Urban Climate Change Resilience

POLICY BRIEF

1

Policy and Regulatory Frameworks for Climate Adaptation and Building Resilience in Urban Areas

Urban Local Bodies will play a critical role in India's response to impacts of climate change. Consistent Approaches across all tiers of government are needed to support resilience action at the local level.

KEY MESSAGES

- The impacts associated with a changing climate are already rapidly changing our world.
- The vulnerability of affected population and ecosystems will dictate the social and ecological outcomes of climate change.
- The scale, pace, and complexity of the risks posed by climate change require a different approach to decision making than in the past.
- To prepare effectively for climate impacts and protect the most vulnerable members of society, decision makers should select approaches that are responsive, proactive, flexible, durable, or robust, depending on the type of change at hand.
- Public engagement, information systems, institutions, decision-support tools, and financial, human, ecological, and social resources are key elements that can equip planners and policymakers in making effective decisions in a changing climate.
- The profound risks posed by a changing climate will require decision makers to make difficult choices.
- For some decisions, a stepwise approach can be taken that keeps future options open and avoids "lock-in" to future vulnerability.
- However, for decisions with long-term consequences, decision makers will have to make early choices to take aggressive action with future risks in mind.
- When setting priorities, policymakers should be mindful of thresholds and may need to adopt a more aggressive approach.
- Existing long-term national plans and policies should integrate climate risks.

Climate change is recognized as a significant manmade global environmental challenge. It is also treated as a threat. The importance and significance of the vulnerability of natural and human systems to climatic changes and adaptation to such changes is increasingly being realized. Consequently, there is now a growing recognition of the vulnerability and impacts of climate change on the key sectors of economic development. The Intergovernmental Panel on Climate Change (IPCC) has clearly concluded that the impact of human activities on climate is unequivocal (IPCC 2013). The debate is the extent and magnitude of climate change. The 5th Assessment of the IPCC provides the latest understanding on the science, impacts, vulnerabilities, adaptation and mitigation of climate change.

1 OBSERVED AND FUTURE CHANGES IN CLIMATE SYSTEM (IPCC, 2013)

Observed Changes in Climate System

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.

Future Global and Regional Climate Change

Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

Atmosphere

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-year period of the last 1400 years.

Global surface *temperature* change for the end of the 21st century is *likely* to exceed 1.5 to 2°C relative to 1850 to 1900. Warming will continue beyond 2100. Warming will continue to exhibit interannual-to-decadal variability and will not be regionally uniform. Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions.

Ocean

Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010. It is *virtually certain* that the upper ocean (0-700 m) warmed from 1971 to 2010, and it *likely* warmed between the 1870s and 1971.

The global ocean will continue to warm during the 21st century. Heat will penetrate from the surface to the deep ocean and affect ocean circulation.

Cryosphere

Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

It is very *likely* that the Arctic sea ice cover will continue to shrink and thin and that Northern Hemisphere spring snow cover will decrease during the 21st century as global mean surface temperature rises. Global glacier volume will further decrease.

Sea Level

The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (high confidence). Over the period 1901 to 2010, global mean sea level rose by 0.19 m.

Global mean sea level will continue to rise during the 21st century. Under all RCP scenarios, the rate of sea level rise will very likely exceed that observed during 1971 to 2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets.

Carbon and Other Biogeochemical Cycles

The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification.

Climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO_2 in the atmosphere (high confidence). Further uptake of carbon by the ocean will increase ocean acidification.

Climate Stabilization, Climate Change Commitment and Irreversibility

Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond. Most aspects of climate change will persist for many centuries even if emissions of CO_2 are stopped. This represents a substantial multi-century climate change commitment created by past, present and future emissions of CO_2.

2 CLIMATE SYSTEM AND ITS RECENT CHANGES

Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system. Urbanization also offers opportunity. Rural-urban migration, whether seasonal, temporary, or permanent, reflects the perception of greater opportunity and choice in the more productive and diverse environment of a city. For poor rural residents, especially those in vulnerable coastal areas or in marginally productive rain-fed agricultural zones, climate change will pose a challenge to their survival. Higher variability in rainfall, longer droughts, more severe floods, more intense storms and high tidal surges will all make rural livelihoods even riskier. Rather than face impoverishment in the countryside, many are likely to respond to greater climate risks by moving to the city.

