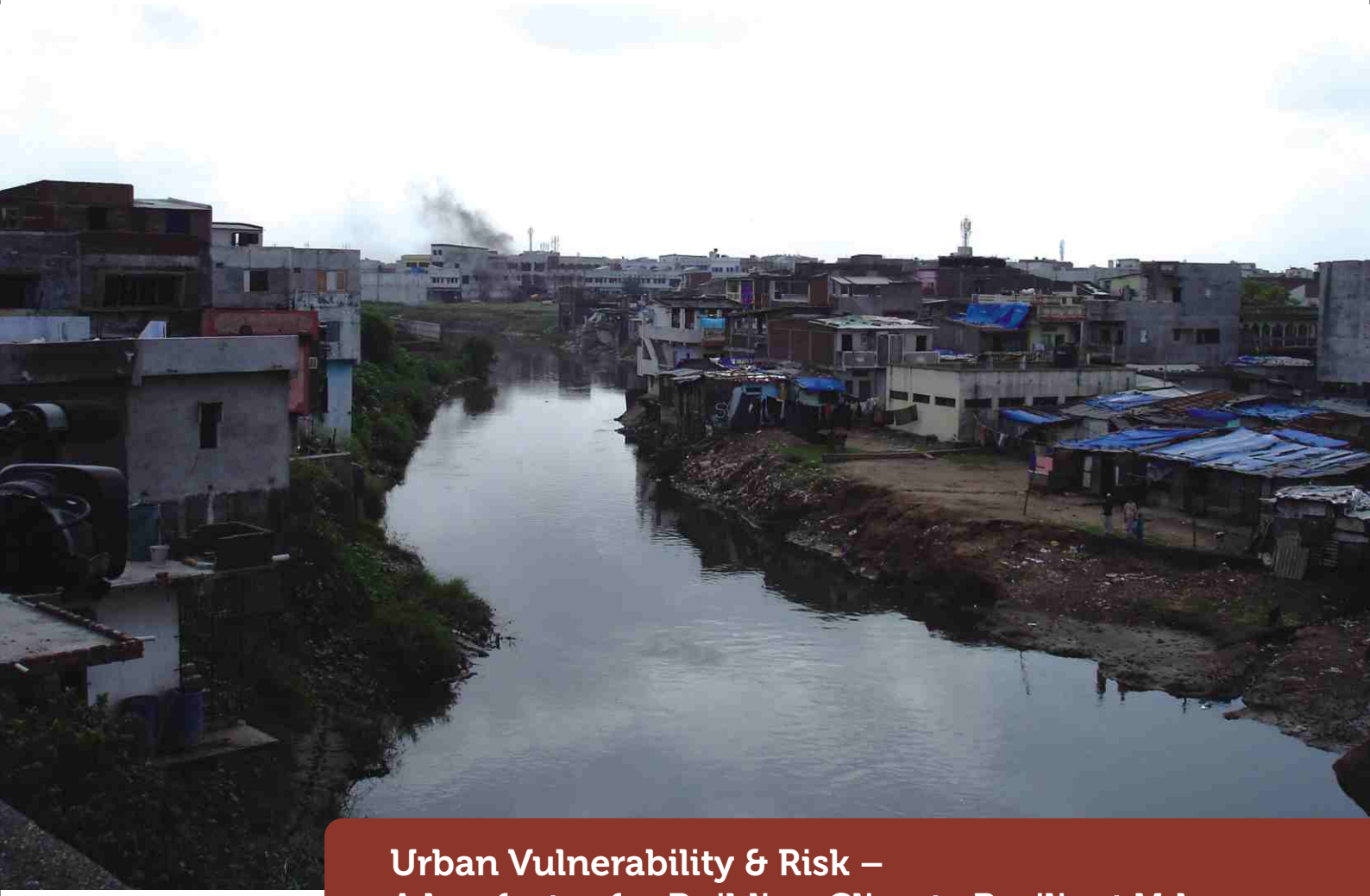
Urban Climate Change Resilience

POLICY BRIEF 2



Urban Vulnerability & Risk – A key factor for Building Climate Resilient Urban Development in Indian Cities

KEY MESSAGES

- Urbanization trend is expected to accelerate in coming decades in India. It is projected that the number of cities with a population of more than 1 million will reach to 75 by 2021 from 53 in 2011.
- Due to diverse physiographic and meteorological conditions, cities in India are exposed to various types of natural hazards. Indian cities are facing additional risk due to climate induced extreme events such as floods, droughts, heat and cold waves.
- An increasing concentration of population coupled with extreme events, results in high damages to assets, interruptions in business continuity opportunity losses, loss of lives, displacement of populations, which is further enhanced by economic and social vulnerability.
- IRADe approach is rooted in the observation that similar climate events can produce very different levels of socio-economic impacts, depending not only on the location and timing of the occurrence, but also the resources and agility of the societies to respond to climate impacts.

