

**Gorakhpur Environmental Action Group (GEAG)** is a voluntary organization working in the field of environment and sustainable development since 1975. Ever since its inception, GEAG has been actively engaged in implementing several development projects addressing livelihood issues of small and marginal farmers, particularly women, based on ecological principles and gender sensitive participatory approach. Besides, GEAG has accomplished several appraisals, studies, researches at the micro & macro levels as well as successfully conducted a number of capacity building programmes for various stakeholders including women farmers, civil societies groups and government officials etc.

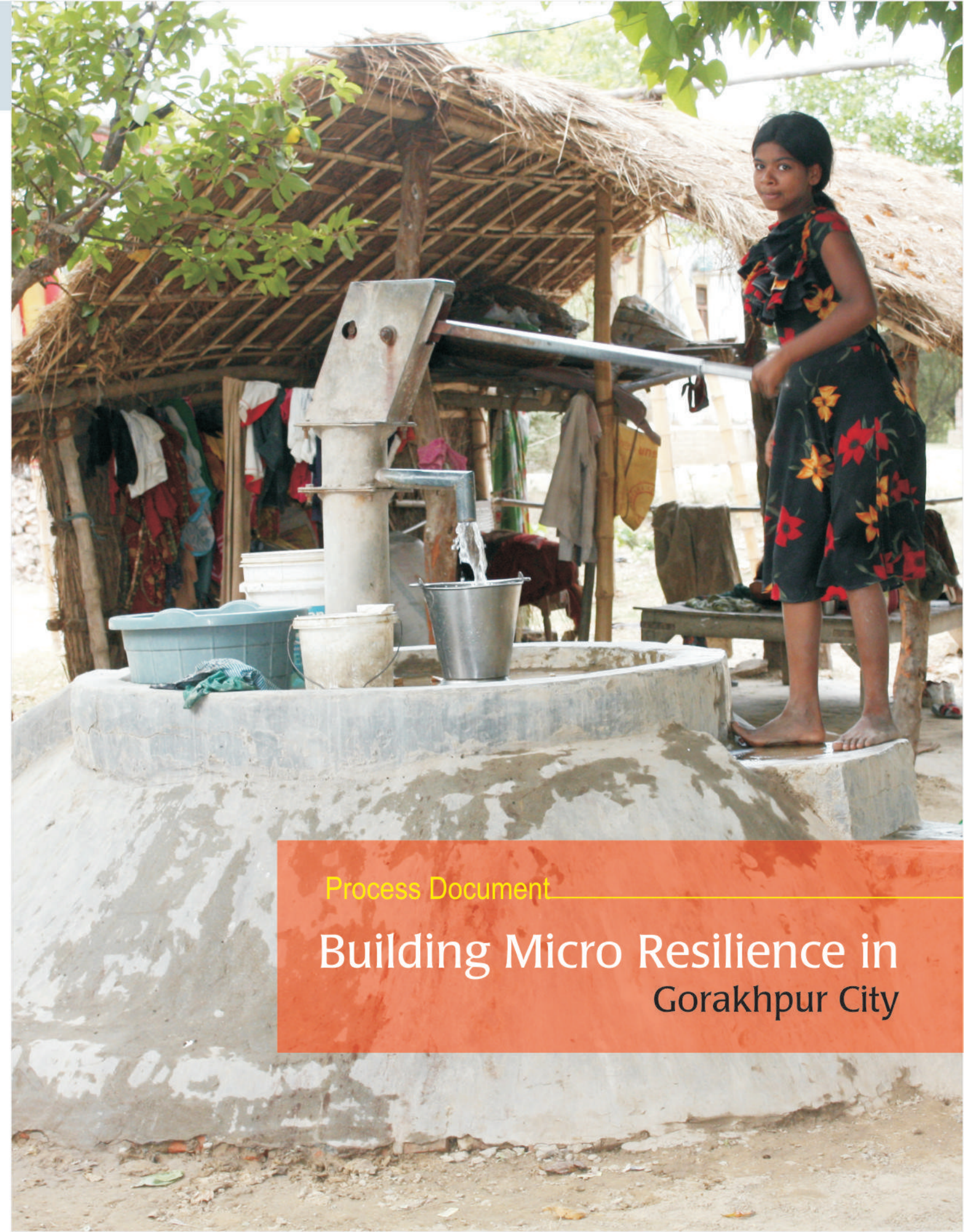
Today, GEAG has established its identity in North India as a leading resource institution on Sustainable Agriculture, Participatory approaches, methodologies and Gender. Acknowledging its achievement, efforts and expertise, United Nation's Economic and Social Council (ECOSOC) accorded GEAG special consultative status in the year 2000. GEAG has also been recognized recently as North India hub for Intersard, South Asia-a network to facilitate information sharing on issues of concern.

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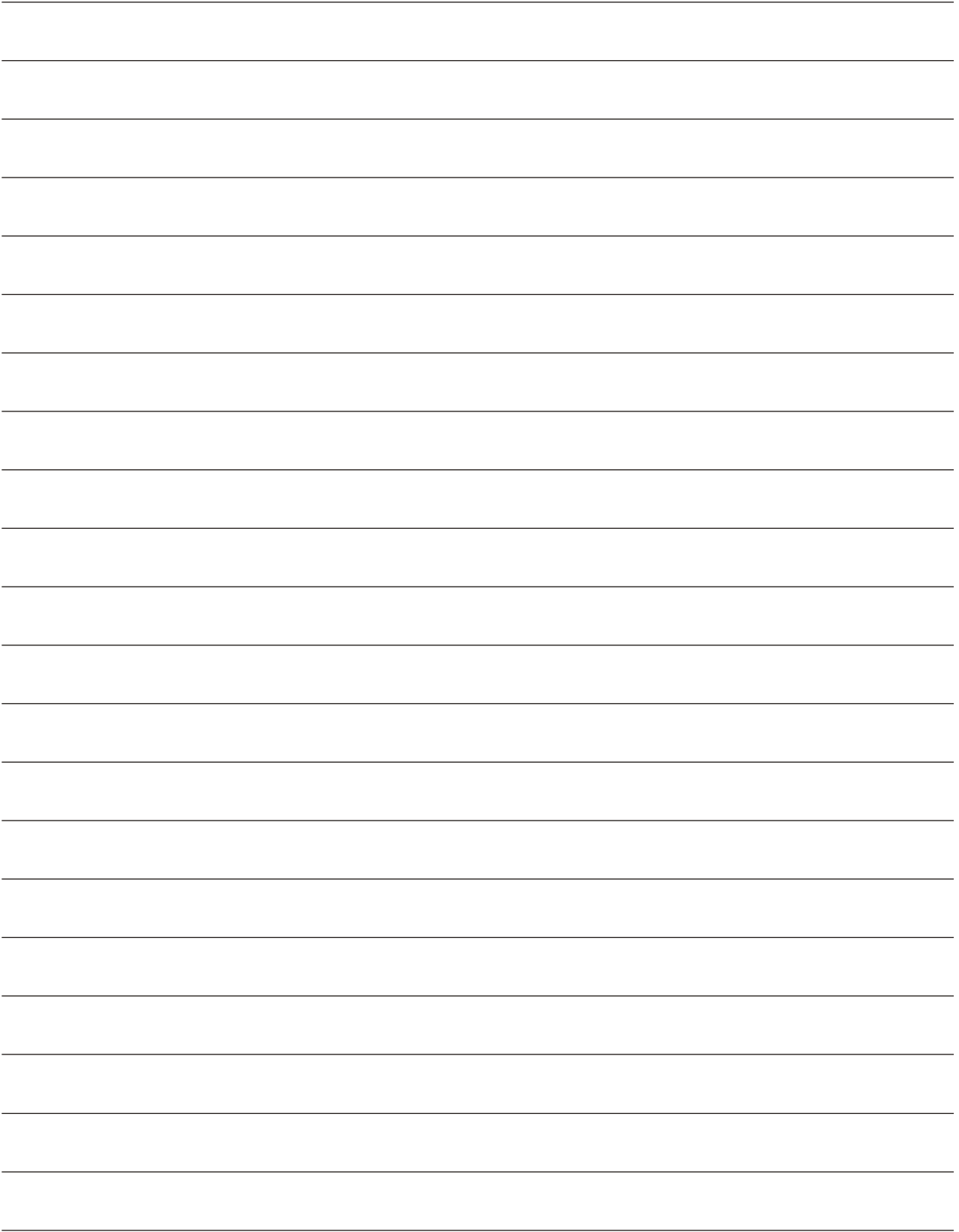
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Process Document

## Building Micro Resilience in Gorakhpur City





# Building Micro Resilience in Gorakhpur City



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<b>Acknowledgment</b> Addressing climate change in urban areas requires building resilience to deal with the residual impacts of climate change. Urban climate change resilience is the ability to withstand and recover from the effects of climate change and is closely linked to urban development processes. This process document focuses on the unique model created by Gorakhpur Environmental Action Group (GEAG) for building micro-resilience against climate change in an urban context by using participatory approaches and a bottom-up development planning process.  We are thankful to ISET International, SEEDs India and ARUP for providing their technical expertise during the course of the project. We are grateful to The Rockefeller Foundation for their financial support in bringing out this document. Lastly, we are thankful to the local communities who shared their experiences and supported in this documentation.	
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LIST OF ABBREVIATIONS

ACCCRN	Asian Cities on Climate Change Resilience Network
CLD	Causal Loop Diagram
COP	Community of Practice
CRA	Climate Resilient Agriculture
CRF	Climate Resilience Framework
CRS	City Resilience Strategy
CSC	City Steering Committee
DDMA	District Disaster Management Authority
DSDS	Delhi Sustainable Development Summit
FGD	Focussed Group Discussion
GCM	General Circulation Model
GDA	Gorakhpur Development Authority
GEAG	Gorakhpur Environmental Action Group
Gol	Government of India
HH	Household
HIG	Higher Income Group
IPCC	Intergovernmental Panel on Climate Change
ISSET	Institute for Social and Environment Transition
LBSNAA	Lal Bahadur Shastri National Academy of Administration
LIG	Lower Income Group
MIG	Middle Income Group
MoUD	Ministry of Urban Development
NGO	Non Government Organisation
NIDM	National Institute of Disaster Management
NIUA	National Institute of Urban Affairs
PLA	Participatory Learning Action
SLD	Shared Learning Dialogue

Urbanization and Urban Planning in India



India's cities continue to grow. Though India's urbanization has been slower than other developing economies in the past decades, this is set to change. More recent studies indicate that by 2031, the urban population will be more than double to what it was in 2001 (MoUD/Gol 2011). However, it is fast becoming apparent that the current urbanization trends are unsustainable and while providing more opportunities and pace to economic growth, the (largely) unplanned urbanization<sup>1</sup> also gives rise to many challenges and vulnerabilities.

The population growth and the demographic shift from rural to urban areas are challenging the ability of urban governments/systems and other actors to provide for the basic needs of people. Urban

poverty, as a proportion of total poverty in India, has doubled from 15% in the early 1960s to nearly 30% in 2004-05. The urban poor are forced to live in slums and informal settlements that are often built on marginal or unsafe land that is deemed unsuitable for permanent residential structures, such as steep slopes, flood plains or industrial areas. This population is even more vulnerable to the impacts of climate change, such as heavy rain, flash floods and landslides. Mainstreaming climate resilience into urban development planning is essential because climate risks may only be one of the several factors defining poverty levels, well-being, economic growth and development in an urban environment.

<sup>1</sup> While almost all cities have Master Plans for a 'planned' growth, there are arguments that these plans are not effective and there are several lacunae in their development as well as implementation resulting in (mostly) unplanned development of cities.



Traditional approaches to urban planning (particularly in developing countries) have largely failed to promote equitable, efficient and sustainable human settlements and to address twenty-first century challenges, including rapid urbanization, shrinking cities and ageing, climate change and related disasters, urban sprawl and unplanned peri-urbanization, as well as urbanization of poverty and informality. It concludes that new approaches to planning can only be meaningful, and have a greater chance of succeeding, if they effectively address all of these challenges, are participatory and inclusive, as well as linked to contextual socio-political processes.

~ UN Habitat, 2009

Historically, urban planning in India has largely been top-down where the social, political and economic dynamics shaping the city and drivers of growth have not featured prominently. The prevailing process of urban planning is done by way of City Master Plan a 20 year perspective plan that is mostly a land-use (spatial) plan and there is little scope for people's opinions in assessing the needs, the demands and the development scenarios.

The city is inhabited by people and ideally the development planning should be for the people and by the people. A proper urban planning development approach must have participatory planning processes apart from addressing the spatial context of the investments in the city. The emergence of sustainable, inclusive cities necessitates having comprehensive, forward-looking strategies wherein more of “bottom- up” rather than “top-down” approaches of planning is carried out. This includes provision of basic infrastructure like water, sanitation, power and public transport lack of which is a significant factor behind growing inequities and urban poverty in the developing world. The two Constitution Amendment Acts introduced in 1992 gave a fillip to the objective of socio-economic considerations, within spatial frameworks for “spatio-economic development planning”. Article 243 G and Article 243 W as inserted in the 73rd and 74th Amendments to the Constitution to provide new decentralized context for planning in Panchayats (rural areas) and Municipalities (urban areas) in India.

*Within the contextual confluence of these facets of urban growth, decentralized planning and building climate change resilience, this project on development of a micro resilience plan at a ward level within Gorakhpur Municipality was undertaken.*

## CHAPTER : 2

### Urban Climate Change Resilience



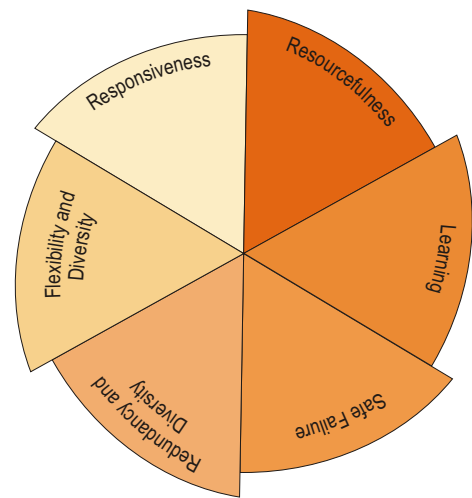
Urban climate change resilience is the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function at an acceptable level. Simply put, it is the ability to survive and recover from the effects of climate change. It includes the ability to understand potential impacts and to take appropriate action before, during, and after a particular consequence to minimize negative effects and maintain the ability to respond to changing conditions.

Historically, the term adaptation has been used to describe the individual actions required to respond to climate change. The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as an

adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, an adjustment that moderates harm or exploits beneficial opportunities<sup>2</sup>.

Resilience, on the other hand, refers to the capacity over time of a system, organization, community, or individual to create, alter, and implement multiple adaptive actions. We believe that resilience is a more accurate, positive, and comprehensive term, describing the dynamic, systemic transformation that is needed to respond to the consequences of climate change, especially future impacts that are difficult to predict.

<sup>2</sup> Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds. Cambridge University Press, Cambridge, UK, 976 pp, 2007. <http://www.ipcc.ch/pdf/assessmentreport/ar4/wg2/ar4-wg2-app.pdf>



Urban resilience to climate change demands that key actors develop and demonstrate a set of core capacities and that city systems exhibit a number of essential characteristics. These characteristics (See Box-1) of resilience can be used to group and conceptualize a set of systemic behaviors that avoid catastrophic outcomes or system breakdown, and enable recovery and stability after dramatic and unexpected events or gradual impacts that force change over time. Each of the characteristics is applicable to the infrastructure, institutional and knowledge networks that comprise urban system.

Box 1 : Resilience Characteristics

Flexibility	Safe Failure
The ability to change, evolve and adopt alternative strategies (in either the short or longer term) in response to changing conditions. Flexibility implies recognizing when it is not possible to return to the previous way things worked and finding new solutions and strategies (evolution). This favors 'soft' rather than 'hard' solutions.	Resilient network infrastructure is designed for safe failure. This is related to its ability to absorb shocks and the cumulative effects of slow-onset challenges in ways that avoid catastrophic failure if thresholds are exceeded. When a part of the system fails it does so progressively rather than suddenly, with minimal impact to other systems. Failure itself is accepted.
Redundancy	Responsiveness
Spare capacity to accommodate increasing demand or extreme pressures. Redundancy is about diversity and the ability to adopt alternative strategies through the provision of multiple pathways and a variety of options. Some components of the urban system serve similar functions and can provide substitute services when another component is disrupted.	The ability to re-organize, to re-establish function and sense of order following a failure. Rapidity is a key part of responsiveness in order to contain losses and avoid further disruption. However, such rapidity of response should not impair the capacity to learn, and therefore a balance between learning and rapidity should be achieved.
Resourcefulness	Learn
The capacity to visualize and act, to identify problems, to establish priorities and mobilize resources when conditions exist that threaten to disrupt an element of the system. This capacity is related to the ability to mobilize assets (financial, physical, social, environmental, technology, information) and human resources to meet established priorities and achieve goals.	Direct experience and failure plays a key role in triggering learning processes. Individuals and institutions should have the ability to internalize past experience and failures, and use such experience to avoid repeating past mistakes and exercise caution in future decisions.

