.

The system of decentralised and bottom-up planning in Mahewa provides a model of public participation that involves the ward corporator, municipal corporation, other government officials and residents in ensuring the provision of basic services.

6. Impacts and sustainability

The micro-resilience planning process in Mahewa has raised broader awareness among diverse audiences and generating initiatives that benefit vulnerable groups. The vulnerability assessment, broad community engagement at the ward and city levels and resilience initiatives focused directly on the issues of poverty and vulnerability, and addressed the problems of the poor and marginalised that climatic changes have caused. The pilot initiative has addressed all three key aspects of urban resilience: institutions, systems and agents.

The major lesson drawn from this participatory approach towards building micro-resilience is that in urban settings of secondary cities with weak governance (institutions) and poor status of basic urban infrastructure (systems), the key strategy is to invest in people (agents). It is through their organisation and, in turn, capacity building and needs-based informed advocacy that the required resources can be appropriately deployed and services improved to achieve better resilience. Local resources may also be identified and generated through schemes and community contribution.

Collective understanding on climate change resilience

The micro-resilience planning, through its participatory methodologies, was quite successful in developing a collective understanding on climate change resilience in the community. The term ‘resilience’ was rarely used to develop this understanding. Instead, through more relevant local examples, the idea of building resilience was passed on to community members.

Provision of basic services

With the empowerment of the community members in Mahewa and active leadership of local-level institutions, provision of basic services was ensured. Liaison with Nagar Nigam and other government officials was done by the ward-level committee members for efficient delivery of services in the ward.

Mahewa, award that was never on the GMC’s list of priorities, began to receive attention when residents started voicing their problems and taking action to ensure that their rights and entitlements were respected and fulfilled. GMC workers are on good terms with the Mahewa ward-level committee members and deal with problems in the ward at the request of the committee members, which was never the case before.

Improved governance

The resilience-planning process improved governance in the ward. Though the government was functional, the ward had suffered from a lack of good governance. People’s participation and initiatives to solve their own problems, with the involvement of the ward corporator, was a step towards resolving this.

For example, although there is a ward-level government health centre, health visitors did not visit all neighbourhoods to immunise children as regularly as was required. Thanks to the efforts of community members, they streamlined health visits to every household in the ward were streamlined, record-keeping of immunisations, and ensured that every child in the ward was immunised.

Links between climate change and development mechanisms

The constant dialogue and sharing between the ward-level committees and city-level institutions, including the CSC, has ensured an understanding of links between climate change and development mechanisms in a city. They established a direct relationship between the two that city government officials had not previously accepted. City planners and government officials have begun to understand that infrastructure planning and development should be forward thinking, keeping in mind the adversities that the climate change may bring to Gorakhpur.

The links between climate change and development mechanisms can be seen from two different perspectives in this case. Firstly, at the ward level, an understanding of the impacts of climate change has developed among the community members. This understanding may not be a highly scientific one, but the community sees that there have been climatic changes in terms of rainfall and temperature over the past few decades and they can relate these to impacts on their lives and livelihoods.

The six development themes that were selected for interventions were implemented through a forward-thinking process in relation to climate change. The process assessed the impacts on agriculture, health, solid waste, water and sanitation, and planned implementation in consultation with the community members.

Secondly, at the city level, the Mahanagar Paryavaran Sanrakshan Manch has provided advocacy on the future impacts of climate change, and the development mechanisms that will be required to minimise its impacts on Gorakhpur's residents. The GMC has prepared a drainage plan for the city, which is awaiting approval from the State and National Government. The city-level institutions and GEAG strongly advocate that changes to the drainage plan should be made with climate projections in mind.

Ownership and empowerment

Community members and institutions have together taken ownership of problems and devised solutions accordingly, in line with Ostrom's (1992) principles of institution building. Through their involvement in the whole process from the outset, the community members and institutions are empowered to take collective action and approach the city authorities to mobilise of resources. By seeing the positive outcomes of their work, they are motivated to continue this work irrespective of GEAG's presence in the ward. Plans for community contribution in some of the interventions will become more formalised, which will enhance the sense of ownership and responsibility.