3 CLIMATE CONTEXT IN INDIA

India has a unique climate system dominated by the monsoon, and the major physio-graphic features that drive this monsoon are its location in the globe, the Himalayas, the central plateau, the western and eastern ghats and the oceans surrounding the region. Climatologically, the entire Indian region is divided into the western Himalayas, north-west, north-east; northern-central region, eastern coast, western coast, and the interior plateau.

Observed and projected Changes in Climate and Weather Events in India

There are some observed changes in climate parameters in India. India's Initial National Communication, 2004 (NATCOM) to UNFCCC has consolidated some of these. Some highlights from NATCOM and others are listed below.

OBSERVED CHANGES	PROJECTED CHANGES
Surface Temperature	
At the national level, increase of 0.4° C has been observed in surface air temperatures over the past century. A warming trend has been observed along the west coast, in central India, the interior peninsula, and north-eastern India. However, cooling trends have been observed in north-west India and parts of south India.	Simulations for the 2030s indicate an all-round warming, associated with increasing GHG concentrations, over the Indian subcontinent. The rise in annual mean surface air temperature by the 2030s ranges from 1.7°C to 2.0°C. The simulations also indicate that both the daily extremes in surface air temperature, i.e. daily maximum and daily minimum, may intensify in the 2030s.

OBSERVED CHANGES	PROJECTED CHANGES
Rainfall/ Precipitation	
While the observed monsoon rainfall at the all-India level does not show any significant trend, regional monsoon variations have been recorded. A trend of increasing monsoon seasonal rainfall has been found along the west coast, northern Andhra Pradesh, and north-western India (+10% to +12% of the normal over the last 100 years) while a trend of decreasing monsoon seasonal rainfall has been observed over eastern Madhya Pradesh, north-eastern India, and some parts of Gujarat and Kerala (-6% to -8% of the normal over the last 100 years). Currently, the frequency of rainy days is more in east and North East India and less over western India.	Over much of northwestern India the 1901 to 2005 period shows increases of more than 20% per century, but the same area shows a strong decrease in annual precipitation for the 1979 to 2005 period (IPCC 2007). The variability of seasonal mean temperature may be more in winter months. The simulations also show a small increase in annual precipitation in the 2030s, with respect to the baseline, that is, 1961– 1990s (or 1970s). Projections for 2030s however indicate that the frequency of the rainy days is likely to decrease in most parts of the country. Presently, intensity of a rainy day is more along the Western coast, especially in the Western Ghats and North-east India. The intensity of the rainy days increases in a more warming scenario suggesting both decrease and increase in intensity across India.
Urban heat island effects are real but local. Increasing evidence suggests that urban heat island effects extend to changes in precipitation.	
Extreme Weather Events	
Instrument records over the past 130 years do not indicate any marked long-term trend in the frequencies of large-scale droughts and floods. Trends are however observed in multi-decadal periods of more frequent droughts, followed by less severe droughts. There has been an overall increasing trend in severe storm incidence along the coast at the rate of 0.011 events per year. A rising trend in the frequency of heavy rain events, and a significant decrease in the frequency of moderate events over central India from 1951 to 2000 has been observed.	The projected number of **cyclonic disturbances** along both the coasts in the 2030s is likely to decrease with respect to the 1970s. However, cyclonic systems might be more intense in the future. All locations along the eastern coast of India that are north of Vishakhapatnam, except at Sagar and Kolkata, show an increase in **storm surge** levels in the 100-year return period by about 15% to 20% with respect to the 1970s. For Sagar and Kolkata, the two stations considered in the head Bay, the increase in the 100-year return levels was found to be less than 5% for the future scenario.
Rise in Sea Level	
Using the records of coastal tide gauges in the north Indian Ocean for more than 40 years, Unnikrishnan and Shankar have estimated, that sea level rise was between 1.06-1.75 mm per year.	These rates are consistent with 1-2 mm per year global sea level rise estimates of IPCC.
Impacts on Himalayan Glaciers	
The Himalayas possess one of the largest resources of snow and ice and its glaciers form a source of water for the perennial rivers such as the Indus, the Ganga, and the Brahmaputra. The available monitoring data on Himalayan glaciers indicates that while recession of some glaciers has occurred in some Himalayan regions in recent years, the trend is not consistent across the entire mountain chain.	Glacial melt may impact their long-term lean-season flows, with adverse impacts on the economy in terms of water availability and hydropower generation.