(Source: Moench, M., S. Tyler, eds. 2011. Catalyzing Urban Climate Resilience. Applying Resilience Concepts to Planning Practice in the ACCCRN Program (2009-2011) Boulder, Institute for Social and Environmental Transition)

There is no silver bullet action that will make a city resilient. Rather, resilience will only be achieved through a collection of interventions and actions

over time, and the ability of individuals and institutions to internalize learning and experience to inform future behavior.

Urban Climate Change Resilience Framework

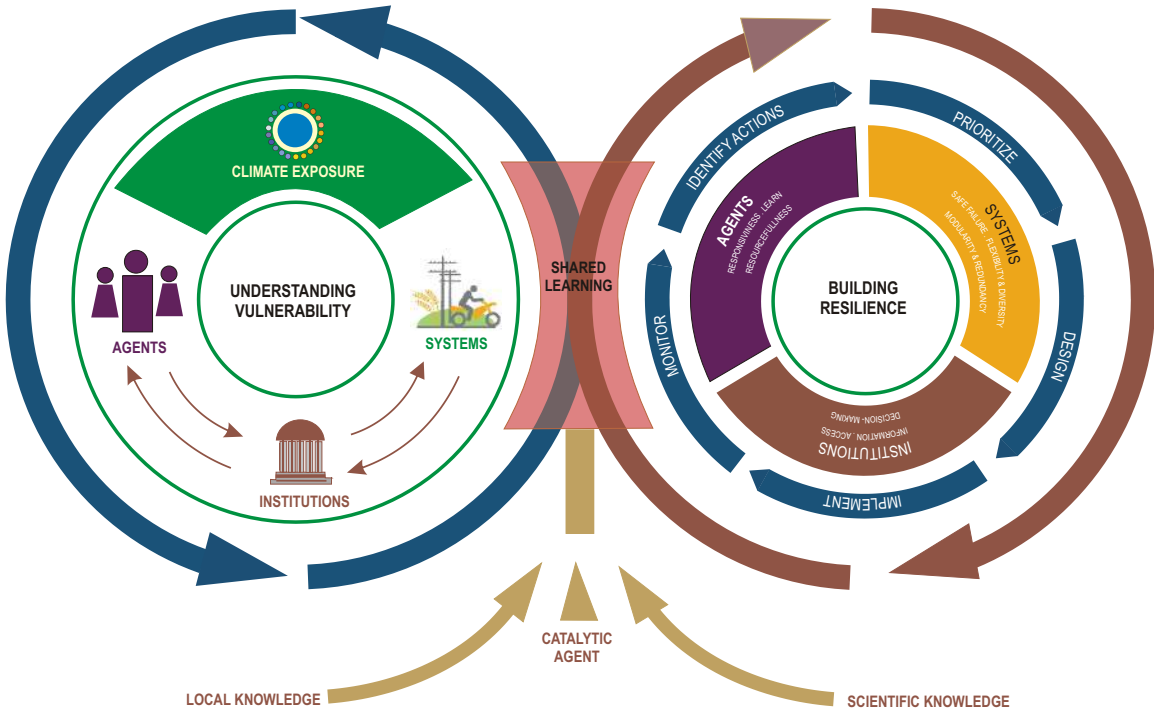
The Climate Resilience Framework (CRF) developed by ISET International is a conceptual planning approach to building resilience to climate change. The CRF is structured to build a broad understanding of urban resilience by describing the characteristics of urban systems, the agents (people and organisations) that depend on and manage those systems, institutions (laws, policies and cultural norms) that link systems and agents, and patterns of exposure to climate change.

It operationalises these concepts through structured and iterative shared learning approaches that allow local planners to define these factors in their own context, in order to develop practical strategies for local action.

The CRF is implemented through Shared Learning Dialogues (SLD). SLDs draw from participatory engagement and research techniques. Throughout the CRF planning process, the focus is on capacity building and on utilizing pre-existing skills and knowledge. Consequently, the Framework can be implemented within existing development or disaster risk reduction mandates.

The process, and the individual components within the process, is iterative, allowing time to build the understanding and relationships required to successfully engage in this work.

Fig 1 : Climate Resilience Framework







## CHAPTER : 3

### The Asian Cities Climate Change Resilience Network (ACCCRN) Initiative



Asian Cities Climate Change Resilience Network (ACCCRN) is a 7-year programme (2008-2014) supported by the Rockefeller Foundation which works at the intersection of climate change, urban systems and vulnerability to consider both direct and indirect impacts of climate change in urban areas. The ACCCRN initiative aimed at generating replicable models and interventions for climate adaptation in medium-sized Asian cities. The initiative takes an action research approach that has catalyzed city level actors to assess key climate stresses and potential vulnerabilities and to propose measures to respond to them, rather than commissioning external experts or national agencies to prepare such plans independently. The ACCCRN programme was implemented in three phases:

#### **PHASE I (2008-2009) : City Scoping and Selection**

In its first phase, the ACCCRN initiative reviewed potential candidate cities and selected 10 cities in 4 countries of South and South East Asia for this programme. The cities are Da Nang, Can Tho and Quy Nhon in Vietnam; Gorakhpur, Surat and Indore in India; Bandar Lampung and Semarang in Indonesia; and Chiang Rai and Hat Yai in Thailand. Vietnamese and Indian cities were finalised in November 2008 whereas Indonesia and Thai cities were finalized in 2009. These cities were selected to develop and demonstrate effective processes and practices for addressing urban climate vulnerabilities using multi-stakeholder planning as well as implementing targeted intervention projects. In each of the 4 countries, national partners were



also identified to lead the ACCCRN programme in the respective country. In India, TARU Leading Edge and Gorakhpur Environmental Action Group (GEAG) were identified as national partners.

## PHASE II (2009-2010) : Engagement and Planning

The activities in the second phase of the ACCCRN programme focused on engagement with the local partners to introduce climate change issues and to develop context specific climate resilience strategies. ISET was the lead organization for this initiative to provide technical assistance and guidance to the national partner agencies in each country. As mentioned earlier, one of the cities selected in India was Gorakhpur where GEAG was the national partner entrusted for developing urban climate resilience plan for the city.

*Gorakhpur, located in eastern Uttar Pradesh lies in the basin of rivers Rapti and Rohin, and is known for its proximity to Kushinagar and Nepal. Major part of Gorakhpur city's physiographic is bowl-shaped, resulting in inward drainage. Gorakhpur is one of the fastest growing cities in the mid-Gangetic plains. Unfortunately, the development of basic urban systems has not kept pace with its growth. At present the capacity of natural, social, institutional and infrastructure systems to provide water supply, sanitation and drainage is over-stretched. Consequently, in many parts of the city the ability of basic systems to support the quality of life for local residents, particularly the poor, is declining. The city primarily faces challenges of flooding, waterlogging, and other water-related problems.*

The Phase-II engagement in Gorakhpur was organised around SLDs. The SLD process helped in identifying the constraints and opportunities in adapting to climate change, understanding the complex systems within the Gorakhpur city, and working with a diverse range of city actors to build urban resilience.

The SLDs were informed by city specific information generated or compiled to support the ACCCRN engagement, including climate science and modeling results, vulnerability assessments, and sector studies. Through this process, GEAG and relevant city stakeholders increased their understanding of climate change and how it was impacting and

*Shared Learning Dialogues are iterative, transparent group discussions with local community actors, government agencies, and specific organisations designed to bring together available information on climate change with local knowledge and perceptions. The shared learning dialogue was the key tool for engaging local stakeholders in the resilience planning process in Gorakhpur and integrating knowledge of climate change from outside experts with local knowledge of development issues and planning priorities. The use of ongoing, iterative SLDs provided a backbone to support and guide the diagnosis and planning steps.*

(Source: Reed S. et.al)

affecting the city, particularly the vulnerable groups and areas, which are prone to the impacts of climate change. This understanding was tested and extended through the development and implementation of climate change adaptation pilot projects in Gorakhpur. Phase-II culminated with preparation of “City Resilience Strategy”. GEAG, along with ISET led the coordination and analysis, with the goal of fostering strong city ownership and integrating resilience planning processes into long-term city planning.

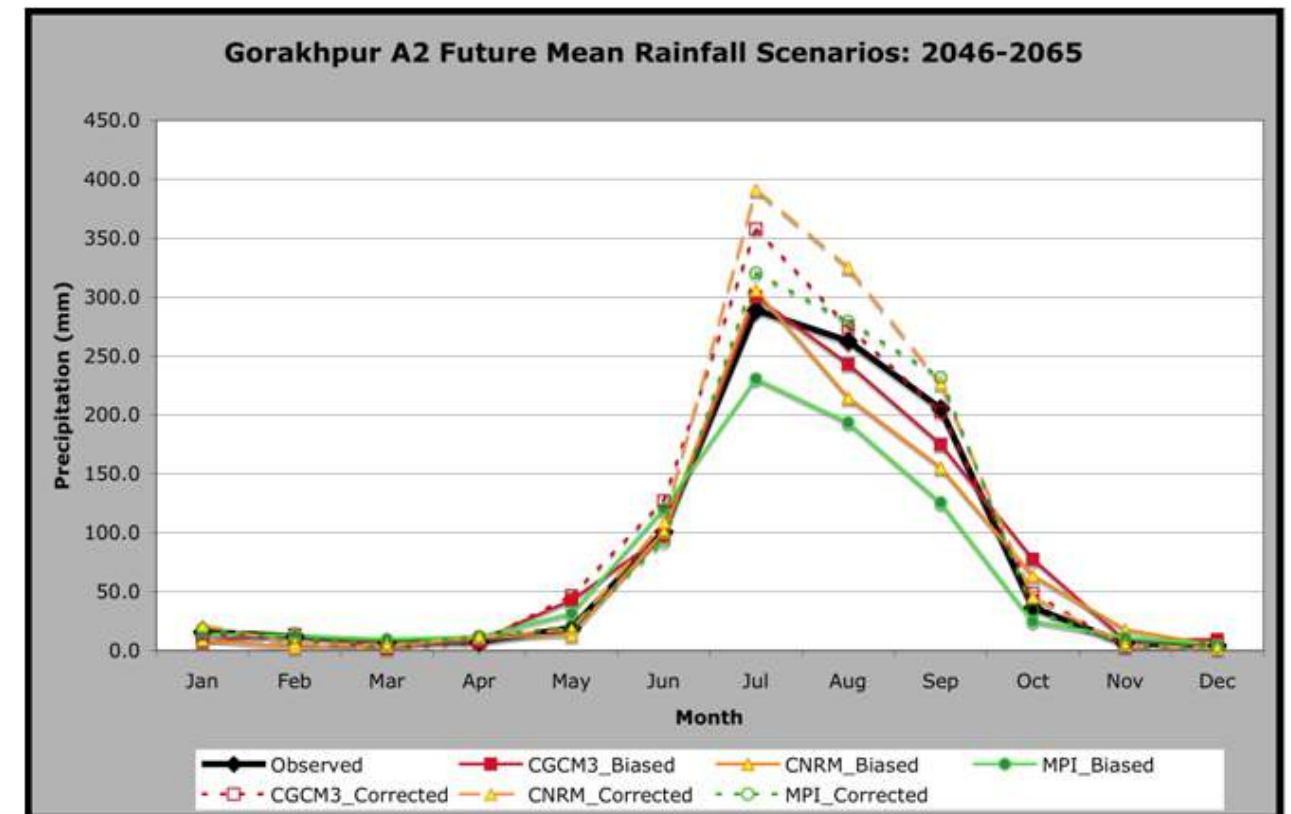
Since Phase II was the critical phase under the ACCCRN programme, a brief of specific activities during this phase is given in the following sub-sections :

### Sourcing Climate Information

Relevant climate data and information are vital in climate resilience planning process. Historical and future climate trends help in making the right choices and decisions in building climate resilience. In Gorakhpur and the surrounding areas, historical rainfall, temperature, and flood data are collected by four different agencies: the local IMD office, the agricultural department, the local revenue department, and the panchayats office. GEAG, in collaboration with ISET under a previous project (Risk to Resilience), had access to historical climate data and statistically downscaled precipitation projections (run for 2010-2050) based on a single GCM (methodology available in Opitz-Stapleton and Gangopadhyay 2011).

This data was used during preliminary vulnerability assessments and for initial flooding and waterlogging estimation for the city, which were presented to the

Fig 2 : Rainfall Projections (2046-2065)



Source : Opitz- Stapleton 2009

city advisory group, the steering committee, and to all ACCCRN partners at the Second Regional Partners Meeting in September 2009. Later, ISET and TARU also assisted GEAG in getting better climate projections data.

### Shared Learning Dialogues

In Gorakhpur, the shared learning process facilitated secondary data collection with key stakeholders such as Gorakhpur Municipal Corporation, Jal Nigam, the electricity department, Gorakhpur Development Authority (GDA), Gorakhpur University, and the Gorakhpur Medical College. Individual and bilateral consultations were conducted with the city mayor, city members of legislative assemblies, the municipal commissioner, and former engineers from water and electricity departments. Group consultations were subsequently held with key stakeholders including academics, engineers, NGOs, journalists, and informed citizens. In March 2009, the City Steering Committee (CSC) was formed with 12 members from government departments, research institutions, and medical college, along with other key stakeholders. Following CSC formation, regular SLDs were

conducted with a larger group (including CSC members, elected representatives from many municipal wards, private sector, among others) each with specific objective like identifying and prioritizing the vulnerabilities in Gorakhpur and to identify the most vulnerable areas/communities in the city, shortlist sector studies and pilot projects for the city, to share the results of the vulnerability assessment studies and sector studies. The CSC was also involved in visioning and resilience planning for Gorakhpur city that led to the development of 'City Resilience Strategy' document.

### Vulnerability Assessment

Climate change vulnerability assessments are key inputs to resilience planning. They assess the vulnerability of a city's ecosystems, infrastructure (physical systems), agents (social groups), and institutions to existing climate variability and future climatic changes, and assess the city's capacity to adapt/respond to that variability and change. Vulnerability assessment also involves identification of who are the most vulnerable groups and from what they are vulnerable and to what extent.



Vulnerability assessment of Gorakhpur city was a key step in the resilience building process and provided critical bottom-up community information, top-down expert analysis of local climate hazards and climate change projections, and synthesis of the two based on which the resilience mechanism was devised. The vulnerability assessment was conducted by GEAG, in conjunction with the Gorakhpur Municipal Corporation.

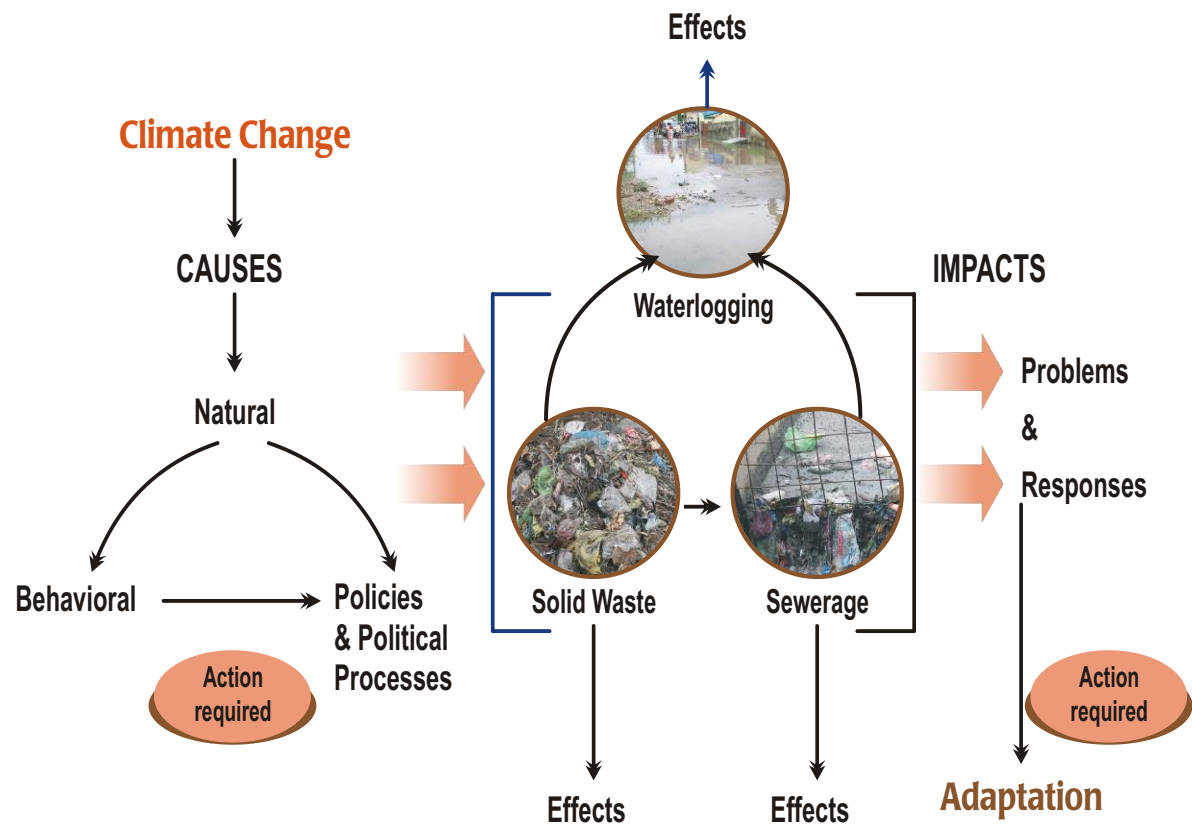
The vulnerability assessment was primarily based on the analysis of primary data collected through community and household questionnaires and participatory methodology tools and SLDs. These questionnaires were supported and validated by consultations with the CSC and a Gorakhpur citizen's forum, to pinpoint, prioritize, and rank according to intensity the physical risks that Gorakhpur residents face. Secondary data was also used occasionally for the purpose of the analysis. Concurrently, sections of the city were mapped by socio-economic unit - **Low Income Group (LIG), Middle Income Group (MIG) and High Income Group (HIG)** based on visual

observation of residences and subsequent validation through field visits.