Lobbying local government for scaling-up

Through public demonstrations in Mahewa, the community and GEAG have successfully lobbied the city government to expand and build on these efforts. Mahewa's success was attributed to having assembled a critical mass of residents who were willing to speak on their own behalf, and to making clear, easy-to-implement service requests. GEAG is now using the combined results of community and city involvement to disseminate and replicate this approach in other wards around the city.

7. Dissemination and replication

The process of piloting a micro-resilience plan at the ward level using participatory methodologies has highlighted relevant insights and practical experiences to consider for replication in similar urban settings. It is important to recognise that resilience is a characteristic of systems, agents and institutions that evolves dynamically over time. It cannot be achieved in a time-bound programme. It is imperative that it is internalised as a core objective that governments and other agents strive for as an integral part of their ongoing activities.

GEAG has an important role in disseminating the outcomes and impacts of this micro-resilience building process. Some of the initiatives taken in this regard are highlighted below.

Media engagement

Print and electronic media were engaged to cover stories of people-led processes in the Mahewa to plan resilience against climate change. Several case studies and experiences were documented and shared at various city-level fora, which included the CSC, Mahanagar Paryavaran Sanrakshan Manch, DDMA, Rotary Club and Masonic Lodge.

One-to-one meetings were held with ward corporators, residents, municipal authorities and other officials at the city level to disseminate the outcomes of the pilot programme. This led to various discussions about using experiences from Mahewa to implement elsewhere, in sectors such as housing, SWM (including in institutions such as hotels, prisons and railways) and urban agriculture.

Tools used for media engagement included dissemination of the City Resilience Strategy, vision sheets, thematic papers, media reports, campaign materials (posters, handbills, and stickers), and a film, Tales of Gorakhpur.

Dissemination through participation in national and international events

Beyond the level of Gorakhpur city, lessons from Mahewa ward have been shared at national forums, including the Delhi Sustainable Development Summit (DSDS), National Institute of Disaster Management (NIDM), Lal Bahadur Shastri National Academy of Administration (LBSNAA), and the National Institute of Urban Affairs (NIUA). The experiences have been also shared at various international platforms, such as the Resilient Cities Congress, Bonn, and in various documents and position papers internationally.

Replication and scaling-up

The first step in the scaling-up process has been that the outcomes and impacts of the whole initiative have given birth to other similar efforts. The District Disaster Management Plan (DDMP) has adopted Mahewa ward as a model for its Urban Disaster Risk Reduction initiative.

Following the successful implementation of the micro-resilience building process in Mahewa, GEAG is scaling up these experiences in three more Indian cities – Jorhat in Assam, Saharsa in Bihar and Bashirhat in West Bengal. Initiatives, such as the Climate Resilient Shelter under the Climate Development Knowledge Network (CDKN); linking disaster risk reduction and climate change and developing plans accordingly at the district level (CDKN-START); and peri-urban agriculture and Decentralised Wastewater Treatment Systems (DEWATS) under ACCCRN are a few examples that reflect the replication of outcomes from the Mahewa experience.

Various advocacy efforts have also been initiated by GEAG at the state (Uttar Pradesh) level with the involvement of the State Disaster Management Authority (SDMA) and Uttar Pradesh Academy of Administration and Management (UPAAM) towards urban disaster risk reduction, to influence state climate policy by placing more emphasis on the urban context.

8. Challenges

The process of establishing a community-owned micro-resilience planning model in Mahewa was a daunting task. GEAG faced a number of challenges:

Agents

1. The foremost challenge related to behavioural change. Behavioural change in the short term is a major challenge, but motivation and sensitisation to inculcate a sense of duty and responsibility through regular dialogue helped to change the mindset and behaviour of community members. This was clearly apparent from the adoption of sanitation, safe drinking water and preventive measures against water- and vector-borne diseases. Initially, people in Mahewa ward were suspicious about the entire initiative, but through consistent efforts, GEAG gained their confidence and the community ultimately responded positively.
2. Getting communities, municipal officials and elected representatives to recognise climate change as an issue was another challenge that the pilot addressed. The popular perception of climate change is generally at the macro level, where it is associated with melting glaciers, sea level rise, global warming and so on, which the media and national debates shape. Micro-level events are very often ignored. Local communities, however, see the effects of climate change when it is related to trends in rainfall patterns, temperature abnormalities during the year, increased humidity and waterlogging (amount and duration), and the possible impacts in the light of climate projection scenarios. SLDs with different stakeholders were helpful in this regard. Local responses can be enhanced if climate change is framed in a local context.
3. Resource constraints were an obstacle in improving basic services and resilience measures such as drainage and SWM. The lack of local leadership and platforms for communities to come together restricted collective thinking and actions. The thematic and spatial community institutions helped to address this challenge, and created a platform where issues were discussed and community champions came forward to lead the actions. Communities contributed in kind (through labour), and also collectively approached municipal authorities and local politicians for needed resources. Strong advocacy on the part of community members helped in identifying possible approaches.
4. Urban communities are more heterogeneous compared to rural communities. On occasion, GEAG observed a clash of interests among the various socio-economic groups in the ward. Whereas poorer households depend more on public utilities, such as community toilets and public hand pumps, the better-off prefer household-based services. The thematic institutions helped in such planning, where different groups came together on a common platform to plan interventions at the ward level and accommodate diverse interests.
5. The capacities of municipality workers in the technical aspects of bottom-up and community-led planning on issues such as vulnerability and resilience were quite low. This was a serious problem in dealing with emerging challenges in the city. Technical staff had very limited opportunity for exposure to such experiences. There are no provisions for conducting orientation or refresher courses for these staff nor is there an effective resource institution to provide information and training.

Systems

1. Availability of common land and green areas is a serious problem in the city, because of the lack of enforcement of regulatory provisions. Waterbodies, parks, orchards and green areas have gradually shrunk. The availability of land for public utilities –sewage treatment, SWM, schools, drainage, community toilets – has also gone down. In Mahewa, the committees at the ward level faced problems in getting public land to build SWM units and low-cost housing. Finally, community members came forward and willingly donated their land for these purposes.
2. The formation of wards is neither done on the basis of natural topography nor any socio-economic or development criteria. The unplanned approach to city development means that new interventions face severe challenges, because effective planning for drainage and sewage management cannot be taken up at the ward level.
3. The non-availability of data on gradients, ecosystems, land use, green areas, water flows, climate, and so on, were a major challenge to planning processes. Efforts were needed to generate such data through studies and research, which were time consuming and resource intensive.

Institutions

1. In 1992, India took a significant step when the constitution was amended to provide enhanced autonomy to local institutions and devolution of power in governance. The 73rd and 74th Constitutional Amendments applied to rural and urban areas, respectively. The amendments provide space for planning and resource allocation at the lowest village and ward levels in rural and urban areas. The state of Uttar Pradesh adopted the 73rd Constitutional Amendment but has still to adopt the 74th Constitutional Amendment in urban areas. Ward-level micro-planning processes are much easier in states where provisions for bottom-up planning approaches are in place. The lack of such policy provision in Gorakhpur was a major hindrance in institutionalising resilience micro-planning.
2. In any community-driven process that needs formalisation and institutional mainstreaming, there is also a need for dialogue between people and institutions. Here, there is no formal or informal provision for such regular dialogue between residents and the municipal corporation. In places where surveillance and monitoring mechanisms are in place, the community has a say, even partially, and there is scope for dialogue. Unfortunately, it is not a common practice in most municipalities. Residents are not part of planning or service delivery processes. This also hinders the smooth flow of communication between community and service providers and affects positive dialogue between stakeholder groups.
3. Coordination between community members, basic service providers and elected representatives was an initial challenge. However, the identification of the causes of the prevailing problems through CLD exercises, possible remedial measures, dialogues on common platforms and the informed leadership of community institutions helped coordination. With the issues becoming the people's agenda for pressure, service providers and elected representatives also responded positively.
4. Political conflict is a major challenge in dealing with city development and resource mobilisation. Although municipalities are autonomous in terms of their development and resource use to a large extent, the resource crunch and a very high dependency on the state government is a reality. The national government funds several major urban schemes, such as the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Development Infrastructure Scheme for Small and Medium Towns (UDISMT). With the ruling parties being different at municipality, state and national level, however, there is a clear political bias in resource allocation from the state and national levels. Even in municipal corporations, a corporator may belong to one party and the mayor (elected directly by the people) to a different one. The municipal commissioner is a state government employee and he is directed by state government policies that may be dictated by a different political party again. Decision-making processes in city development become difficult in such situations.