4 POSSIBLE IMPACTS OF PROJECTED CLIMATE CHANGE ON DIFFERENT SECTORS

Water Resources

Changes in key climate variables, namely temperature, precipitation, and humidity, may have significant long-term implications for the quality and quantity of water. River systems of the Brahmaputra, the Ganga, and the Indus, which benefit from melting snow in the lean season, are likely to be particularly affected by the decrease in snow cover. A decline in total run-off for all river basins, except Narmada and Tapti, is projected in India's NATCOM I. A decline in run-off by more than two-thirds is also anticipated for the Sabarmati and Luni basins. Due to sea level rise, the fresh water sources near the coastal regions will suffer salt intrusion.

Agriculture and Food Production

Food production in India is sensitive to climate changes such as variability in monsoon rainfall and temperature changes within a season. Studies by Indian Agricultural Research Institute (IARI) and others indicate greater expected loss in the Rabi crop. Every 1°C rise in temperature reduces wheat production by 4-5 Million Tonnes. Small changes in temperature and rainfall have significant effects on the quality of fruits, vegetables, tea, coffee, aromatic and medicinal plants, and basmati rice. Pathogens and insect populations are strongly dependent upon temperature and humidity, and changes in these parameters may change their population dynamics. Other impacts on agricultural and related sectors include lower yields from dairy cattle and decline in fish breeding, migration, and harvests. Global reports indicate a loss of 10-40% in crop production by 2100.

Health

Changes in climate may alter the distribution of important vector species (for example, malarial mosquitoes) and may increase the spread of such diseases to new areas. If there is an increase of 3.8°C in temperature and a 7% increase in relative humidity the transmission windows i.e., months during which mosquitoes are active, will be open for all 12 months in 9 states in India. The transmission windows in Jammu and Kashmir and in Rajasthan may increase by 3-5 months. However, in Orissa and some southern states, a further increase in temperature is likely to shorten the transmission window by 2-3 months.

Forests

Based on future climate projections of Regional Climate Model of the Hadley Centre (HadRM3) using A2 and B2 scenarios and the BIOME4 vegetation response model, Ravindranath et. al. show that 77% and 68% of the forest areas in the country are likely to experience shift in forest types, respectively under the two scenarios, by the end of the century, with consequent changes in forests produce, and, in turn, livelihoods based on those products. Correspondingly, the associated biodiversity is likely to be adversely impacted. India's NATCOM I projects an increase in the area under xeric scrublands and xeric woodlands in central India at the cost of dry savannah in these regions.

Possible Impacts on Urban Areas

Water Resources

- The substantial spatial differences in precipitation changes imply adaptation of sub-regional agriculture, changes in water supply arrangements and a strong policy emphasis on water conservation and efficiency in most cities, as more rain could fall in more intense spells and drought intensity could increase. This increase, combined with a shorter wet season, will imply a change in the hydrology of many river systems and therefore a modification in the storage capacity and management regime of many dams and reservoirs, thus impacting urban water systems.
- A decrease in the number of rainy days (5–15 days on average) is expected over much of India, along with an increase in heavy rainfall days and in the frequency of heavy rainfall events in the monsoon season. These changes are expected to increase the vulnerability of Indian agriculture and natural resource-linked livelihoods, and also that of the urban poor who typically reside in areas more prone to pluvial flooding and who are most vulnerable to water scarcity as they largely depend on informal water markets.

- The substantial increase in extreme precipitation (similar to Mumbai in 2005 and the 2005 and 2006 Gujarat flood events) expected over a large area of the west coast and central India will require a significant revision of urban planning practices across city and neighbourhood scales to integrate flood and climate change mitigation and adaptation measures into day-to-day urban development and service delivery activities.