The Gorakhpur vulnerability assessment concluded that Gorakhpur is vulnerable to waterlogging due to its natural topography of 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 intensively waterlogged. Extrapolation of the climate change projections from the nearby river basin to the city of Gorakhpur indicates that flooding and waterlogging might potentially increase due to climate change and land use patterns.

A risk frame of the city (Wajih, S. et al., 2009) prepared and validated by representatives coming from different sectors, explained the inter-connectedness of three major identified risks and waterlogging being the main risk, which tends to aggravate due to the contribution of solid waste and sewerage.

Fig 3 : The Risk Frame



Source : Wajih et al., 2009, Vulnerability Analysis of Gorakhpur

### Sector Studies and Pilot Projects

Sector studies and pilot projects were designed to allow further investigations around the vulnerability assessment findings. **Sector studies** explored key areas of vulnerability for which information was lacking and helped in determining the degree to which the existing systems could respond to varying climatic conditions. **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. Moreover, it was felt that findings from these

pilot projects would help in achieving buy-in from the stakeholders at a later stage.

In Gorakhpur, sector studies were selected by the GEAG and CSC to address information gaps identified in the vulnerability assessments. Studies were completed in early 2010 so that results could feed into the city resilience strategies. The objective of the studies was to capture the systemic vulnerabilities of the selected sectors in the city and to highlight cross-sectoral linkages. Box-2 lists the sector studies completed in Gorakhpur.

#### Box 2 : Sector Studies in Gorakhpur

##### Saving a Dying Lake: The case of Ramgarh Tal in Gorakhpur, Uttar Pradesh

This 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. It also outlines the efforts taken up by the government to rejuvenate the lake.

##### Servicing the City: Migrant Workers and Deprivation in Gorakhpur, Uttar Pradesh

This study evaluated the immigration of manual workers and other essential service providers to Gorakhpur. The study highlights the causes of migration, the dynamism of social deprivation in source and destination, and the living conditions of migrants.

##### Geo-hydrological Study of Gorakhpur

Assessed the geo-hydrological condition of Gorakhpur and the role it plays in creating and/or mitigating physical and anthropogenic problems like water logging, solid waste and sanitation, deterioration of surface and ground water quality, etc.

##### Study on the usage pattern and problems created by the indiscriminate use of polythene in Gorakhpur city

This study focused on the assessment of usage pattern, magnitude and the problems related to indiscriminate use of polythene bags from an environmental perspective. The study also aimed at creating awareness among the people of the city and sensitizing decision makers to take action to check the use of polythene bags.

##### Review of Gorakhpur Master Plan 2021

A thorough review of the Gorakhpur Master Plan of 2001-2021 was done by GEAG and the recommendations were submitted to the Gorakhpur Development Authority. The recommendations were made keeping in mind that they would influence the adaptation measures for potential climate change impacts through schemes for assessing risk and vulnerability; public education; improving water quality and health; insuring against losses; and preserving livelihoods.

##### Technical Feasibility Study for a Low Cost and Low Energy Drainage System in Rasoolpur, Gorakhpur

The key objective of this study was to undertake a preliminary assessment and submit proposal to mitigate the existing flooding problem in Rasoolpur village. The in-depth study understood and appreciated the issues and reason behind the frequent flooding in the village. The main reasons for the frequent flooding were attributed to the low lying areas of the concerned site, inadequate drainage system within and outside the site and the runoff discharge to the site from the surrounding areas.



The results of the vulnerability assessment and sector studies were used to identify pilot projects whose primary objective was encouraging buy-in and trust on the part of city stakeholders for the ACCCRN

programme in Gorakhpur. The pilots were also used to test approaches for building resilience. Box-3 gives a brief on the different pilot projects done in Gorakhpur city.

Box 3 : Pilot Projects in Gorakhpur

Decentralized Solid Waste Management through Community Participation
200 households were engaged in implementation of decentralized, community based solid waste management. Project provided livelihoods creation, ecosystem benefits in the form of greater recycling and composting of waste, reduction in flooding and water logging from waste-blocked drains.
“Polyethylene No More” Campaign
Building on the waste sector study, GEA G produced and distributed a series of four-page leaflets to communicate challenges associated with sanitation and waste in Gorakhpur, encouraging citizens to change their habits regarding waste and recycling and to actively participate in community solicitation of better services from city government.
Ramgarh Lake Conservation Campaign
Building on the Ramgarh Lake sector study, the campaign worked to raise understanding within the community of the risks to Ramgarh Lake. Work obtained supplemental funding and support from India's Ministry of the Environment

City Resilience Strategy

The City Resilience Strategy (CRS) consolidated learning from future climate and local vulnerability gathered through SLDs, vulnerability assessment, sector studies, and pilot projects. The idea of developing the CRS was 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 CRS was envisaged to be a broad local-level guidance document which provided the context, evidence, and analysis to justify actions to strengthen urban resilience to climate change. Qualitative assessments and participatory techniques were used for formulating 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 response to changes as they occur.

The resilience strategy for Gorakhpur recognised that responding to climate change would require

integrated courses of action to address a combination of institutional, behavioural, social and technical issues. The resilience strategy for Gorakhpur emphasized on the promotion of an active and conscientious citizenry as a mechanism for building greater public accountability and improving service delivery. This approach is mainly intended to be a platform for strengthening governance. This helped in making the whole process people-centric wherein the people were sensitised, mobilised and involved in planning for climate change resilience at the neighborhood, ward and city levels.

The Gorakhpur strategy outlined historical and future climate vulnerabilities, with special attention to potential impacts on waterlogging. The other main risks it emphasized are sewerage and sanitation challenges and solid waste management. The plan then identified vulnerable groups and sectors and highlighted associated vulnerabilities. The strategy also reviewed climate and urban development scenarios and categorized actions by sector and by geographic area. It then specified actionable interventions and grouped them into six larger “Final Action Items.” For more information on CRS please refer <http://www.hamaragorakhpur.com/PDF/Towards-a-Resilient-English.pdf>.

PHASE III (2011-2014) : Project Implementation

The Phase-III of ACCCRN programme focused on funding of city-led climate change adaptation interventions. The Rockefeller Foundation envisaged funding a range of interventions that had been generated through the Phase-II City Engagement Process. It was expected that these intervention projects would respond directly to some of the actions that Cities had identified in order to build urban resilience to climate change, and that these actions would be supported by the City Resilience Strategy. The following resilience building projects have been funded under this phase:

- Promoting ward level micro resilience planning in Gorakhpur :** The project establishes micro planning mechanisms in the Mahewa Ward within the city of Gorakhpur that address multiple sectors including agriculture and livelihoods, solid waste and drainage management, water and sanitation, drainage, housing, health and education. The project advocates for the integration of climate resilience in the overall development planning process to the local government.
- Promoting adaptive peri-urban agriculture in Gorakhpur:** The project scope includes 8 villages, all prone to recurring floods and water logging, with livelihoods dependent on input intensive agriculture, or casual labor during the floods. The project aims to demonstrate the importance of ecosystem services of peri-urban agriculture such as flood buffering for broader area of the city.

Ward Level Community Based Micro Resilience Planning in Gorakhpur City

The vulnerability assessment, development of city resilience strategy and implementation of an initial set of activities in the form of pilot projects helped the Gorakhpur city and GEAG deepen their understanding on future directions of building resilience against climate change. GEAG then chose to use Gorakhpur's Mahewa Ward, a low income ward suffering from drainage, water quality, sanitation and public health deficiencies, as a laboratory for testing an urban micro resilience model.

The thought process behind this intervention was that the micro-resilience planning would experiment with small-scale interventions at household and neighborhood levels. Household resilience interventions may include education, communication (especially for women and children), techniques for integrated farming, waste management, water, health, and sanitation, and enhanced access to services. On a neighborhood level, the program will seek to build institutions and capacity for resilience planning, promote planning and the use of climate information, and launch demonstration projects, awareness campaigns, and health surveillance through a ward level resource center.





## CHAPTER : 4

### Mahewa Ward in Gorakhpur City : An Overview



Gorakhpur has 70 Municipal wards with different socio-economic characteristics; as such, each ward has differential risks to climate and vulnerability of people. Differential risks may either be due to natural location of ward and/or due to difference in infrastructure development of ward. Risk is also compounded due to socio-economic conditions of residents of particular ward. City resilience strategy defined criteria for identification of most vulnerable wards in Gorakhpur in terms of systems and people therein. Underlying assumption was once vulnerabilities of intervention ward were addressed and functional resilience achieved, resilience planning could be taken up by the Municipal Corporation as management tool for planning in Gorakhpur.

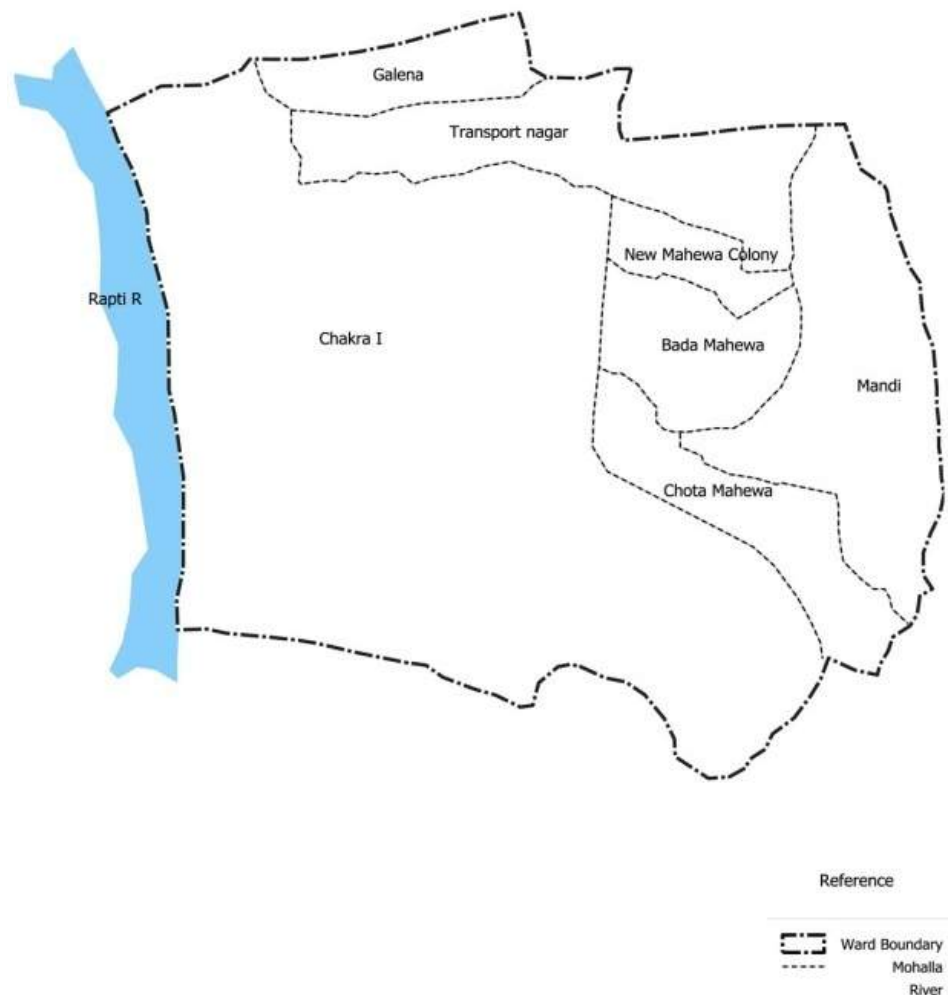
These views led to identification of the following criteria for selection of the most appropriate ward for piloting this intervention :

- Area should have maximum exposure to climate change impacts, i.e. excess precipitation, impact of disasters, etc.
- Possibilities of infrastructure development and related investments in area
- Inhabited by large population of socio-economically weaker section
- Presence of open area and natural ecosystem

**Mahewa ward** is best with almost all the issues that Gorakhpur city is facing as identified by the CRS. Due to its location on the bank of river Rapti with gentle slope gradient, it is prone to flood and water logging. In recent past, due to climatic variability, the nature of flooding and water logging events have become uncertain with respect to time of occurrence, its depth and duration of water stagnation. Such water logging conditions, coupled with poor drainage and sewerage system has aggravated the incidences of



Fig 4 : Mahewa Ward



water and vector borne diseases and contamination of ground water beyond the permissible limits. Due to these problems, the living condition of those living in this ward has worsened.

A geo-hydrological sector-study conducted by GEAG recorded 31 low lying wards in the city which were highly prone to water logging during rainy season. Mahewa ward falls on drainage line through which city used to drain itself, before these low lying areas were reclaimed by land filling done by private developers.

The Mahewa ward is socio-economically backward, comprises lower income households, with limited access to municipal services, and poor quality of existing infrastructure. Roughly 1.32 percent of the total population of the Gorakhpur city resides in the

#### Mahewa Factsheet

**Location** : South-west periphery

**Total area** : 2.8 km<sup>2</sup>

**Population** : 8226 (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.

Mahewa ward. The ward is divided into six mohallas (neighborhoods) namely, **Chota Mahewa, Bada Mahewa, New Mahewa Colony, Transport Nagar, Chakra and Galan**. This ward used to be the dumping ground of the city for its solid waste. Mahewa is quite peculiar also for the very low literacy rate which is 45.5 percent and female literacy is abysmally low at 22.4 percent. About 80 percent of the households either work as daily wage laborer, domestic help, vendor and/or hawker.

Almost half of the population residing in Mahewa does not have access to sanitation services. Access to piped water supply in the houses is rare and approximately 64 percent of the households do not have this facility. Majority of the population (approx. 85 percent) belong to backward or scheduled castes belonging to traditional fishing communities. (Source: Baseline survey conducted in February 2011)

#### Land Use Patterns

There is range of land uses within the Mahewa ward. The land use consists of residential areas which include HIG , MIG and LIG resident areas, commercial areas, agricultural land, and orchard. Most of the commercial area is scattered in various mohallas. The Transport Nagar is most developed mohalla in Mahewa ward with majority of commercial activities happening there whereas most of the low-lying area consists of orchard in Chakra along the Rapti River. The below table gives an overview of the land use data in Mahewa ward:

Table 1 : Land Use Data of Mahewa Ward

Land use	Area in Acre	Percentage
Embankment with Road	3.14	0.53%
Embankment	1.07	0.18%
Road	18.04	3.02%
Agriculture	44.05	7.37%
Commercial	49.55	8.29%
Residential	46.54	7.79%
Market (Mandi)	47.48	7.94%
Orchard	211.2	35.34%
Water Bodies	23.69	3.96%
Open Space	152.86	25.58%
<b>Total</b>	<b>597.62</b>	<b>100.00%</b>

Source : GEAG

#### Baseline Survey

A comprehensive baseline survey was conducted in Mahewa using quantitative and qualitative methods for data and information collection. Participatory tools like PLA exercises were used to gather the required information. The participatory process of conducting baseline survey helped in building an initial rapport with the community and gaining their confidence.