India is witnessing rapid growth in the urban centers. Urbanization trend is expected to accelerate in coming decades as well. It is projected that the number of cities with a population of more than 1 million will reach to 75 by 2021 from 53 in 2011. Due to diverse physiographic and meteorological conditions, cities in India are exposed to various types of natural hazards. Indian cities are facing additional risk due to climate induced extreme events such as floods, droughts, heat and cold waves. An increasing concentration of population coupled with extreme events, results in high damages to assets, interruptions in business continuity opportunity losses, loss of lives, displacement of populations, which is further enhanced by economic and social vulnerability.

To address uncertain climate risks to urban ecosystem, it becomes a challenge for decision makers at city level and other urban climate resilience practitioners to select a suitable methodology for assessment of hazard risks, vulnerability & capacity assessment and risk analysis of cities to develop "City Level Climate Action Plan" in a given scenario. India has more than 400 cities in 2011 and climate informed development is needed because urbanization in India is accelerating and cities need to be sustainable and resilient. Hence methods and tools need to be developed to undertake a rapid assessment of city vulnerability and start building capacities to cope with the challenges and planning for adaptation.

1 RAPID VULNERABILITY ASSESSMENT - APPROACH

IRADe approach is rooted in the observation that similar climate events can produce very different levels of socio-economic impacts, depending not only on the location and timing of the occurrence, but also the resources and agility of the societies to respond to climate impacts. IRADe promotes that cities have to put themselves on a sustainable path in terms of infrastructure, governance and socio-economic conditions, unless these foundations are not strong and sustainable, they cannot handle a new stress such as climate change.

The rapid vulnerability assessment framework developed by IRADe, explores various aspects influencing the vulnerability of the cities like considering variability in the maximum and minimum temperature and precipitation over the decades and socio economic factors. It also considers the impact of inefficient or lack of infrastructure services on the resilience of the cities. In contrast to other approaches the Hazard, Infrastructure, Governance, Socio-economic (HIGS) framework developed by IRADe also underlines the necessity of identifying elements of urban resilience like: institutions, socio economic aspects and infrastructure system, into the vulnerability assessment. This clearly indicates the link between vulnerability assessment and resilient urban development by taking into account the four pillars (hazards exposure, infrastructure, governance and socio economic status). The HIGS frame work serves as a rapid vulnerability profiling tool as it addresses the major issues in the urban areas and their impact on the resilience of the cities.

This framework has been tested on 20 cities from 14 different states that represent different demography and diverse physiographic characteristics and ecosystems like coastal, riverine, hilly, arid etc.

2 HAZARD EXPOSURE IN CITIES

In India, over 40 million hectares of area is prone to floods; and the average area affected by floods annually is about 8 million hectares, where as 68% of area is susceptible to drought (Ministry of Home Affairs Govt. of India, 2011). Climate change has also influenced the micro-climate of cities, leading to extreme weather conditions (for example heat waves, cold waves etc) which could cause health problems and other issues related to the quality of life. The low-lying and densely populated coastal cities such as Mumbai, Kolkata, Chennai, Surat and Thiruvananthapuram are vulnerable to cyclones and associated hazards such as storm surges, high winds and heavy rainfall (Parikh.J.et al 2013). The riverine cities like Delhi, Indore, Allahabad, Hyderabad, and Haridwar are highly exposed to floods. River deltas are among the world's most valuable and

heavily populated areas where as some of the cities are evolved on the bank of major rivers such as the Ganges and Brahmaputra where as other inland cities like Jodhpur, Jaipur, Gwalior and Bhopal are exposed to heat waves, and droughts. With large populations, living in the coastal areas and flood plains, Indian cities need particular attention as millions become simultaneously vulnerable.