9. Lessons learnt and conclusion

The notion of building urban climate resilience was an abstract one at the outset of this process and the tools and methodologies used to define and achieve it were novel. GEAG is expert in implementing programmes through participatory methodologies, but most of its work has been in rural settings. This was the first time that GEAG took up the challenge of piloting a climate change micro-resilience planning programme through participatory methodologies in an urban setting.

The pilot has shown encouraging results and the participatory methodologies used should ensure the long-term sustainability of the interventions. The entire process, however, has also highlighted lessons that should be considered when implementing similar initiatives to build micro-resilience plans against climate change. Some of the lessons learnt in the process are highlighted below.

Dynamic process

The process of building the micro-resilience plan was a dynamic one, which meant that many things changed during the course of implementation as the pilot progressed. The micro-resilience plan that GEAG developed on the basis of the vulnerability assessment done at the start initially served its purpose in initial actions. But with emerging changes in terms of capacity levels, infrastructure and maintenance situations, enhanced responsiveness from institutions, clash of interests, GEAG realised that it needed to change certain approaches and strategies. In the concluding phase of the pilot, it was clear that micro-resilience planning is a dynamic process, and plans need to be re-visited on a periodic basis and changes made where necessary. It is imperative to review actions and progress at each level of implementation.

Varying priorities

The urban population in secondary cities such as Gorakhpur is less homogenous compared to rural areas and bigger cities, especially at the level of a neighbourhood or ward. Variations in socio-economic class and priorities related to basic infrastructure and services also differ accordingly, and this should be kept in mind when carrying out micro-planning initiatives for resilience building. Whereas higher socio-economic groups can afford to bear the costs of individual services in their homes, poorer residents depend more on community and public services (toilets, drinking water wells), for which payments can be minimised. In Mahewa, however, GEAG observed that poorer households came forward more readily to contribute labour and in-kind contributions for the public good, because they were more vulnerable and most exposed to the problems – and opportunities – of common and public goods and services.

Community ownership

The planning and management of services and infrastructure is the sole responsibility of the municipal corporation and its related departments, as service providers. Local community members, especially the poor and marginalised, have no say in planning, setting priorities or decision making, and so neither services nor management are community owned. This causes apathy about the state of infrastructure and service provision, and a lack of transparency and trust. The work in Mahewa showed that community involvement has not only helped in planning and improving services, but also mobilised resource contributions. The formation of community institutions for various has begun to provide some indication of the sustainability for these efforts.

Scientific and future planning

Resources for urban development are often allocated based on historic data that, depending on its availability, may be inadequate. In this context, a top-down approach is followed, where the city is seen at the macro level. Local issues and problems are largely neglected, and community members are not consulted. The Mahewa interventions showed that proper planning that incorporated future projections of habitation patterns, population, climate and so on, was helpful. Although this is resource intensive, in the long term it is expected to be cost effective.

Data availability and capacity building

As mentioned above, the availability of authentic and well-maintained data is a serious problem. There is no assigned government department or academic institution to maintain the required data that can be made available to planners and researchers. Data collection processes have been initiated in JNNURM cities, but are severely lacking in secondary cities. For urban development and climate change resilience, it is important that authentic data is generated, collected, maintained and made available as and when required.