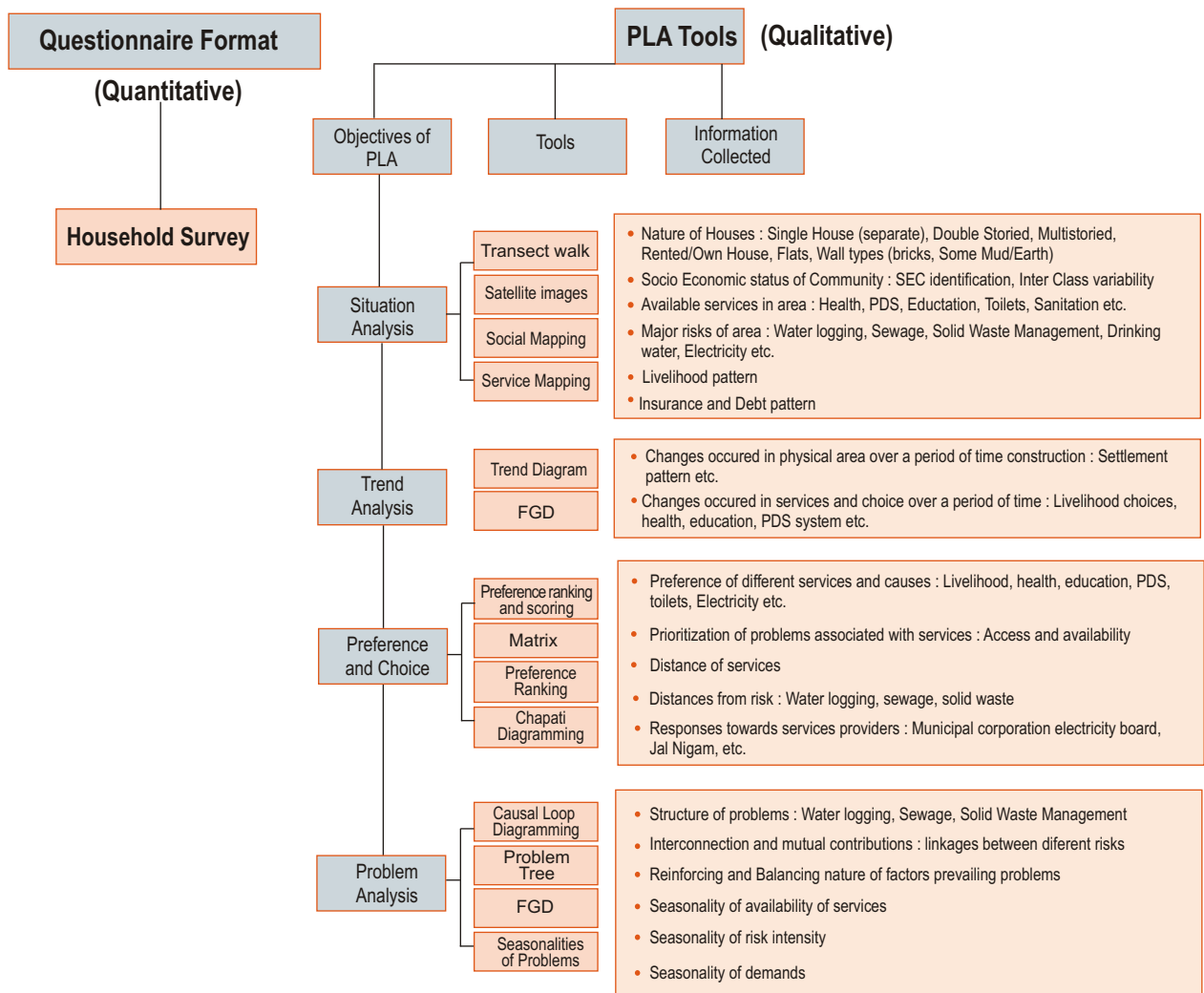
The population of Mahewa is 8226 as per Census 2001 and 90% of the total population was covered by the baseline survey. Six community consultations in different neighbourhoods of Mahewa were conducted and the people participated with great enthusiasm and support in all the consultations. The overall objective of the base line survey was to assess the need, preference and priorities of the targeted communities of the project area. The specific objectives of the baseline study were:

- To establish a sound quantitative and qualitative baseline information, level of risk factors, impact of risks on the community living in the area
- To assess the existing demographic, economic, health, sanitation, and livelihood condition of the communities for preparing a guide map for future intervention through micro planning
- To assess the felt need of the communities through bottom up approach in coping the risk they have been dealing with

The methodology and tools adopted in the qualitative survey is represented in the following schematic diagram :



Fig 5 : Survey Methodology



During the baseline survey, it was seen that the whole of Mahewa ward is confronting with physical, social, economic, political and institutional vulnerabilities. Owing to its presence in the low lying area, the western part of the ward is highly flood prone while the eastern part is inflicted with problems of acute waterlogging. Approximately 33 percent of the land is water logged by floods from rivers and rainfall. There is one embankment built to protect the city from riverine floods that divides the ward into two parts.

The major vulnerabilities due to climate impacts that the people of Mahewa were facing were:

### Waterlogging

Unplanned development, poor infrastructure, absence of underground sewerage, and lack of solid waste management was contributing to waterlogging problems in the ward. The 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, deteriorating health conditions and increasing health hazards for the residents.

### Sewerage and sanitation

Mahewa is poorly connected with a sewerage network. Open drains were severely damaged and choked with silt and garbage due to their improper or no maintenance. Some parts of Mahewa did not have drains at all.

### Solid waste

Another important issue in Mahewa ward was the poor management of solid waste, especially plastic. Collection of garbage from streets and homes was not regular. Due to the lack of formal dumping sites, the entire solid waste generated was disposed either along the roads or used as land-filling material for low lying areas. Widespread use of plastics was one of the major causes of choked drains leading to water stagnation in the ward. Prolonged waterlogging together with poor solid waste management has caused an increase in the incidence of vector borne diseases as well as contamination of ground water. Malaria and dysentery have historically been problems. The recent years have seen an acute rise in diarrhea, hepatitis and fluorosis.

Accessibility to municipal services in the ward was limited and existing infrastructure was of very poor quality. As a result of growing encroachments, natural water bodies within the ward were under threat causing problems of drainage and water quality. Being an outlying area, internal morphology

and composition of communities in the ward are altering rapidly. As such there is limited social cohesiveness and a general apathy to city level governance issues.

In spite of direct exposure to floods from the Rapti river basin (1998, 2001, 2007-10 floods) local planning processes have not sought to mitigate potential impacts.

All these studies (climate analysis, geo-hydrological studies and baseline survey) inferred that severe water logging problems would arise in the future due to dysfunctional drainage system in the Mahewa ward. The ward level resilience plan will hence accentuate system management for delivering essential functions under climate stressed condition.

The data and information collected through survey backed by community consultations were classified and categorized under the following heads:

- Demographic characteristics
- Social status
- Economic status
- Assets
- Livelihood
- Access to and quality of services
- Hazards
- Prioritization of problems
- Peoples view of development
- Future intervention and their prioritization





The detailed findings from the baseline survey can be obtained from the baseline survey report. However, the survey concluded a set of action points which were required in order to build resilience against changing climate patterns for the people of Mahewa. These are summarised as below:

- The six main issues or themes that were being impacted by the effects of climate change and needed urgent attention to build resilience were: water & sanitation, community health, climate resilient agriculture, decentralised drainage system, risk resilient building (primary school, house, and community toilet), and livelihood improvement specifically for women of slums.
- There was a need to mobilise community and unite them on these common interests. Common interest group committees on water & sanitation, community health, climate resilient agriculture, decentralised drainage system, risk resilient building (primary school, house, and community toilet), and livelihood improvement specifically for women of slums, to be constituted to monitor the situation of the services.
- Ward level committee, as per 74th Constitutional Amendments Act to be constituted having representation from other institutions and active individuals of the ward. This ward level committee would act as decision making institution at ward level.
- Construction (demonstration) of low cost housing in water logged area
- Introduction of climate resilient agriculture planning, techniques (time and space management, multi-tier cropping, crop cycle management, adoption of water resistant crops, integrated farming practices, waste recycling and training of farmers) for water logging affected farm areas using climate information.
- Plan for decentralized drainage system for storm water management.
- Design of low cost raised community toilet and establish link with banks for the households interested in construction of such toilets.
- Decentralized solid waste management at neighbourhood level with the support of community
- Awareness on safe drinking water, method of

purification, sanitation and disease reduction at household level.

- Liaison with the Municipal Corporation to enhance connectivity of municipal water supply though local demand.
- Need for monitoring drinking water quality through potable kits. Also raising of platforms for India Mark-II handpumps to allow access to safe drinking water at times of flood/waterlogging.

### Climate Threshold Determination Process and Inferences

The critical threshold is the magnitude or intensity that must be exceeded for a certain reaction, phenomenon, result or condition to occur or be manifested. The particular amount of precipitation that causes specific magnitude of waterlogging in a particular region/ area that has significant impact is referred to as threshold of precipitation for that area. The assessment of threshold of precipitation and its future projection is essential for the assessment of future scenario of flooding/water logging which is prerequisite for proposing the climate resilient plan of an area.

In urban areas the incidents of water logging happen to be when surplus rain/storm water or used water (sewer and drains) stagnate and cannot drain out properly due to poor and unscientific drainage system. Hence, amount and duration of precipitation should be estimated to project the magnitude of future waterlogging on the basis of the threshold of rainfall for water logging. For this purpose the historical data of precipitation and past scenario of waterlogging should be analyzed to establish the relationship between amount and duration of rainfall and, depth and duration of waterlogging. The historic data of precipitation may be available from the meteorological sources but the past information regarding the depth, duration and area of water logging might not be available for which the community consultations is the only mean to get the information. This participatory technique of data collection (such as participatory learning action and shared learning dialogue) on precipitation and its impact in form of waterlogging (depth, duration and damages incurred) was used in Mahewa to acquire the quantitative data regarding the magnitude of waterlogging as a result of particular amount of rainfall.

The participatory tool of data collection can be the most effective tools to assess the impact of particular amount and duration of the waterlogging through which the future scenario of water logging as the result of present trend of climate change can be estimated which shall be an important component for formulating a climate resilient future plan of an area.

### Assessing precipitation threshold in Mahewa

The SLDs were organized in different *mohallas* and communities were consulted for past rainfall and waterlogging incidents. Though the historic rainfall data for city was available but due to lack of such data at local level, recall method was used. The ever highest flood level of 1998 and heavy down pour of 17th September of 2009 (126 mm) in Gorakhpur has been kept in mind as an incidence of worst conditions of waterlogging and rainfall. In respect to these incidents community recalled the incidences of extreme rainfall and consequent extent and duration of waterlogging. Mostly community information was qualitative which then was transformed into quantitative terms by correlating to with historical rainfall data. The amount and duration of rainfall was authenticated with the secondary data available from different sources. The data collected through the process was used for projection of future rainfall and its impact in form of waterlogging. The future expected scenario of infrastructural development was also considered for final assessment of changes in frequencies of enhancement in thresholds of waterlogging in the area.

### Process of clustering the neighborhoods of Mahewa ward for SLD

The SLD was conducted in the month of December, 2012. The entire Mahewa ward was divided into four parts, on the basis of their location, physical attributes like relief, slope, gradient and drainage, location of the bund, raised roads, nature of risk and socio- economic conditions of resident of the area. This division helped conducting SLD in a meaningful way that considered as much as possible homogeneity on hydrological and socio-economic parameters. The ward was divided into following parts for community consultations :

**East Transport Nagar and New Mahewa Colony cluster :** It is north east part of the Mahewa where middle and high income groups are residing. It has higher altitude and a major drains have been constructed which are able to drain out most of the water (domestic and storm). Therefore, it is free

from the risk of waterlogging. But south part (New Mahewa colony) has been developed in low lying area still suffers the problem of water logging in monsoon period.

**Bada and chota Mahewa cluster :** This cluster includes two *mohallas* and is located on the south-eastern part of Mahewa. This whole area is low lying. In this area, there were many natural water bodies which were buffer zones for accumulation of storm water but now most of them have been filled up for permanent construction. This part is highly vulnerable and water risk prone. One regulator/pump station has been established to pump the water in other side of embankment but gentle slope, less gradient, choked drains with silt and garbage, do not allow the water to reach to the pump station. Most of the inhabitants of this area are poor and belong to backward castes and scheduled castes

**Galan, West Transport nagar and North Chakara cluster :** The North western part of Mahewa ward was included in this cluster. It is a saucer shaped area whose central part has less elevation than periphery. Thus it is highly waterlogged. Its major part is under commercial use with transport establishment and shops which gets inundated specially ground floor, during rainy season causing heavy loss of material of shops and stores. Two regulator/ pump stations have been established to drain out water to other side of bund, but some times even these are unable to drain out the rain water.

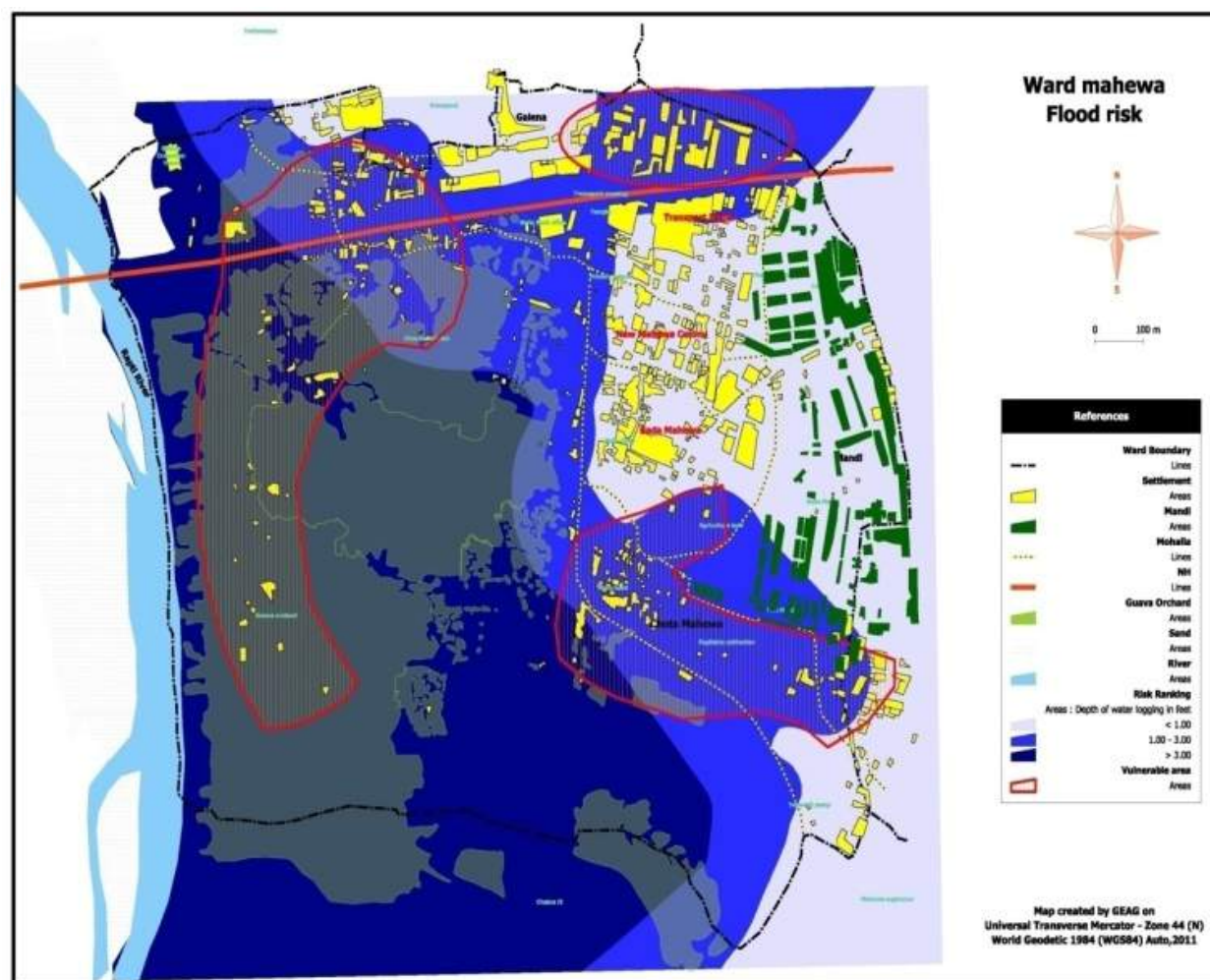
**South Chakara :** It is undeveloped flat flood plain with least slope along river Rapti. It is covered with Guava orchard. This area is lacking in basic amenities like roads, drains, electricity and other infrastructure. Due to absence of drainage system and domestic and storm water is drained in the open space of the nearby area. Owing proximity to river Rohini, it is worst affected by floods almost every year.

These physical and cultural features of each cluster affect the water logging condition, depth and period of inundation.

**SLD Data Verification :** The past climate data especially extreme rainfall dates/ weeks corroborated with the actual observed available data of the city available in government records. These were used as threshold extremes in historical past. The qualitative observations through



Fig 6 : Flood Risk Map of Mahewa



community consultations as regard level and spread of waterlogging was fine-tuned and quantified. For this, a GPS survey was conducted in the ward to collect the information of depth and duration of water inundation at different points of the ward as indicated by the community. A fresh data base was prepared. Finally a hazard map was drawn on the basis of spatial and non spatial information. After developing the various layers of different themes (water inundation, settlement, land use, road and topography). A final map was developed after over lapping the all layer maps for indicating the vulnerability of the ward. Latter, the final map was reviewed by community and other key persons.

**Inferences :** From the analysis it was noticed that specific magnitudes of rainfall incident over one, two and three days (individually and cumulative) caused critical waterlogging/ flooding problems. For example, 100 mm rainfall incident cumulative over three days caused severe waterlogging problems. This specific signature, for example, of rainfall characteristic could be identified in modeled climate projections to see frequency of occurrences of such characteristic-rainfall in future.

## CHAPTER : 5

### Building Community Institutions for Climate Resilience



The institutional characteristics that contribute to resilience and adaptive capacity in urban areas are poorly understood. However, institutional relationships are central factors that influence the resilience of systems and agents in many ways. Whether or not systems can be managed or shaped in a flexible manner as conditions change, whether or not groups of agents can organise in innovative ways that respond to needs as they emerge, how societies respond both during and after extreme events- all these are shaped by institutions.

Local institutions are key to the capacities of communities to respond to various risks and adapt to changing conditions. Firstly, strong institutions at the local level help communities to coordinate action and take joint decisions. Local institutions are the foundation that enable local communities to voice and enforce their interests, to influence decisions taken at higher levels, and to hold policy makers

accountable. Through strong local institutions, communities are more successful in seeking information, financial flows and capacity building support for dealing with the impacts of climate change.