3 VULNERABILITY & FUTURE IMPACTS

Beyond the overall economic loss from natural disasters across the country, plans for infrastructure development need to reflect the varying priorities of different sub-regions. The accelerated development of Indian cities have neglected the adequate planning on natural drainage, ecology and environment; resulting in the aggravation of an already precarious situation. The urban poor too face increased risks, especially slum and squatter settlements dwellers, partly due to their increased exposure to natural hazards and partly due to lower adaptive capacity. Permanent changes to local ecosystems induced by climate change such as the salinization of ground-water and river estuaries might also alter the local economic base. Adaptation to such changes may be difficult to achieve, but it is essential. If the cities are to make progress in paving the way for climate resilient urban development, they must improve their understanding of the natural hazards and climate change induced risks and the factors that influence vulnerability.

It is critical for the cities to better understand these risks and how they vary across time scales and spatially across geographical location and the city level development sectors like infrastructure, municipal finance and other public private assets, in order to develop comprehensive and integrated city level climate and natural hazard risk profiles that incorporate observed climate variability in terms of maximum and minimum temperature and rainfall, water bodies, ground water levels, climate induced natural hazards. It is necessary for urban areas to adopt adaptation approaches in view of likely future climate change impacts.

4 HIGS FRAMEWORK FOR CLIMATE RESPONSIVE URBAN DEVELOPMENT

Currently, a structured approach and dataset to understand the distribution of vulnerability to climate change impacts across the India is lacking. The framework developed by IRADe provides a systematic approach to prepare vulnerability profiles of the cities and corresponding datasets. It covers aspects related to the sensitivity and exposure of the cities. It also highlights the need for integration of climate resilience n in urban planning.

To understand and analyze these measures for India's urban centres, a framework has been designed based on four themes 'Hazard-Infrastructure-Governance-Socio-economic characteristics (HIGS)' which are determined on the basis of cities characteristics like location, economic and geographical significance, to determine the exposure to the hazards, populations, urbanization trends, basic service level and the managing authorities.

HIGS: the framework comprises four sets of variables these are 'H' denotes Hazards and extreme events, 'I' is for the Infrastructure status, 'G' for Governance and 'S' for Socio-economic characteristics. The framework helps to understand the current scenario of cities and urban settlements that features many of the impacts of climate change, such as increased weather events; variation in temperatures and precipitation; increase in vector borne diseases; and introduces new hazards like sea level rise etc.

To implement the framework a vulnerability template is developed, which helps in gathering the datasets and identifying the key vulnerabilities, also its linkages with natural causes, sustainable practices and strengths of the concerned authorities.

Hazards: physical and Meteorological Indicators

H

- Temperature (Max. & Min.)
- Precipitation (Max. & Min.)
- Mean sea level
- Frequency of floods
- Frequency of droughts
- Frequency of cyclones

Socio- economic Indicators

S

- Demographic composition (sex ratio, age structure)
- Slum population
- Literacy rate
- Migratory flow
- Urbanization trend and urban sprawl

HIGS Framework for Climate Responsive Urban Development

Infrastructure and Urban Services

I

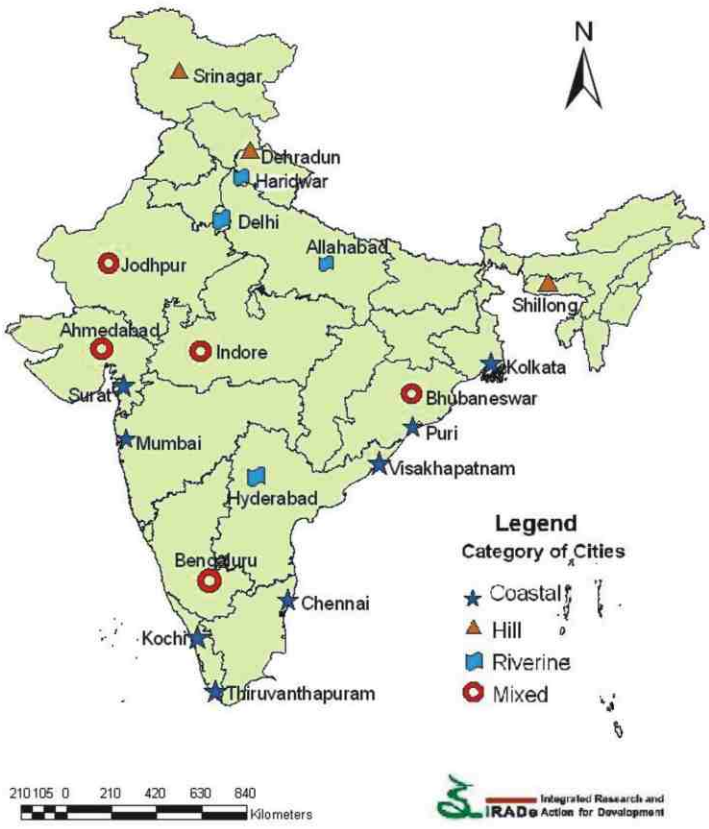
- Water supply
- Sewerage system
- Solid waste management
- Storm water drainage
- Transportation
- Power
- Housing