The capacity building of staff engaged in planning and providing services is also important, so that they are able to deliver services efficiently and meet the emerging challenges of climate change, increasing disaster impacts and fast-growing urbanisation. Regular orientation, exposure and training would be helpful in this regard. City-to-city exchanges would also help in learning the working tools and strategies of better-performing cities, as well as theme-specific exchanges for cities dealing with similar issues.

Climate change-Disaster risk reduction-Development links

Generally, in city planning processes, disaster management is not well considered. In cities such as Gorakhpur that are affected by floods and waterlogging, it is important that disaster management aspects are considered in developmental planning. In Gorakhpur, the climatic situation is shifting and projections of the future climate clearly indicate that disaster events are increasingly likely to occur. The work in Gorakhpur city under ACCCRN and parallel interventions on integrating climate change aspects into disaster management planning show that disaster management and climate change impacts can be mainstreamed in developmental planning at the micro (ward, zone), meso (city) and macro (river basin) levels.

Poor and vulnerable to be mainstreamed

The population of poor residents is increasing in the city and this group is becoming increasingly marginalised because of the growth of the city, greater competition for limited public services, increased frequency of disaster events, which are largely caused by climate change, and other related factors. The city's resilience cannot be developed unless the needs of vulnerable groups are adequately covered and mainstreamed in city development. In wards such as Mahewa, specific measures must be

taken to address the priorities of the poor. The Mahewa micro-planning intervention showed that if the poor are adequately involved, they can also contribute to city development and resilience through measures such as resource contribution and links (linking with appropriate subsidies and schemes), advocacy of their own problems and priorities, and improving services through community monitoring and behavioural change.

Hierarchy of informal institutions and link platforms of formal and informal institutions

Active civil society is an indication of positive governance in the city. The involvement of residents in managing city affairs ensures their participation in planning and transparency. It is a reality, however, that people's participation in urban development is almost negligible. In the ACCCRN process the formation of residents' groups and forums, on a sectoral and spatial basis, have been helpful. The thematic and ward committees of local people in Mahewa ensured needs-based planning, better and more effective access to services, community monitoring, resource contribution and advocacy for local needs. Sensitised to issues of environment and climate change, such neighbourhood- and ward-level committees joined with city-level residents' fora such as the Mahanagar Paryavaran Sanrakshan Manchto propagate learning in other wards. The links between these community institutions working at different levels helped to create an effective voice of the people and advocacy for the local population, especially the poor and marginalised.

Ecosystem (system, agents, institution)

Ecosystem services are very important in the city context, and the poor and marginalised are particularly dependent on such services. Gorakhpur city residents depend on more than 103 water bodies for drainage, livelihood activities. City-based orchards and farm systems have been a key source of food and livelihoods. Open green areas also play an important role in enhancing the city's water-holding capacity. The city-level residents' campaign in saving Ramgarh lake, low external input agriculture in various locations, conservation of green areas and water bodies, are a few examples that show the efforts that have been made to acknowledge the role of the ecosystem in building city resilience. Thus, besides agents and institutional aspects, if awareness and information is ensured, residents come forward to address system-related factors too.

Conclusion

GEAG's pilot initiative to establish micro-planning mechanisms in Gorakhpur's Mahewa ward has succeeded in demonstrating an approach for addressing multiple sectors, which include agriculture and livelihoods, drainage and solid waste management, and community health and housing, for an integrated approach to building resilience. The impacts of climate change severely affect all these sectors. Participatory processes have been the main drivers of these initiatives and have contributed to the success of the interventions. Coupled with the active participation of community members to implement their own initiatives and actions, bottom-up planning approaches that seek to involve local government representatives are contributing to building resilience against climate change.

Although Mahewa has benefited from GEAG's support through the ACCCRN process, scaling up participatory micro-resilience planning to other wards will require other 'champions' to drive the process forward successfully. Agents have a role to push this ahead, acting through committees at various levels from the ward to the city. Bearing in mind that Mahewa is one of 70 wards in Gorakhpur, Mahewa's micro-planning model, and the lessons learnt during its implementation, will be shared throughout the city and used to advocate to the local government the integration of climate resilience into the overall development planning process.

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