#### Need for People's Participation and Bottom up Approach for Building Climate Change Resilience in Mahewa Ward

In the Mahewa ward, the baseline survey which was done before the initiation of the resilience planning process, inferred that collaborative actions at the local level were required to address the multiple challenges that the ward was facing and accordingly build resilience. This was so because in the city like Gorakhpur, which is situated in the flood prone foothills of the Nepal Himalayas, the key systems, agents and institutions that relate to enhancing the risks of climate change impacts are linked to natural



settings, behavioural patterns and weak governance. Top-down planning processes without citizens' participation largely ignore the local situation and the capacity development needed at the city level. Immigration of rural migrants in large numbers to urban areas adds new challenges to those faced by municipalities who are already struggling with limited resources and abilities to provide basic services to citizens.

The Vulnerability Assessment of the city and the City Resilience Strategy also strongly advocated for a bottom-up approach to planning and service delivery. The 74<sup>th</sup> Constitutional Amendment in India has provided ample scope for decentralised planning and governance in urban areas but this has not been implemented in many states including Uttar Pradesh. The non- operationalisation of this provision has severely limited the adoption of appropriate methodologies and people-led disaster management and climate adaptation processes apart from affecting transparency and participatory governance. On the other hand, experiences have shown that people's participation has often remained central to development processes.

Empowerment of people and their participation in the development and resilience building processes ensure the sustainability of actions initiated. The communities get a sense of ownership of the problems as well as the solution and once this mindset sets in, the processes will continue and ensure sustainability.

Based on these understanding, it was concluded that in Mahewa, which lacked basic infrastructural facilities, and a generally apathetic governance that hampered proper development, active participation from the community and a bottom-up approach of functioning was the only way forward for building resilience against climate change.

### Community Mobilization and Formation of Institutions

The process of community mobilisation and their participation in the resilience building process was initiated. Community institutions were formed at three levels which were at the **neighbourhood level**, **thematic level** and at the **ward level**. These institutions were formed with the agreement and participation of the community people with GEAG playing the role of a facilitator. People who were

active, had local influence, were articulate and had the interest to be part of the committee to work for the development of the ward were included in the committees. Membership was often voluntary where people came forward and depending upon their subject of interest (e.g. drainage management, solid waste management, etc.), chose to be in a particular committee. Meetings of all the committees are held on a monthly basis.

The concept of institution building in this case of resilience planning in Mahewa was based on Elinor Ostrom's eight principles of institution building summarised below (*Ostrom, E., 1992, Crafting Institutions for Self-Governing Irrigation Systems; Institute of Contemporary Studies, San Francisco, California*). These were adapted for local application in Mahewa.

- 1. Clearly Defined Boundaries :** The three-tier community institutions which were formed in Mahewa had clearly defined boundaries. Mahewa has six neighborhoods which have been demarcated by the Gorakhpur Municipal Corporation. These boundaries were considered for forming community groups and hence a total of six community groups were formed (one in each neighborhood) at the neighborhood level. The community groups were then mobilised on commonly identified six problematic themeswater & sanitation, community health, climate resilient agriculture, decentralised drainage system, risk resilient building (primary school, house, and community toilet), livelihood improvement specifically for women of slums. These issues became the operational boundary for these thematic level institutions. Lastly, the ward level committee comprised members from the thematic committee and is headed by the Ward Corporator.
- 2. Proportional Equivalence between Costs and Benefits :** Each institution at each level has clearly defined rules specifying the amount of resource required or used for a particular work which the members plan to do. It is agreed that the monetary benefits gained by any initiative will be utilised in the interest of the 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 was faced with three

levels of functioning first, at the constitutional level where the rules helped the community members to create and constitute themselves as institution; second, the collective decision making process and the third at the operational level. At each level, members' right to take part is protected.

- 4. Monitoring :** The institutions have working rules defined by its members. These members also function as monitors as it helps in monitoring each other's activities. All the members are aware that others are watching and non-compliance would be noted and would be followed by penalties. This becomes the incentives to follow rules strongly.
- 5. Graduated Sanctions :** The institutions have set some rules for actions to be taken in case a member violates rules. They are likely to receive graduated sanctions depending upon the seriousness and context of the offence from other users. For example, the committee members decided to shame the people by placing a red mark on the house of the people who do not give waste to the waste collector and rather throw away on roads making the surroundings dirty. Further, they have decided that if this step did not result into any positive actions, they will impose monetary fines for ward people who throw the domestic wastes on the roads. As yet, the system of placing the red mark was done and that itself was a step which motivated people to correct their actions. But the committee has clear rules for collecting monetary fines, in case required, and the money will be utilised for improving the services and taking care of operation and maintenance costs.
- 6. Conflict Resolution Mechanisms :** The community has also set procedures of settlements of disputes in each institution. So far, no such cases have come up but the procedures for resolving the conflicts are defined.
- 7. Minimal recognition of Rights to Organise :** The rights of the members to organise themselves as institutions through their own rule-making 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 into bigger groups or with other bodies to give them the protection and support the small groups need.

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

Based on these principles, **three-tiered self governed community institutions** were established as an approach towards building resilience at **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 & sanitation, drainage, climate resilient agriculture, risk resilient building and micro-credit.

At the ward level, engagement with ward level committee was done for taking up issues such as provision and maintenance of municipal services and conservation of natural water bodies. These ward level committees were also the nodal points for climate scientists and city planning experts to establish relationships and an on-going involvement in planning from the start of the resilience process.

### Neighborhood Committee

The Mahewa ward has six neighborhoods (commonly called as *Mohallas* locally) as demarcated by the Gorakhpur Municipal Corporation. The baseline survey conducted in these neighborhoods was a strategic opportunity to build rapport with the community members and gain their confidence. With the initiation of the micro resilience planning



process, open meetings were held with the community members and a committee of 10-12 members was formed in each of these neighborhoods. The committee comprises of active members from the community who were willing to come forward and take initiatives in improving the condition of Mahewa ward.

The neighbourhood committee is the first level committee in the 3-tier self governing institutional system at Mahewa. Need assessment of problems and identification of issues that enhance the impacts of climate change are one of the main tasks of this committee. Since the committee members are the local community members, they also function as catalysts for mobilising other community members, sensitising them on the issues and bringing about awareness on the problems and how it can be dealt with. The neighbourhood committee holds regular meetings on a monthly basis to discuss these issues.

Community consultations and baseline survey had identified six issues which were contributing to the vulnerability of Mahewa. In order to be effective, the neighbourhood committee comprising of 12 members distributed the 6 emerged issues among them (2 members responsible for 1 issue) and became responsible for their work around these issues. The distribution of issues was done in consultation with all the committee members and the members chose issues based on their interest and expertise.

### Thematic Committee

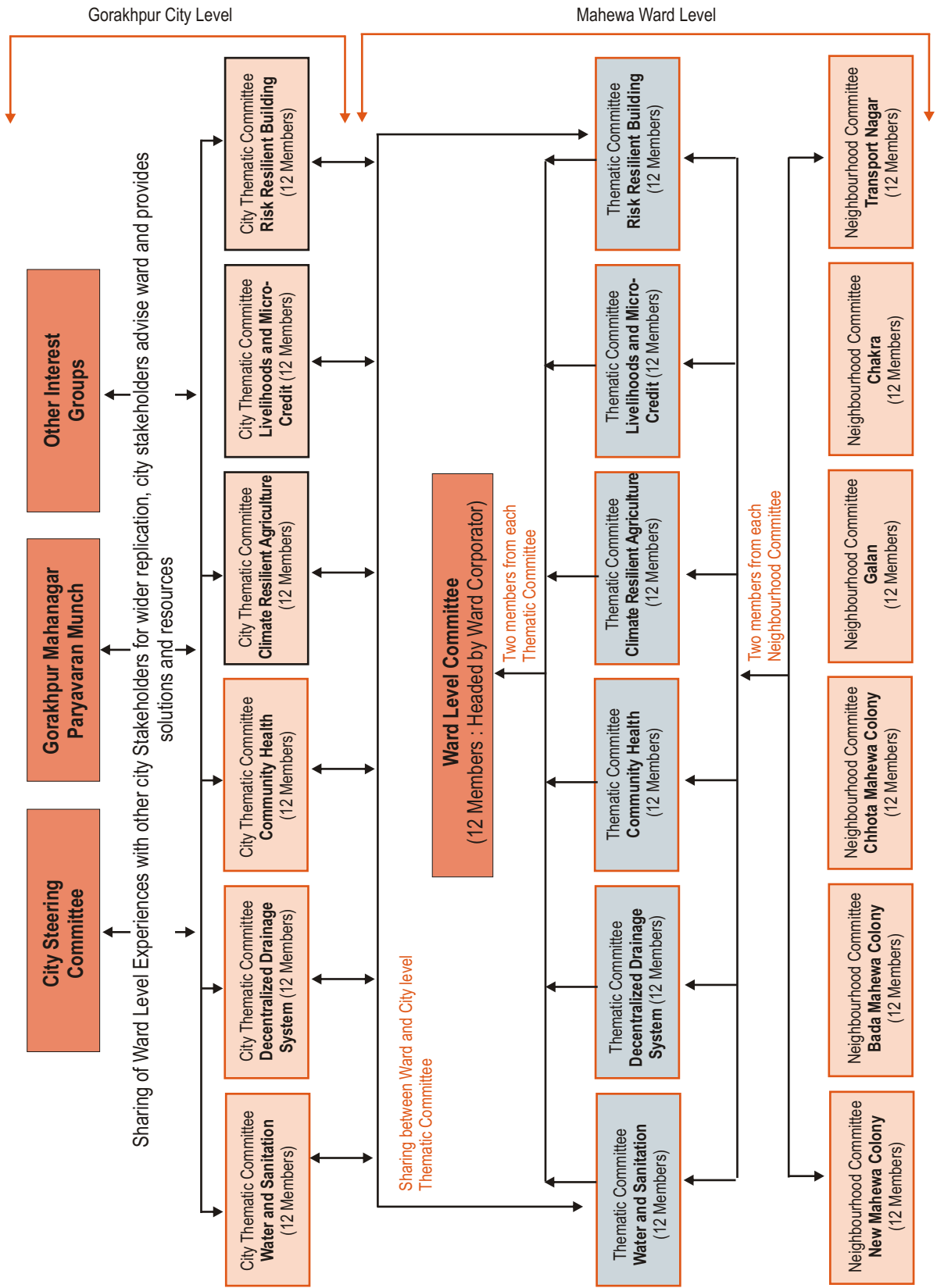
This was a fairly important institution that fell at the second level in the 3-tier institutional framework at Mahewa. While there were 2-member team in each neighbourhood committee working on a specific issue, it was felt important to form thematic committees to collate the issues and problems of all the six neighbourhoods of Mahewa ward. Hence, 2 members from each of six neighbourhood committees came together and constituted the 6 thematic committees comprising 12 members each on the following themes:

- ◆ Water and sanitation
- ◆ Community health
- ◆ Climate resilient agriculture
- ◆ Decentralised drainage system
- ◆ Livelihood opportunities, esp. slum women
- ◆ Risk resilient building

Members of the thematic committees come together on a monthly basis to discuss the thematic problems of the whole ward collectively. For instance, the drainage committee comprises of 2 members from each of 6 neighbourhood committees who is responsible for looking after drainage related problems. At the thematic level, the drainage problems of all the 6 neighborhoods are collectively discussed and actions to improve the situation are framed. The thematic level committees have framed rules and regulations in consultation with the community members for effective functioning. To



Fig 7 : Convergence between Ward and City Level Institutions





Box 5 : Key Tasks of Thematic Committees

**Climate Resilient Agriculture**

1. Inform other farmers about the weather related forecasts
2. Organize meetings with some other farmers group
3. Disseminate information on new agricultural techniques to other farmers of the ward

**Ward and Sanitation (WatSan)**

1. Vigilant towards Nagar Nigam's (Municipal Corporation) tasks
2. Ensure proper dustbins are available for collection of garbage. In case of problems, lobby with the concerned units for provision of such facilities.
3. Supervise the management of solid waste in the ward
4. Spread awareness on the importance of toilet among community members
5. Aware and sensitize the people on the importance of safe drinking water
6. Support the community in getting water supply connection
7. Sensitize other community to conserve the water bodies in Mahewa

**Community Health**

1. Identify health problems of ward and prioritize them during meetings
2. Meet concerned health department regarding prioritized health issues
3. Advocate and regularize the visits of health visitors from health check post
4. Develop rapport with health facilitators and be vigilant towards their functions
5. Ensure good health and better quality of life for the community members by organizing health camps, generating awareness on related issues.
6. Find out alternative options for better health services

**Decentralized Drainage System**

1. Make efforts to sensitise people on topping encroachment on drains
2. Advocate with concerned departments for cleaning up of silt and repairing of damaged drains
3. Create awareness among community members to stop throwing wastes in drains
4. Ensure active participation when the repairing or construction work of drains is being carried out.

quote an example, the water and sanitation thematic committee has fixed an amount of Rs.10/- to be paid by the community members as a fee for door to door collection of solid waste.

**Ward Committee**

This is the third level committee in the institutional structure at Mahewa. Again, 2 members from each of thematic committees came forward and formed the ward level committee comprising of 12 members. The ward level committee is headed by the Ward Corporator. The members of this committee meet once in a month.

The main function of the ward level committee is to implement the plans and actions decided by the

thematic level committees. The ward committee takes stock of the issues under each theme and makes an action plan for dealing with those issues. Based on the problems and need, plan for generating resources are made by the ward committee. The ward committee also approaches the government bodies like Nagar Nigam, Gorakhpur Municipal Corporation and other elected representatives whenever support is required from them. Regular monitoring is another important task of the ward committee to ensure that the actions are being implemented in a proper manner. The ward committee shares the updates on the progress of the work with the thematic committees on a regular basis. Figure-7 shows the convergence between ward level and city level institutions for micro resilience planning.

## CHAPTER : 6

### Thematic Interventions to Build Climate Resilience



Based on the baseline survey and SLDs conducted in the Mahewa ward, six issues were prioritized by the community members which needed urgent interventions as climate change was directly impacting on these issues. Hence, as mentioned in previous sections, three-tier committees were formed to deal with the problems. Following is an account of the activities done under each thematic issue which in turn, contributed to developing resilience against climate change in the Mahewa ward:

#### Water and Sanitation (Solid Waste Management, Water Quality Monitoring)

##### Pre-intervention situation

The physical availability of domestic water was not a problem for the residents of Mahewa ward. The baseline showed that about 56% of the people had access to handpumps for drawing water. Because of

higher level of ground water table installation of hand pump was not a costly affair and so most of the residents had their own handpumps. Northern parts of the area had municipal water supply connection. Thus, New Mahewa and Transport Nagar people fulfilled their domestic water needs from municipal water supply and tap connections installed by the GMC.

Although water availability (quantity) was not a problem in Mahewa, its quality was a serious issue. Broken pipelines passing through open drains had caused serious contamination of drinking water. Majority of the Indian mark II hand pumps in the area were installed in low and water logged areas. As a result, during the rainy season the handpump water used to get contaminated. According to a survey conducted in February-March 2011, out of the total 1406 households, only 331 households had access to piped water supply. A total of 12 India Mark-II



handpumps were installed in the ward and many of them were dysfunctional and only 175 households had access to the working handpumps. Rest of the families were dependent on shallow handpumps which were completely contaminated. Besides that a large part of the area has not been regularized and being in a flood prone and water logged zones, people's accessibility to safe drinking water gets affected. Due to low literacy and also low levels of awareness, people were not conscious about the after-effects of drinking contaminated water. The baseline survey indicated that almost 60 percent of the households did not filter water before drinking while only 25 percent took some precautionary measures like filtration before consuming. The vast majority of households (55 percent) did not have a sanitary toilet in their house. Consequently they were forced to go for open defecation. Though there were some community toilets but they were also not in good condition. During heavy rains and waterlogging, it used to be a nightmare for the people, especially women to go for defecation.

Apart from water and sanitation issues that the ward was facing, ill management of solid waste in the ward was adding to the problem. The municipal authorities had failed to mobilise the community and educate citizens on the rudiments of handling waste and proper practices of storing it in their own bins at the household-, shop- and establishment-level. In the absence of a basic facility of collection of waste at source, citizens were prone to dumping waste on the streets, open spaces, drains, and water bodies in the vicinity which was creating insanitary conditions. Citizens assume that waste thrown on the streets would be picked up by the municipality through street sweeping but it was not in practice. The reasons behind this were lack of governance in the ward and lack of financial and human capacities to assign workers to collect wastes. Moreover, the development of this ward was not on the priority of the Municipal Corporation and hence the condition of the basic services was very poor. For the general public, which is quite indifferent towards garbage disposal etiquette, the onus of keeping the city clean is entirely on the Municipal Corporation. This mind set was a serious drawback which was responsible for unscientific systems of waste management in Mahewa.

In a nutshell, it was inferred that mismanagement of solid waste was impacting the water and sanitation situation in the ward. These three problems were closely linked and the community felt that if solid

waste management process was streamlined in some ways, it could have positive impacts on water and sanitation situations as well.