Governance - Institutions

G

- Participatory
- Transparency
- Accountability
- Response efficiency and capability
- Innovative financing

The interplay of the four variables is of importance to understand priorities and proximate causes of increased climate risks in Indian cities. It helped in bringing out the vulnerability profiles of 20 cities in context of climate resilience and seeks to build a case for leveraging range of action while broadening prospects for climate resilient urbanization, understanding the high impact events and high impact tailored interventions at city level also the city profiles have highlighted the unforeseen challenges posed by climate risk on socioeconomic dimension. It also studies the vulnerable groups in the context of increasing urban poverty, expansion of slums, and growth of informal sector in the urban economy.



5 VULNERABILITY PROFILES OF 20 INDIAN CITIES – KEY OBSERVATIONS

Flooding and water scarcity is a problem faced by most cities. There have been unprecedented floods of high intensity and flash floods in many cities in the last 10 years especially in coastal cities such as Mumbai, Surat, Kolkata, Visakhapatnam, Kochi and Puri. Most of these floods are due to insufficient storm water drainage system in the cities and improper solid waste management system that usually choke the drains and leads to urban floods even during the normal monsoon showers. The hill cities are exposed to landslides. Besides that several infrastructure elements were analyzed and it was found that not even a single city had 100 per cent coverage of basic infrastructure facilities like water supply network, solid waste management and storm water drainage.

The city level studies revealed that seven coastal cities may perhaps be affected by very high cyclonic wind velocities causing severe damage to tall flexible and sheeted residential and industrial structures. Five cities including Surat, Greater Mumbai and Thiruvananthpuram are prone to cyclonic winds. The hill cities are exposed to landslides. Flooding and water scarcity is a problem faced by most cities. There have been unprecedented floods of high intensity and flash floods in many cities in the last 10 years especially in coastal cities such as Mumbai, Surat, Kolkata, Visakhapatnam, Kochi and Puri. Several infrastructure elements were analyzed and it was found that not a single city had 100 per cent coverage of basic infrastructure facilities like water supply network, solid waste management and storm water drainage.

Cities like Allahabad, Bhubaneswar and Mumbai receive more than 180 lpcd of water daily, while Shillong receives only 50 lpcd. The total sewage generated in Surat is treated, while Hardwar and Mumbai have the capacity to treat 79 and 78 percent, respectively, of the total generated sewage. Delhi and Kolkata, two of the highest sewage generating cities, have low sewage treatment capacity, in Delhi only 33 per cent of the collected sewage is treated, whereas in Kolkata it is only 15 percent. Cities like Kochi, Chennai and Visakhapatnam generate the highest per capita solid waste with 0.76 kg/day, 0.70 kg/day and 0.67 kg/day respectively. Socio economic variables depict a high concentration of population in the cities in terms of density per house. Kolkata has the highest number of persons per household (11persons/hh), followed by Hyderabad and Chennai which have an average seven people per house. Shillong, Dehradun and Srinagar have lower population densities than coastal or riverine cities.

It was been found that most of the cities are prone to multihazards, for example, cities like Shillong, Dehradun and Srinagar are prone to flooding, landslides and cold waves.

The outcome of this work provides evidence that cities can use a combination of key institutions, enabling policies and financing options to allow sustainable and climate resilient urbanization of India's growing cities.