### Impacts of climate change

As mentioned before in this report that studies on climate projection have revealed that in the coming years, extreme temperatures will be felt in summers and winters in the Gorakhpur city. Erratic rainfall situations will also aggravate with increased rainfall in lesser number of rainy days. This will lead to acute waterlogging if appropriate steps are not taken now. Therefore, lack of proper drainage system in the Mahewa ward, absence of underground sewerage lines, waterlogging in the ward, open defecation because of lack of individual and community toilets and the fast pace of increasing population will not only contaminate the groundwater in the long run but will also adversely impact the health and hygiene of people living in this ward. Hence, climate change impacts will be severely felt on these marginalized people in the years to come.

### Project intervention and outcomes

In order to deal with the water and sanitation problems in the ward, a thematic committee on this issue was constituted as mentioned earlier. The water and sanitation committee looked after the solid waste management and water quality surveillance activities in the Mahewa ward. Following activities were undertaken to improve the water and sanitation situation in the ward and make it climate resilient:

**Solid Waste Management (SWM) :** The interventions started with intensive awareness programmes on the important of water, sanitation and solid waste management in the ward. Though people were suffering with the adverse impacts of these issues especially during the rainy season, they were reluctant to take initiatives to overcome this problem. Changing the mindset of the people and sensitizing them on these issues was a daunting task which the water and sanitation committee members took up with the support of GEAG. Awareness campaigns were held which included distribution of pamphlets and posters, small group meetings and discussions, street plays and wall writing through which people were made aware on the importance of these issues.

Post to the awareness campaigns, the committee started working on an intervention for effective



management of solid waste in the ward with the support of GEAG. The experiences gained from the pilot project on decentralized solid waste management post the vulnerability assessment of the Gorakhpur city were implemented in the Mahewa ward. It was learnt that community participation had a direct bearing on efficient SWM.

It was concluded that this problem could be overcome by sensitizing the community, bringing about awareness and coming up with a plan to manage the solid waste through community participation. A solid waste management committee was formed comprising 12 members. The causes behind the problems of solid waste management were understood through participatory Causal Loop Diagram (CLD) development.

The initiative started with an effort to get a government land for the construction of the site for waste management. Since all the government lands were under dispute, the community members came forward and expressed interest in providing their land free of cost for establishing the solid waste management units. Hence, three units were established which was a significant achievement for the whole community. Area specific technology was developed and adopted for the solid waste management. In Mahewa, drums are being used to convert the biodegradable waste in compost. The drum technology was adopted as it could be shifted from one place to another in case the area got waterlogged. This was done keeping in mind the

changing climate patterns and an effort to build resilience against it.

The collected and separated biodegradable kitchen waste is kept in a porous bag after mixing a culture in it and finally the bags are put in drums. After 24 hours the liquid starts to come out from the hole made in lower side of drum and is collected in the containers to be used as liquid manure. After 14 days of last kept bag in drum the total waste is naturally converted in to compost which is used as manure after getting it dried. The total process is supervised and monitored by the ward level committee constituted for the purpose.

For decentralisation of solid waste, the three units of SWM have been established and two workers have been appointed for each unit for door-to-door collection of the solid waste in the morning. They separate the biodegradable waste from total collected waste for composting. The non-degradable waste is given to rag pickers to sell for recycle and the rest materials are disposed off at safe place. The solid waste thematic committee looks after the whole process such as the appointment of workers, monitoring of waste collection, separation and process of composting as well as look after the regular sweeping of roads and cleaning of drainage by municipal corporation persons. The committee in consultation with the community members has fixed a fee of Rs.10/- which every household pays on a monthly basis. This is a small initiative towards sustainability of this process which is in line with



Ostrom's principles. The committee is also organizing awareness campaigns for sanitation, prohibition of plastic use, generation of resources and fund for the sustainability of SWM. The initiative has improved the sanitation condition of the ward and most of the drains are now free of garbage. The liquid and solid manures prepared through solid waste management are being used by the local farmers and they have given very positive response on its quality and effectiveness. It has raised the yield capacity of the soil and active as bio-pesticide to protect from insects and pests.

This method of solid waste management with people's participation has not only been an effective model but has helped in keeping the environment and surroundings clean. This has proven to be a successful model which can be very well adopted by other wards of the city.

**Drinking water quality surveillance and awareness:** During meetings with the community groups, it was learnt that the drinking water was not safe in that area which was often resulting in outbreak of water borne diseases especially during monsoon season. Because of low levels of literacy, poverty and lack of awareness, people in the ward could not see the connection between water and ill-health. Getting their water tested for quality issues was a big unknown to them. In order to make people aware of the unsafe drinking water in their ward, a water testing laboratory was established by GEAG in the Mahewa liaison centre. Water samples from various sources like shallow & deep bore hand pumps, piped water and bore well were collected from different parts of the ward and their physical and chemical attributes were tested during pre and post monsoon season in the laboratory. The testing results were shared with the households in community group meetings. It was also shared with the members of the ward level committee in order to make them aware of the water quality issues in the ward and advocacy for adoption of relevant measures for ensuring safe access to water was done by the thematic committee members. Consequently, more than 300 households adopted preventive measures like filter/RO system in their homes. The community members inferred that access to safe water has resulted in reduced incidences of water borne diseases like diarrhoea, vomiting, fever, etc. Besides, the committee members carry out regular awareness campaigns at relevant times, especially during the monsoon season to educate people to access safe water.



The committee members have been consistently advocating with the local administration. People's demonstration with local community at water works (JalKal) department was carried out which compelled the department to enhance safe drinking water facility to the people of the Mahewa ward. As a result, the concerned department extended 667 metres of water supply pipeline in the unserved area of the ward and 35 households were motivated to have new connections with valid registration. The community members identified five deep bore hand pumps which used to get water logged in times of flooding. It was decided to raise the level of handpumps and construct a platform which could provide safe drinking water during flood/ water logging period. The constructions were financially supported by GEAG and the community made contribution in kind by providing labour and playing supervision roles. The community members are now taking care of its operation and maintenance costs as and when the need arises. Today, approximately 900 households who used to suffer because of water problems have access to clean and safe drinking water because of this initiative. This has also shown clear impacts on the health of the community people, especially children.

### Decentralized Drainage System for Storm Water Management

#### Pre-intervention situation

The lack of proper drainage infrastructure was a serious problem in the Mahewa ward. The drainage system that existed at the time of baseline survey lacked engineering considerations and did not meet the design requirements. The majority of population in the Mahewa ward falls in low income group. Due to limited accessibility to municipal services and the poor quality of infrastructure, Mahewa was often

faced with the challenges of flooding, water logging, and other water-related problems. The maintenance of the drainage network that existed was poor. In addition, the drainage network did not meet the right design standards to provide protection from flood occurrences to the community. Also, the storm water drains used to be filled with garbage preventing the flow of storm water during monsoons.

#### Impacts of climate change

Erratic and intense rainfall over a lesser number of rainy days leads to acute water logging and flooding in the Mahewa ward due to inadequate drainage infrastructure. Most of the drains run full even in the dry season. Therefore, runoff flows along the roads during rainy season for any significant storm. There are number of locations in Mahewa ward which has high risk of flooding especially during monsoon. These flood locations are inherited either by human actions or by nature. One of the major reasons for flooding is lack of drainage infrastructure which community through government agencies should take care off. Galan is one of the neighborhoods which has significant flooding risk. Galan is located in low lying area as compared to surrounding, where runoff from surrounding start draining into Galan in monsoon and cause flood inundation. Based upon interview with the locals,

houses surrounding the Galan are flooded up to one floor water level affecting the daily life of people.

#### Project intervention and outcomes

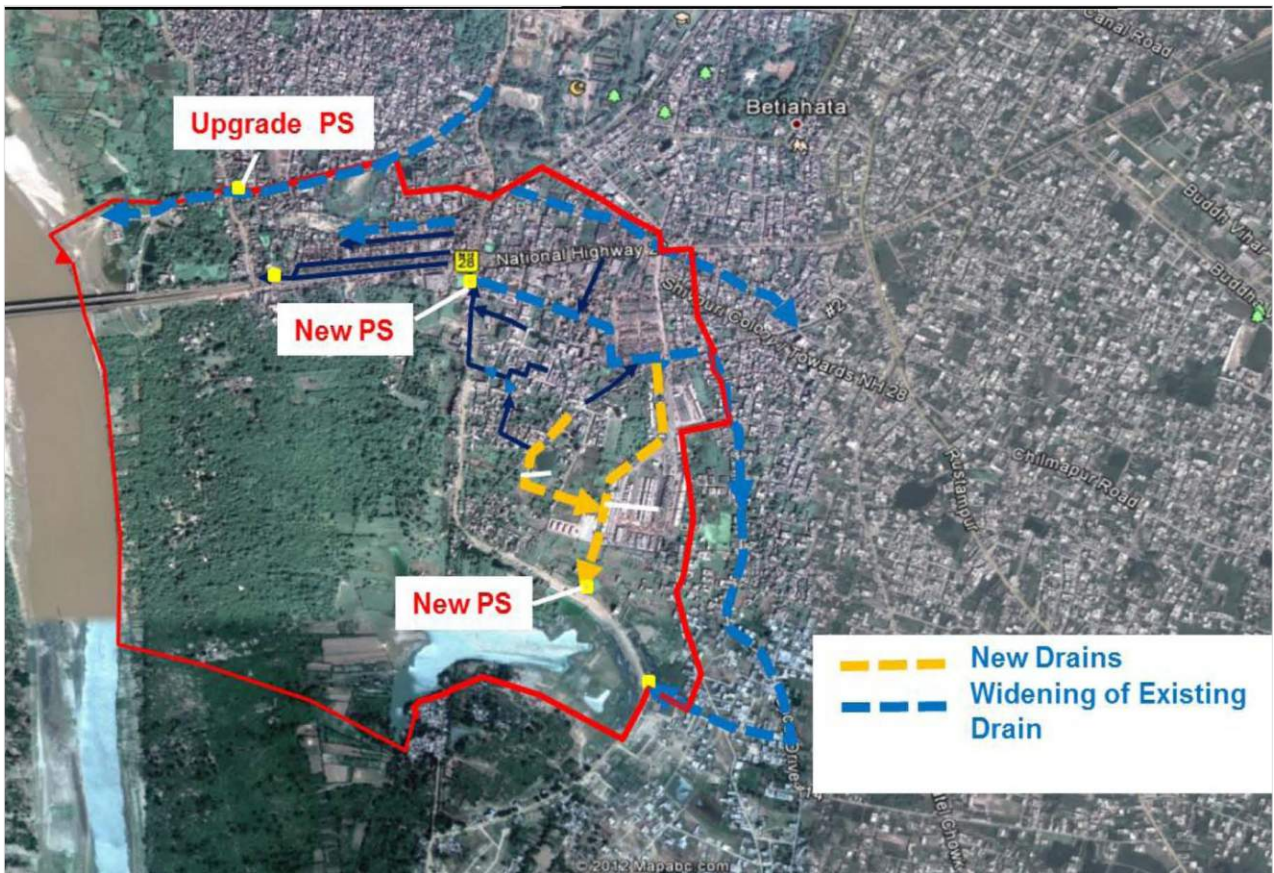
In order to reduce water logging problem in the Mahewa ward, a reconnaissance survey of the whole area was conducted with the members of the drainage thematic committee and a meeting was convened with them to find appropriate solutions to this long-standing problem. Through survey, several water logging points/ places were identified and 5 sites in the ward were strategically selected with the discussion of local people to retrofit the existing drains which would help in reducing water logging after rains.

In this process, the drainage thematic committee organised rigorous meetings with the local residents of Mahewa and motivated them to participate in solving this problem. After initial inhibitions and questions, the residents agreed to come forward and contribute in form of cash, kind or labour for construction/repair of the drains at selected points. Thereafter, the plan and estimated budget was finalized. With the support of the community, 751 metres long drainage was retrofitted. The support shown by the community was overwhelming as they contributed in terms of money or gave construction materials or contributed by working as labourers.





Fig 8 : Proposed New Drainss, Pumping Station and Upgrading of Existing Pumping Station



This activity has had a major impact on the residents of Mahewa. The entire area which used to get water logged for months together every year was free from water logging during heavy rains (517 mm) in September 2012. About 4000 persons have benefitted directly or indirectly by this activity. The Municipal Corporation also constructed the roads and drains in other parts of the ward due to an intense pleading by community along with the Corporator.

Apart from these studies, GEAG had also engaged ARUP to carry out a study to prepare guidelines for planning, designing, construction, operation and management of drainage system at ward level within Gorakhpur by taking into consideration latest advancement in this field around the world. In addition, a drainage master plan was developed for the Mahewa ward including its implementation strategy for drainage improvement works (Fig. 8).

Climate Resilient Agriculture (CRA)

Pre-intervention Situation

Farming as an occupation has been on a declining

trend in the last few years in Mahewa. This has been because the Gorakhpur Masterplan 2021 demarcated this area as residential area because of which people were forced to leave this area. The other reason that was cited as part of the household and community consultations was that farming as no more a lucrative business for people due to increasing input costs and declining benefits. Today, about 14% of Mahewa ward is under agricultural activities which are done mostly by the small and marginal farmers. Due to the presence of a wholesale vegetable market nearby, Mahewa farmers mostly grow cash crops i.e. vegetables but that are more susceptible to the unfavorable weather conditions. At times of flood and water logging, the farmers used to face acute problems as their crops used to damage. This was becoming a compelling reason for the farmers to sell their land and shift their means of livelihood.

Farmers in Mahewa followed traditional farming practices which included usage of large quantities of chemical fertilizers. The community consultations revealed that the cultivators do not have any knowledge or do not get any support regarding low

external input sustainable agriculture practices from the agriculture department. A large area of agricultural land is used for guava cultivation in Chakra. At least 100 families are dependent on guava cultivation in that area. They usually get income by producing guava two times in a year.

Impacts of climate change

Climate has a direct bearing on agriculture. Extreme temperatures during summer and winter season not only have affects on the soil but also enhance incidences of pests and insects in the crops. Disasters like flood and waterlogging washes away entire crop which leads to serious losses for the small and marginal farmers. Their food security is hindered completely.

The following table gives an account of the types of climate risks and how they impacted the farming practices of the small and marginal farmers in the Mahewa ward:

Table 2 : Climate Risks and Impacts

Climate Risks	Impacts
Change in rainfall patterns	Untimely rainfall crop grown at various states like harvesting, winnowing, etc. For Example, it led to rotting of potato/onion, problems in storage of food grains high incidence of diseases, decline in production, etc.
Floods	Floods impacted the kharif crops mostly leading to pressure on Rabi crops. This resulted in food insecurity.
Drought (rare)	Drought in flood affected areas has proven to be the worst situation for the farmers of Mahewa. Floods destroy the kharif crops and drought takes away the Rabi crops leading to high food insecurity for the farmers. This has had several social implications also on the farmers, their lives and livelihoods.
Variations in vegetable	This has a direct temperature bearing on crops. Since most the farmers in Mahewa depend on vegetable crops, very high or very low temperatures have impacted on th quality of vegetables and control on weeds become difficult.
Change in weather	Weather changes have impacted the timely sowing of crop seeds due to which the production gets affected.

Project Intervention and Outcomes

Under the Climate Resilient Agriculture theme, 10 farmers of Mahewa ward were selected for developing as model farmers and were informed by GEAG about resilient farming systems in water-logged conditions. These farmers were selected on the basis of following criteria:

- Should be a small and marginal farmer
- Should be open to learn new and innovative techniques
- Preference was given to women farmers
- Should be able to take risks
- Should be ready to go out and learn
- Should be intensively involved in agricultural activities.

Detailed farm planning for one year was prepared with these 10 farmers. Their land was divided into smaller parts and mapped by GPS. According to the waterlogging information in each of these parts, crop planning was done with the farmers and suitable crops and techniques were suggested. The farmers were trained on techniques of time and space management in crops, crop diversification, multi-tier farming system and integration of animal husbandry in their farm to mitigate the impacts of climate change and reduce the input cost in agriculture. The interested and motivated farmers have now adopted the resilient farming method and getting good produce even in water logged farms. Farmers were educated about the techniques to create and use elevated seed beds covered with low poly house to raise vegetable nursery during monsoon periods when their fields are water logged. This would help them to plant the nurseries as soon as the fields are free from water inundation. Likewise the climber variety of vegetable (Sponge gourd and bottle gourd) were planted with support of *Dhaicha* (*Sesbania aculeata*). This supportive plant (*Dhaicha*) is good source green manure. It increases the nitrogen content in the soil and can be also used as fuel during the rainy season.

All these 10 model farmers were trained and input support was given to develop platform for climber variety of vegetable crops. As a result of these initiatives, farmers have adopted climate resilient farming practices which are helping them in getting good yields even during times of adversities.

**Linkage with agricultural departments:** Effective linkages were established between the thematic committee and the ward level committee on CRA





with the agriculture and other related departments so that the farmers could be benefitted with new schemes and subsidies. As a result of this linkage, farmers have been able to mobilize seeds, saplings, soil testing services and attend several capacity building programmes.

**Replication:** The model farmers have been instrumental in disseminating their experiences of adopting climate resilient agricultural practices to the other farmers of the Mahewa ward. Gradually, the other farmers have also started adopting such practices. 40 new farmers have got associated with the model farmers to learn and adopt CRA practices.