Key Observations from Study

- ?All 20 cities covered have city development plans.
- ?10 cities active in the area of disaster management, which includes Delhi and Mumbai.
- ?7 cities prone to cyclones, which may cause severe damage to residential and industrial infrastructure, if such event happens in near future.
- ?Drought conditions prevail in most of the cities covered.
- ?Delhi, Surat, Chennai, Indore, Kolkata, Ahmedabad and Kochi progressive cities with respect to climate change context.
- ?Sewage treatment highest in Surat (100%) followed by Haridwar (79%) and Mumbai (78%). No such facility exists for Bhubaneswar and Dehradun.
- ?Kochi generates highest per capita solid waste (0.76 kg/day) followed by Chennai (0.70 kg/day). Dehradun and Shillong produces the least municipal solid waste.
- ?Kolkata has the highest population density (11 persons per household) while Haridwar has the lowest population density (2 persons per household).

6 KEY RECOMMENDATIONS

Disaster Risk Reduction (DRR): The reduction of stressors caused by human activities will increase the resilience of habitats to the effects of climate change and variability. Through the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), cities are being provided with an opportunity to respond and upgrade basic infrastructure services; however, out of twenty cities more than 14 do not have total coverage of basic services.

Rejuvenation of water bodies: Restoring lakes and urban water bodies will reduce the risk of flooding as they are the best moderators. Sixteen cities have lakes, water bodies and flood plains. There are only three - Delhi, Surat and Trivandrum - with per capita water supply above 135 lpcd. Trivandrum has a per capita water supply above 150 lpcd, the standard bench mark for cities. Kolkata, Bengaluru, Hyderabad and Mumbai have extremely inadequate basic services.

Climate conscious development and spatial planning: Development planning that incorporates climate change and variability is essential and this should apply to institutions and governments alike. If climate change and variability are not proactively taken into account, the effectiveness of conservation plans will reduce. The use of technologies for efficiently managing resources and service quality are fast emerging and viable at city levels. The capacity of Urban Local Bodies (ULBs) to afford and use these technologies would determine their ability to deliver standardized service levels.

Prioritize a climate resilient agenda: Cities need to identify priority activities that respond to their urgent and immediate needs for adaptation to climate change since further delay could increase vulnerability or lead to increased costs at a later stage.

Sustainable urban development indicators: As this involves measuring and monitoring of service delivery, it plays a very important role in analyzing a city's capacity to cope with the climate related hazards and also gives an overview of the cities basic services status.