### Community Health

#### Pre-intervention situation

The poor sanitation, unmanaged solid waste dumped in low lying area, poor awareness level on health and hygiene, mass level open defecation, substantial breeding of mosquitoes, flies in the stagnated water and use of contaminated underground water for drinking are the major causes of outbreak of water and vector borne disease and epidemic in the Mahewa ward. Children suffered from water borne diseases such as diarrhea, pneumonia, small pox, skin diseases, malaria, cholera, typhoid, jaundice and Japanese Encephalitis. Low levels of awareness, poor socio economic conditions and subhuman filthy living condition were the prime reasons for these diseases. Due to their ignorance, people found it difficult to relate the water and ill-health connect.

#### Impacts of climate change

Owing to its low lying area, waterlogging and flood situations have been common because of erratic rainfall patterns. Due to this, the water in the shallow handpumps gets easily contaminated which is consumed by the residents and leads to illness.

Also, water stagnation becomes a breeding ground for insects mosquitoes and flies which spread diseases.

#### Project intervention and outcomes

The Community Health Committee was constituted to work towards improvement of health related issues in the ward. Regular awareness campaigns about hand wash, general hygiene, wall writing for preventive care for various communicable and water and vector borne diseases and immunization activities have been done with the initiatives of the committee. Health awareness camps were organized to bring about consciousness in the community on the water and vector borne diseases. In this awareness programme local people were informed about the causes and preventive measures of water and vector borne diseases through IEC materials, and counselled by competent doctors of the city. Door to door information was given to reach the children, pregnant and lactating women for routine vaccination at pre decided time and place. Now women have become aware and they come with their children to vaccination booth on pre determined dates of immunization. The referral services have been started to the specialized doctors. About 210 women and adolescent girls were trained on aspects of proper health & hygiene that are in turn, disseminating the message in the entire community.

A Clean Water Campaign was organized in the ward where several activities were undertaken for bringing about awareness on the importance clean water and safe sanitation. Chlorine tablets were distributed to people for cleaning their water and importance of boiling/filtering the water before consumption was informed. Appropriate liasoning with the govt. departments was done by the community members

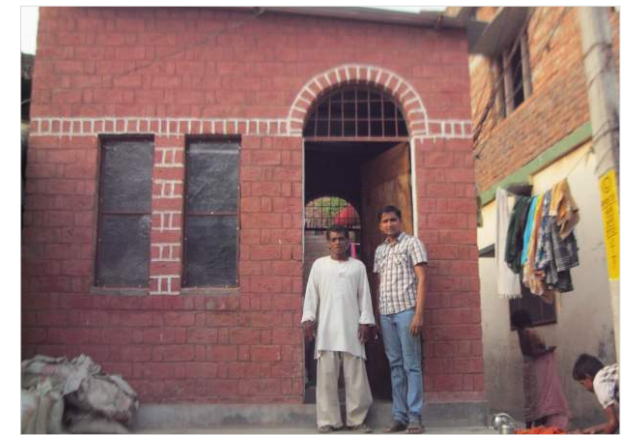


to get piped water supply and now 712 households have access to it. Rising of handpump levels and construction of platform was also done in order to avoid contamination during waterlogging periods. 337 households came forward and constructed individual latrines in their homes. The outcomes of these interventions have been very heartening. There were no incidents of malaria, cholera and Japanese Encephalitis found after the project interventions in the Mahewa ward. No water borne diseases have been reported such as jaundice, dengue, etc. People have realized the importance of health and its connection with cleanliness and hygiene and they are taking due care of it.

### Risk Resilient Building

Large sections of the community are from marginalized and poor socio economic background. Thus, these poor people are more vulnerable to these climatic hazards and its impact. This initiative is very innovative and interesting for the people of Mahewa. As major portion of the ward is water inundated, this initiative caters to the dream house for those people who do not have the capacity to build house at current price and designing trends. For the purpose of demonstration, one low cost building was constructed in the Mahewa ward. In this process technical support was taken from SEEDs India, a Delhi based NGO. This risk resilient building will :

- **Will enhance physical impacts by encouraging practices of disaster resilient technologies :** Lack of knowledge of technology encourages the habit of inappropriate constructions which
- **Will ensure financial benefits by intervention of cost effective houses :** Low cost demonstrates house constructed in rat trap bond technology which not only reduces the cost as compared to conventional brick techniques but also gives avenue to the desires of the poor people to have a safe house in affordable cost.
- **Will minimize climatic impacts by intervening sustainable technologies :** The rat trap bond makes the house more climatic resilient which provides people with comfort living in extreme weather dipping dependability on other energy



Source : Seeds India

further swells onto the risks on the lives. This project addresses climate change resilience of safe housing technologies in vulnerable communities like Mahewa which will improve the lives of the urban poor. Intervention of easy technologies will ensure adaptation/replication of safe technologies for urban poor to afford safe houses.

#### Box 6 : 2013 Lighthouse Activity Award for the Risk Resilient Building

Community-Based Micro-Climate Resilience has helped the urban poor communities in Gorakhpur to adapt to climate change by designing and building a new, affordable flood-resilient house. Using locally available bricks and techniques to reduce energy intensity, this has proven to be environmental friendly, both in terms of optimization of resources and energy efficiency.

GEAG along with the technical support from SEEDs India designed a low cost model house to meet local needs that can be easily replicated throughout the

community in the Mahewa ward of Gorakhpur. This house features unique design elements that limit the climate change impacts such as higher plinth levels to reduce risk of waterlogging, walls constructed to moderate temperature and earthquake-proofing. The house is both climate resilient and produces fewer carbon emissions. The total cost of construction of this house was 0.15 million. This initiative was awarded a 2013 "Lighthouse Activity" by the UNFCCC at the 19th session of the UN Conference of the Parties at Warsaw, Poland.



sources. Rat trap reduces the cost of wall by 26% and also allows savings on material, simultaneously minimizing the environmental impact.

- **Will improvise social/community benefits by intervening toilet facilities :** Cluttered houses, inappropriate technology adaptation and unhygienic living conditions are common scenario in Mahewa. The house with the sanitation unit ensures better health and hygiene for the family.

### Livelihood for Women in Slum Areas

Majority of the community members in Mahewa are poor and marginalized with hardly any income opportunities. Hence, to catalyze the livelihood opportunities for the women of two selected slums a training need assessment was apprehended. Based on their skills and interest, 30% of the women are linked with semi public micro-finance institutions for their entrepreneurship. Few women have shown interest in animal husbandry such as goaterly and piggery and for this purpose, Gorakhpur Rural bank, a nationalised bank, is in the



process of sanctioning loans to them. Adolescent girls who were interested and willing to learn sewing and stitching were admitted in a charity school providing free training for them. The other livelihood activities adopted by women members are packaging of incense sticks, pencils and bindi packets and making wall hangings. The women members have also formed a group called Mahewa Mahila Samiti. An orientation meeting was organized in which Manager of Grameen Banks have shared about the schemes and the process to take maximum benefits from the respective bank. As an impact of this meeting, common interest groups have been formed to take the financial support from the bank.

### Momentum for Change 2013 Lighthouse Activity

## Community-Based Micro-Climate Resilience



United Nations  
Climate Change Secretariat

*Christiano Figueres*  
UNFCCC Executive Secretary



## CHAPTER : 7

### Monitoring of Institutions



The monitoring system that exists within these community institutions is fairly participative in nature. The institutions have rules which are clearly defined by its members. The members function as monitors as it helps in monitoring each other's activities. All the members are aware that others are watching and non-compliance of rules would be noted and followed by penalties. The emphasis is not on fault-finding of members, rather it is on fact-finding and helping the community members to take steps to correct their actions which in the long term will help others as well. This becomes the incentives to follow rules strongly.

All the six institutions established at the community level have monitoring functions embedded in them. Below is a step-by-step monitoring process of how community was sensitized for disposing their domestic waste to the waste collector in the Mahewa ward:

1. At every 10 households in the ward, a vigilance group has been formed which is on a voluntary basis to check the attendance of the waste collector.
2. The thematic committee member marks the attendance of the waste collector on a calendar regularly.
3. The above two activities are supervised by the solid waste thematic committee and by the ward committee.
4. Doors of the households which do not give their waste to the waste collector are marked with a chalk by the waste collector. He then, comes and reports the same to the neighborhood committee and the solid waste thematic committee members.
5. The use of chalk for marking the households was not found to be very effective as it used to get rubbed off. Therefore, in order to bring about



positive behavior change in people and that they start giving the waste to the waste collector instead of throwing on the streets, the neighborhood committee and the vigilance committee members decided to make a three indicators which would be painted on the doors of the households. They decided that the households will be marked by three different colors - red color for households who do not give waste to the waste collector, green color mark for the ones who regularly gave waste and orange color was meant for the households who although give waste to the collector but still throw some garbage on the streets.

6. The above activities are supervised by the thematic committee and the ward committee members along with the GEAG project team.

7. The committee members have themselves decided that if this method of putting marks on the households and shaming the people does not change their attitude towards disposing garbage safely, they will impose a monetary fine for such households.

This type of monitoring mechanism with graduated sanctions has been working well in the Mahewa ward. Similar monitoring mechanisms are being set up for other themes as well. People are changing their mindsets and adhering to the rules. The strength of participatory monitoring processes proves to be successful as the entire onus is on the community.

## CHAPTER : 8

### Urban Climate Resilience Indicators



The Urban Climate Resilience Indicators was developed through an intensive process led by ISET International. It was intended that these indicators would be used by city level partners to develop indicators that will help them think about and track changes in urban climate resilience. The matrices use the Urban Resilience Framework definitions and categories of system resilience and agent capacity, as well as institutional factors, and then derive example indicators for selected systems. Following is the process that was adopted in formulation of these resilience indicators:

- **The first step: Vulnerability Assessment :** In order to create indicators of Urban Climate Resilience, cities will need to first undertake a *Vulnerability Assessment*. The analysis from a *Vulnerability Assessment* shows which systems are most vulnerable, which social groups are most vulnerable, in which locations, to climate change impacts in the city.

- **The Second Step: Selecting Priority Systems:** Using the *Vulnerability Assessment*, cities should next decide on which systems are of greatest importance for overall city resilience. Cities should pick 3 or 4 systems for which to develop indicators.
- **Identifying Indicators using this Draft Guidance Tool:** Based on the *Vulnerability Assessment*, and using this guidance tool, cities can develop their own indicators for each system selected.
- **Indicators and Indices:** Once data has been collected for each indicator, they can be scored and aggregated using the scoring method. This allows overall summaries for different resilience factors and for each system studied, in order to make comparisons and to show changes over time.



Indicators may be qualitative (e.g. Yes / No or narrative descriptions). Indicators should be simple and understandable, but they should also be measurable (in other words, the value of the indicator should be clear from the data). Indicators should be chosen so that the values that mean higher resilience are practical and achievable, relevant to the desired resilience outcome, and apply to the appropriate timeframe for local action. They should be based on data that is already available, or can be obtained fairly easily.

Based on this guidance tool, GEAG prepared the climate resilience indicators for all the six themes but these were adapted to local working conditions. These indicators were developed over a period of 3 year process. The steps and processes adopted by GEAG in preparing these indicators were as below:

- Identification of climate risks in the city
- Vulnerability assessment of the city and identification of vulnerable areas and sector
- Development of Resilience Strategy for the city

- Long term and short term resilience actions
- Implementation on six-resilience actions at the ward level
- Base line data collection and analysis for tracking of resilience actions
- Indicators set in this resilience frame work like **system** (flexibility and diversity, redundancy and safe failure), **agent** (resourcefulness, responsiveness, and capacity to learn), **institutions** (policies etc.)
- Broad indicators and sub-indicators were developed for these six identified vulnerable sectors and comparative analysis and validation of existing government indicators were under taken

As a result of the above exercise, following indicators and sub-indicators were developed for all the six themes operational in Mahewa ward. The community institutions are being monitored on the basis of these indicators.

Table 3 : Resilience Indicators

Services	Main Indicator	Sub Indicator
Water Supply	Zone wise demand/ supply ratio of water supply	a. Number of neighborhoods of water supply b. Number of water coonection c. Norm of per capita water supply d. Actual amount of water supply
	Extent of non-revenue water	a. Total water produce b. Total water supply
	Coverage of water supply connection	a. Number of HHs in neighborhoods b. Total Number of NHs with direct water supply connection
	Cost recovery in water supply services	a. Total operating expenses b. Total annual operating revenue
	Redressal of customer complaints	a. Total complaint received b. Total complaint readdressed
	Budget on water supply	a. Budge allotted for maintenance b. Percentage of expenditure incurred on maintenance
Sewerage and Drainage	Coverage of sewerage network	a. Total length of underground sewerage b. Are there any sewerage zone in the NH? c. Number of HHs having direct connection
	Storm water drainage network	a. Total length of road network b. Total length of PST drain
	Incidence of water looging/flooding	a. Number of water logging points marked b. Number of days of flooding/ water logging
	Percentage redressal of customer complaints/ efficiency of redressal of customer complaints	a. Total Number of sewerage related complaints received per month b. Total Number of complaints reddressed per month
	Efficiency in collection of sewerage charges	a. Current revenue collection in a year b. Total operating revenue billed during the year
	Total revenue received from sewerage charges (SLB)	a. Total annual operating expenses b. Total annual operating revenue
Community Health	Health related	a. Number of public/private health care centers in the ward b. Number of physicians in ward c. Number of ICDS centers available in the ward d. Number of health camps organized e. Number of persons reached out through health camps f. Percentage of HHs adopted vaccination
Risk Resilient Buildig	Housing related	a. Percentage of built up area in the flood prone area b. Number of HHs who relocate voluntarily away from hazardous areas c. Number of HHs in flood/ waterlogging having safe plinth
Sanitation and Solid Waste	Sanitation and Solid Waste	a. Number of HHs covered by SWM b. HHs level coverage of SWM services c. Percentage of redressal of customer complaints per month d. Percentage of expenditure incurred on SWM services e. Budget allocated under solid waste management services
Climate Resilient Agriculture	Conservation of open spaces	a. Number of farm models developed b. Number of farmers linked with CRA
	Adaptive Agriculture in water logged condition	a. Percentage of increase in net income of farmers b. Number of farmers adopted loft farming techniques c. Number of crops grown in one year



## CHAPTER : 9

### Impacts, Sustainability and Scaling up



This initiative of building micro resilience planning in Mahewa ward has succeeded in terms of meeting the expectations of raising broader awareness among diverse audiences and generating initiatives that benefit the vulnerable sections of the society. The interventions done through formation of community institutions at the ward level and their convergence with the city level institutions helped in addressing the problems of poor and marginalised which people which are caused by climatic changes. The pilot initiative has impacts on all the three key aspects of urban resilience i.e. systems, agents and institutions. Below is an account of the few visible impacts that the project has succeeded in making:

#### Collective understanding on Climate Change Resilience

The term “resilience” is a technical one and is difficult to understand for a common person. Hence, while

dealing with this term in relation to issues, “resilience” term was rarely used. The idea of building resilience and its concepts were transferred to the community members successfully by developing this understanding through local examples. Therefore, the micro resilience planning, through its participatory methodologies of functioning was quite successful in developing a collective understanding on climate change resilience in the community.

#### Provision of basic need services

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



which was never on the priority list of the Municipal Corporation, started getting all the attention when the residents started voicing their problems, taking initiatives and walking that extra mile to ensure that their rights and entitlements are respected and fulfilled. The workers from the Municipal Corporation has come to good terms with the Mahewa ward level committee members and attends to problems in the ward on the request of the committee members which was never the case before.

### Improved Governance

Another significant impact of the resilience planning process was in ensuring improved governance system in the ward. Though the government was functional in the ward since ages, there was hardly any governance and the ward had been suffering because of this limitation. People's participation and their initiatives to solve their problems involving the Corporator of the ward started ensuring good governance in the ward. To quote an example, there is a ward level government health centre established and the health visitors are supposed to visit all neighbourhoods of the ward for immunisation of children but they never used to come regularly. With the efforts of the community members, the visit of the health visitors to every household of the ward was streamlined. They also started maintaining proper records of immunisation and made sure that every child in the ward was immunized.

### Linkage between Climate Change and Development Mechanisms

The linkage between climate change and development mechanisms can be seen from two different angles in this case. Firstly, at the ward level, an understanding on the impacts of climate change has been developed among the community members. The understanding may not be a highly scientific one but the community is easily able to understand that there have been climatic changes in terms of rainfall and temperature over the last few decades and they are able to relate its impacts on their lives and livelihoods. In line with these climatic changes and the anticipated changes that the climate projections show, a drainage plan has been prepared by ARUP which clearly outlines the number of drains, its dimensions, etc that will be required which will keep Mahewa free from waterlogging. Another example of this linkage is that the six development themes that were selected for

interventions were implemented through a forward thinking process on climate change. The impacts that the climate change has been causing on agriculture, health, solid waste, water and sanitation situations, etc were assessed and accordingly the implementations were planned in consultation with the community members.

Secondly, at the city level also this linkage has been well accepted. The *Mahanagar Paryavaran Manch* has been advocating on the future impacts of climate change and the development mechanisms that will be required to minimise its impacts on the residents of the city. The Gorakhpur Municipal Corporation has prepared a drainage plan for the city which is under the approval process. The city level institutions and GEAG is strongly advocating that necessary changes in the drainage plan should be made keeping in mind the climate projections and should be retrofitted in the plan accordingly.

### Ownership and Empowerment

The community institutions and the entire community together have taken the ownership of the problems and situations and devised solutions accordingly which is very much in line with Elinor Ostrom's principles of institution building. Through their involvement in the whole process since the beginning, the community and institutions are empowered enough to take collective actions and approach to the higher authorities in the city for mobilisation of resources, etc. Their minds have opened up and they have experienced the positive outcomes of their own work which is keeping them motivated to continue this work irrespective of GEAG's presence in the ward. Going forward, plans of community contribution in some of the interventions will be even more formalised which will enhance the sense of ownership and feeling of responsibility towards their actions.

### Lobbying with Local Government for Scale up

Using these results of demonstration in Mahewa, the community and GEAG has successfully lobbied with the city government to expand and build on these efforts. Mahewa ward's success was attributed to having assembled a critical mass of citizens who were willing to speak out on their own behalf, and to having 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.

### Scaling up of Mahewa Experiences in other Wards of the City

Similar to the institutional framework at the Mahewa ward level, institutions were formed at the city level too. Six committees on the same issues as were identified in Mahewa ward were formed which comprised of citizens from the city, academicians, doctors, government functionaries, etc. City level thematic institutions were formed so that the internal experiences from Mahewa could be disseminated into wider city level departments and organisations by means of exposure visits, create thematic platforms to share learning, and publication of experiences.

The ward level committee formed in Mahewa regularly meets the city level thematic committee on a quarterly interval. There is an effective convergence established between these two bodies. The experiences and learning from Mahewa ward are widely shared in the city level thematic committee meetings so that those can be replicated in other wards of the city which are dealing with similar problems of climate change. The City Steering Committee acts as an active advisory body and advises on the ideas for solutions at the Mahewa level. The Steering Committee provides feasible solutions and resources, whenever required, for solving the problems at the Mahewa level. For example: for conducting the health camps in Mahewa, the city doctors were mobilised for free check-ups of the residents of Mahewa. This could happen only because of the convergence that has been established between 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 MPs, MLAs, Nagar Nigam, Government Departments, etc. For example: liaisoning with the agriculture department was done to get subsidised inputs for the farmers practicing 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) Gorakhpur has adopted Mahewa ward as a live model for Climate Change Adaptation & Disaster Risk Reduction.

Another important outcome of this has been that based on the experiences of decentralised drainage

management in Mahewa, ARUP organisation has developed a City Drainage Plan for Gorakhpur. This is a significant advocacy tool in the hands of GEAG and a contribution to the city's planning process. Experiences from the ward are also shared in a continuous learning mode, with other city stakeholders such as the *Mahanagar Paryavaran Sanrakshan Manch* (City Environment Protection Forum), the elected Corporators of other wards in the city and other interest groups.

### Replication

Some of the interventions piloted in Mahewa have already been used in other projects by GEAG and even by other people in the city. For example, the learning from Climate Resilient Agriculture has been used extensively in the peri-urban project where these techniques and methods have been disseminated and implemented. Similarly, the solid waste management system has been adopted by a prominent hotel in the city and the Gorakhpur Jail for converting their kitchen solid waste into manure.

### Media Engagement

The print and electronic media have been engaged to cover stories of people led processes in the Mahewa ward to plan resilience against climate change. Several case studies and experiences were documented and shared at various city level forums such as City Steering Committee, *Mahanagar Paryavaran Manch*, District Disaster Management Authority (DDMA), Rotary Club, Masonic Lodge, etc. One to one meetings were held with other Ward Corporators, citizens, Municipal authorities and other officials at city and higher levels to disseminate the outcomes of the pilot. This led to various discussions for using experiences from Mahewa and implementing in other areas of city in sectors such as housing, solid waste management (which has scaled at various institutions like hotels, jail, railways, etc), urban agriculture, etc. The tools used for media engagement were dissemination of the City Resilience Strategy, vision sheets, thematic papers, media reports, campaign materials (posters, handbills, and stickers), video film (Tales of Gorakhpur), etc.



## Dissemination through Participation in National and International Events

The learning of the innovative people's led resilience planning in Mahewa ward has been shared at various national fora such as like Delhi Sustainable Development Summit (DSDS), National Institute of Disaster Management (NIDM), Lal Bahadul Shastri National Academy of Administration (LBSNAA), National Institute of Urban Affairs (NIUA) etc. The experiences have been also shared at various international platforms like Community of Practice (COP), Resilient Cities Congress, Bonn, Durban Mayors' Conference, Durban, Community Based Adaptation (Hanoi, Dhaka), Planet Under Pressure (London), etc. The learning has been incorporated in various documents and position papers at international levels.

## CHAPTER : 10

### Key Challenges



The whole process of building micro resilience in Mahewa went through several hurdles which were overcome. Here is an account of some of the key challenges faced during the course of the intervention. The challenges are being grouped into System, Agents and Institutional aspects, as follows:

#### Agents

1. The first and foremost challenge was related to behavioral change. Behavioral change in a short course is a major challenge but motivation and sensitisation to inculcate the sense of duties and responsibilities through regular dialogue and discourse was done to change the mind set and behavior of the community members. This is clearly apparent from the adaptation of measures of sanitation, safe drinking water and preventive measures against water and vector borne diseases.
2. People of the Mahewa ward were suspicious about the entire initiative at the initial stage but through consistent efforts, confidence was gained and then there was positive response from the community.
3. Recognizing climate change as an issue by communities, Municipal functionaries and elected representatives, was yet another challenge that was dealt with during the course of the pilot. Shared Learning Dialogues with different stakeholders were quite helpful in this regard. It was realised that the local response can be enhanced if the climate change is understood in the local context.
4. Resource constraint was also another obstacle in improving situations of basic services and resilience measures like drainage, solid waste management etc. The lack of local leadership and platforms for communities coming together restricted collective thinking and actions. The



community institutions, both thematic and spatial, helped in addressing this challenge. The issues were discussed and community champions came forward to lead the actions. Communities on one hand contributed in kind and labor and at the same time collectively approached Municipal authorities and local politicians for needed resources. The strong advocacy from the community members helped in identifying possible ways.

- Urban communities are more heterogeneous compared to rural set ups. At occasions the clash of interests among various socio economic groups residing in the ward were also observed. On the one hand, where the poor households depend more on public utilities like community toilet, public hand pumps, etc. the better offs on the other hand, prefer household based services. The thematic institutions helped in such planning where communities belonging to diverse groups came on a common platform to plan interventions at the ward level and work for accommodating diverse interests.
- The capacities of Municipality staff on technical aspects to deal with bottom up and community led planning on issues like vulnerability and resilience is quite low and this was a serious problem in dealing with emerging challenges of the city. The technical staffs have very limited opportunity to get exposed to such experiences. There are neither any provisions for conducting orientation or refresher courses for the technical staff nor there is any effective resource institution from where such information can be sourced and trainings can be obtained.

### System

- In Mahewa, the committees at the ward level faced problems in getting public land for establishment of solid waste management units or the low cost house. Finally, the community members came forward and willingly donated their lands for these purposes.
- The formation of wards has been done unscientifically and as such there are no criteria on which it is based upon. They are neither carved out on the basis of natural topography nor any socio-economic or developmental criteria. Because of such unplanned and unscientific approach towards city's development, the new interventions face severe

challenges like flow of water. Planning like drainage, sewage management etc cannot be taken up effectively at a ward unit level because of such limitations.

- The non availability of data on aspects like gradients, ecosystems, land use, green areas, water flows, climate, etc were felt as a major challenge in planning processes. Efforts were needed to generate such data through studies and research which were time consuming and resource intensive.

### Institution

- In any community driven process which needs formalization and institutional mainstreaming, there is a need for mutual dialogues amongst people and related institutions. In urban governance there is no formal or informal provision of such regular dialogue between citizens and Municipal Corporation. In places where surveillance and monitoring mechanism 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. Citizens are not part of any planning or service delivery process. This also caused hindrance in smooth flow of communication between community and service providers and hence a positive dialogue amongst the two stakeholder groups was affected.
- The 74<sup>th</sup> Constitutional Amendment provides space for planning and resources allocation at the lowest ward levels in urban areas. In the state of Uttar Pradesh, this is yet to take place. Micro planning processes at ward level are much easier in states where provisions for such bottom up planning approaches are in place. The lack of such policy provision in Gorakhpur was a major hindrance in institutionalising resilience micro-planning.
- Coordination between community, basic service providers and elected representatives was an initial challenge. However, the identification of causes of the prevailing problems through causal loop diagramming exercises, possible remedial measures, dialogues on common platforms and an informed lead of community institutions helped in such coordination. With the issues becoming people's agenda and a pressure, service providers and elected representatives also responded positively.

## CHAPTER : 11

### Lessons Learnt and Conclusion



This was the first time that GEAG took up the challenge of piloting a climate change micro resilience planning in an urban setting. The pilot has shown encouraging results and the participatory methodologies used in the process have ensured long term sustainability to the interventions. However, the entire process has also thrown up lessons that should be considered in implementing similar initiative of building micro resilience plan against climate change. Some of the lessons learnt in the process are highlighted below:

#### Citizen's Ownership

The planning and management of services and infrastructure is the sole responsibility of Municipal Corporation and its related departments, as service providers. The local communities, especially the poor and marginalized, have no say in planning, priority fixing and decision making and hence the services

and the management are not owned by community. This also causes apathy towards such infrastructure and services and lack of transparency and trust. The work in Mahewa has demonstrated that involvement of communities has not only helped in planning and improving the services but also motivated them for resource contributions. The formation of community institutions for various issues has already started giving indications of sustainability of the efforts.

#### Dynamic Process

The process of building micro resilience plan was a dynamic one which meant that during the course of implementation, many things changed as the pilot progressed. The micro resilience plan developed on the basis of the vulnerability assessment done in the beginning of this implementation served the purpose in initial actions. However, with emerging changes in terms of capacity levels, infrastructure and



maintenance situations, enhanced responsiveness from institutions, clash of interests, etc., it was realised that the approaches and strategies adopted needed necessary shifts. In the concluding phase of the pilot, it is learnt that any such micro resilience plan is a dynamic process and it needs re-visiting the plans and making necessary changes in actions on a periodic basis. Hence, it is imperative to review the actions and progress at each level of implementation.

### Varying Priorities

The urban population living in secondary cities like Gorakhpur is less homogenous as compared to rural areas and bigger cities, especially in micro situation of a neighbourhood or ward. The variation in socio-economic class and their priorities related to basic infrastructure and services also differs accordingly. It is important to keep this in mind while carrying out micro planning initiatives for resilience building. On the one hand where the higher socio-economic groups need enhanced quality services in their houses and can afford to bear its costs, on the other hand, the comparatively lesser better offs depend more on community and public services (toilets, drinking water, etc.) for which payments can be minimized. It was, however, surprising to observe that weaker groups come forward more readily for labor and in-kind contributions for public good. This is because it is them who are more vulnerable and are exposed to the problems and opportunities of common and public goods and services.

### Scientific and Futuristic Planning

The common practice followed in urban development has been resource allocation on the basis of a plan which is based on historical data. In such a context, a top down approach is followed where the city is seen at a macro level and the local issues and problems are largely neglected and the communities are not consulted for their perceptions, problems and priorities. The plans are also developed on the basis of available data which are largely inadequate. The Mahewa interventions demonstrated that proper planning with futuristic projections on issues like habitation patterns, population, climate, etc were helpful. This, however, is resource intensive but in the long term is expected to be cost effective.

### Data availability and Capacity Building

As mentioned above, the availability of genuine and

well maintained data is a serious problem. There is no assigned government department or academic institution which maintains needed data that can be made available to planners and researchers. Data collection processes have been initiated in JNNURM covered cities but it severely lacks 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 urbanization. Regular orientation, exposure and trainings will be helpful in this regard. The city to city exchanges will also be helpful in learning the working tools and strategies of better performing cities. Theme specific exchanges (amongst the cities dealing with identical thematic issues) will also be helpful in this regard.

### Climate Change- Disaster Risk Reduction-Development Linkage

Generally, in the city planning processes, disaster management is not well considered. In cities like Gorakhpur which are affected due to floods and water logging due to its location and geo-climatic situations, it is important that disaster management aspects are considered in developmental planning. In Gorakhpur there is a shift in the climatic situation and the projections of future climate clearly indicate that more such disaster events are likely to occur which the city will have to deal with. The work in Gorakhpur city under ACCCRN and the parallel interventions on integrating climate change aspects in disaster management planning in Gorakhpur demonstrate that disaster management and climate change impacts are mainstreamed in developmental planning and it is very much possible at a micro (ward, zone), meso (city) and macro (river basin) level.

### Poor and Vulnerable to be Mainstreamed

As explained in the paper, the population of poor is increasing in the city and this group is becoming more marginalized due to growth of the city, increasing competition for limited public services, increased events of disaster which are largely climate change induced and other related factors. The city's resilience cannot be addressed unless the vulnerable groups are adequately covered and mainstreamed in

city development. In wards like Mahewa where large poor population resides, specific measures are needed to be taken for addressing poor population and their priorities. This was observed in the Mahewa micro planning intervention that if the poor are adequately involved, they can also contribute to city development and resilience through measures like resource contribution and linkages (linking with appropriate subsidies and schemes), advocacy of their own problems and priorities and improving the services through community monitoring and behavioural change.

### Hierarchy of Informal Institutions and Linkage Platforms of Formal and Informal Institutions

Active civil society is an indication of positive governance in the city. The involvement of citizens in managing the city affairs ensures their participation in planning and transparency. However, it is a reality that people's participation in urban development is almost negligible. In the ACCCRN process the formation of citizens' groups and forums, both on a sectoral and spatial basis, have been quite helpful. As narrated in the paper the thematic and ward committees of local people in Mahewa ensured need based planning, better and effective access to services, community monitoring, resource contribution and advocacy for local needs. Such neighbourhood and ward level committees joined with city level citizens' forum like *Mahanagar Paryavaran Manch*, sensitive to issues of environment and climate change and working on such issues for the last few years to propagate the learning to other wards. The linkage of these community institutions working at different levels helped in creating effective voice of the people and also effective advocacy for the local population- especially the poor and the marginalised.

### Ecosystem (System, Agents, Institution)

Ecosystem services are very important and the poor and marginalised are particularly dependent on such services. Gorakhpur city had more than 103 water bodies on which local communities were dependent for drainage, livelihood activities, etc. City based orchards and farm systems have been the key source of food and livelihood for the people. The open green areas are also playing important role in enhancing the water holding capacity of the city. The city level citizen's campaign in saving Ramgarh lake, low external input agriculture in various locations,

conservation of green areas and water bodies, etc are a few examples demonstrating efforts taken in recognising the role of ecosystem in building resilience of the city. It was a good learning in the process that besides agents and institutional aspects, if awareness and information is ensured, the citizens come forward for addressing the system related factors also.

## Conclusion

This initiative by GEAG to establish micro planning mechanisms in the Mahewa ward within the Gorakhpur city under the ACCCRN programme has succeeded in addressing multiple sectors including agriculture and livelihoods, drainage management, solid waste, community health and housing. All these sectors are those that get severely affected by the impacts of climate change. Participatory processes have been the main drivers of these initiatives and have contributed to the success of the interventions. Bottom up planning approach coupled with active participation of the community members to take initiatives and actions by involving the local government representatives has apparently worked well in building resilience against climate change. This new micro planning model will be shared among other wards in the Gorakhpur city and will advocate the integration of climate resilience in the overall development planning process to the local



## Notes

- ◆ Government of India Census, 2011
- ◆ UN Habitat, 2011, Global Report on Human Settlement: Cities and Climate Change
- ◆ Moench, M., Tyler, S., Lage, J., 2011. Catalyzing Urban Climate Resilience.
- ◆ Opitz-Stapleton, 2009
- ◆ Ostrom, E., 1992. Crafting Institutions for Self-Governing Irrigation Systems; Institute of Contemporary Studies, San Francisco, California
- ◆ Reed, S., Friend, R., Toan, V.C., Thinphanga, P., Sutarto, R. and Singh, D., 2013, 'Shared learning' for building urban climate resilience experiences from Asian cities, Environment and Urbanization October 2013 25: 393-412, first published on 11 September 2013 doi:10.1177/0956247813501136
- ◆ Satterthwaite, D., 2009. The implications of population growth and urbanization for climate change, Environment and Urbanization, 21(2): 545-567
- ◆ Uttar Pradesh Statistics, 2011
- ◆ Uttar Pradesh Primary Census Abstract 2011
- ◆ Verma, S.S., 2009. Geohydrological Study of Gorakhpur City, Sectoral Study conducted by the Department of Geography, DDU Gorakhpur University, under the Asian Cities Climate Change Resilience Network (ACCCRN), sponsored by the Rockefeller Foundation.
- ◆ Wajih, S., Singh, B.K., Tripathi, S., Bartarya, E., Srivastava, A., Singh, A.K., Goyal, S., 2009. Vulnerability Analysis of Gorakhpur.
- ◆ Wajih, S., Singh, B.K., Bartarya, E., Basu, S., ACCCRN ISET Team, 2010. Towards a Resilient Gorakhpur.
- ◆ Ministry of Urban Development, Government of India, The High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 2011. Report on Indian Urban Infrastructure and Services.
- ◆ UN Habitat, 2009. Global report on human settlements: Planning Sustainable Cities.