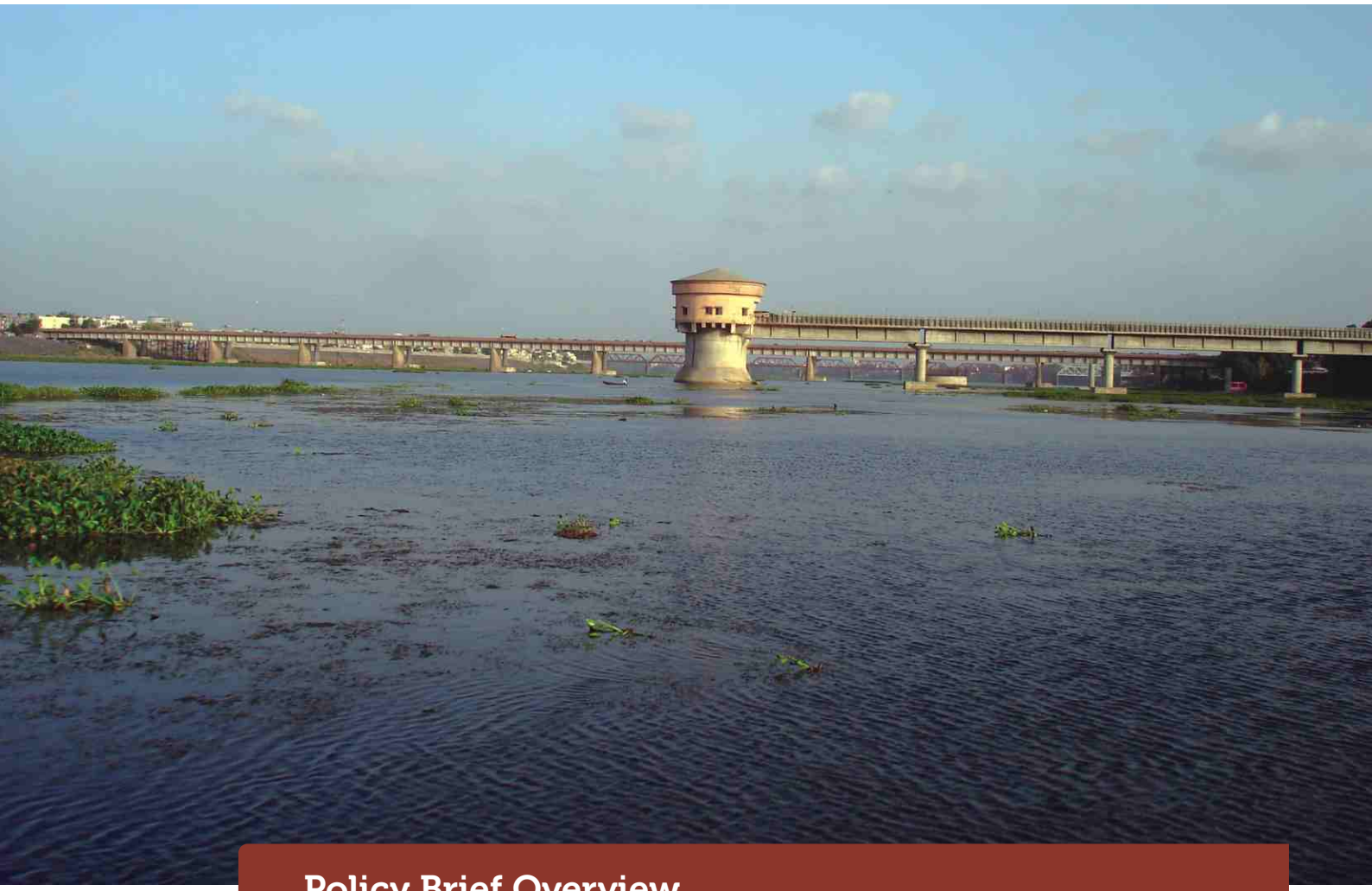
Enhance institutional and policy coordination at the city level: It is important that activities are planned and measures undertaken are mainstreamed for maximizing benefits. There are cities that have a high degree of physical exposure to climate change and a limited capacity to respond to the challenge of adaptation, for example, hill cities like Shillong and Haridwar. Other cities, with less immediate exposure to impacts from climate change and with greater institutional and financial capacity could work jointly with more vulnerable cities to assist and enhance their technical capacities to address the challenges of adaptation.

Resource allocation: Currently, there are no specific agencies or institutions at the city level that oversee mainstreaming of sustainable and climate resilient measures ; managing climate change knowledge; or disseminating climate related information to the general public. There also appears to be a lack of coordination among stakeholders and local agencies. To enhance urban governance there is a need for central and state governments to be engaged in a city's climate resilience agenda for promoting sustainable development.

7 CONCLUDING COMMENTS

The challenge of climate change can only be met if cities are healthy and sustainable under normal circumstances. Their existing infrastructure should be adequate. Efficient and responsive governance should be in place. Their citizens should be educated, healthy and empowered who are in a position to control their destinies-at least in normal circumstances. A city that protects itself from storms, floods, droughts, heat waves, and diseases benefits its residents; their environment is better, their health is more protected, and their economic activities are less liable to damage and disruption. Such cities bounce back against natures' fury in a much shorter time.

In order to have climate resilient development with positive mark on India's growing urban centers, IRADe is stressing to mainstream climate resilience measures in urban development programmes and policies as a priority. The well-targeted interventions emerging out of "HIGS" framework has multiplier effects in promoting sustainable and inclusive urban growth.



Policy Brief Overview

Asian Cities Climate Change Resilience Network (ACCCRN) is a network of cities in India, Indonesia, Thailand, Philippines, Bangladesh and Vietnam, experimenting with a range of activities that will collectively improve the ability of the cities to withstand, to prepare for, and to recover from the projected impacts of climate change. One of the key intervention focuses to build policy debate around UCCR. Policy makers seek evidence-based guidance as a foundation for decision-making. ACCCRN India partners have been working with cities in India since 2008 and it highlights sound practices, demonstration projects and interventions on building resilience to climate change.

It was recognized to tap the knowledge and develop evidence-based Policy Briefs to address the needs of the decision makers at the level of the national/state and city government on UCCR. In the period 2013-2014, ACCCRN India is producing a series of UCCR policy guidance briefs. For a complete list of reports, case studies, policy briefs, please visit www.acccrn.org

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