Agriculture and Food Production

- Drought has two typical first-order impacts on Indian cities: drinking water shortages and increases in food and biomass fuel prices. It also has a number of important second-order impacts: depressed demand for urban-produced secondary goods and services because of depressed agricultural demand; and increasing seasonal and distress migration from rural areas.
- Climate change is expected to increase drought in semi-arid peninsular and western India, forcing more of the landless and small and marginal farmers to migrate to cities. They often form the most vulnerable groups in cities – having limited skills, education, capital and access to the social networks that underpin much of economic and social mobility in urban India. They often live in illegal, unserviced settlements exposed to a wide range of environmental risks from flooding to fire, and continual cycles of demolition and eviction by civil authorities. They are, therefore, dual victims of existing natural hazards and emerging climate change – displaced from their original places of residence and occupations, and challenged by urban risks in their new urban places of residence.

Public Health

- Climate change is expected to accentuate environment-related health risks, including those from water-washed diseases (e.g., diarrhoea, cholera and typhoid), due to water scarcity and malaria. Malaria is expected to expand from its currently endemic range in eastern and northeastern India to western and southern India, thereby placing a large incremental population at risk. Given that Indian cities have become major reservoirs of vector-borne diseases such as malaria and dengue fever, it can be expected that morbidity risks would increase. Additional research needs to be undertaken on the potential impact of water scarcity and flooding on environmental health conditions in cities and their consequent impact on morbidity, mortality and productivity.

Urban Heat-Island (UHI) Effect and heat wave conditions

- Due to the UHI effect higher temperature is generally observed in the urban area compared than its surrounding. The key factors contributing to UHI effect include: (a) reduced permeable surfaces, (b) tall buildings and narrow streets, (c) decrease in surface water, (d) concentration of heat generating activities in urban areas such as motor vehicles, factories, buildings, concrete/ black top roads etc. and (e) removed vegetation. According to studies urban heat island effect is strengthening micro-climate warming causing frequent heat-wave conditions. Studies indicate that urban areas have been more rapidly warming over time than the rural areas. The effect of heat can generally be felt on the health, and more critically by the vulnerable population (e.g., elderly, infants and pre school children, people with deteriorating health conditions etc.). The ill-effects of UHI have also been observed on the infrastructure (e.g., sudden crumpling of concrete roads, deformed railway tracks etc. due to excessive heat). Strategies such as curbside planting, installation of light coloured roofs, roof top gardens, etc. can be adapted to tackle such problems.

Climate-induced Extreme Events

- The climate change is likely to affect the hydrological cycle, which will result in (i) more rainfall in lesser time; (ii) decrease in number of rainy days; (iii) overall increase in precipitation; (iv) increased glacialmelt-runoff initially and then afterwards decrease; (v) increase in runoff but less ground water recharge; (vi) increase in flood events particularly of flash floods; (vii) increase in drought like situations; and some other related issues like (viii) increase in landslide events in hilly areas etc.

- The Indian summer monsoon circulation dominates the rainfall over South Asia, and as such rainfall variability over the region is considered to be synonymous with monsoon variability. All-India summer monsoon rainfall displays predominant interannual variability, marked by recurrent large-scale droughts and floods. Impacts of climate change and climate variability on the water resources are likely to affect irrigated agriculture, installed power capacity, environmental flows in the dry season and higher flows during the wet season, thereby causing severe droughts, floods and flash floods in urban and rural areas.

Impact on Infrastructure and need for integrated approach

- Lack of understanding of adverse impacts of climate change and vulnerability of infrastructure assets is a challenge for risk management. Disaster and emergency risk management in a climate change context could be a restrictive approach towards a mechanism that has interlinkages with almost every component of a system and extends onto a longer time horizon. Developing a comprehensive risk management and adaptation framework therefore requires an integrated approach by incorporating issues concerning urban development and growth, vulnerability, risk unbundling, the redirection of ongoing investments and micro and macro interventions.

5 Responding to uncertainty and long time-scales

In recent years, responding to the impacts of climate change on the society, economy, and the environment at large has emerged as a defining challenge for policy-makers. This is particularly because of uncertainty in quantification of the regional impacts of climate change, as well as with regard to the time-scales over which some of these impacts are likely to be fully manifested and understood. For example, Sea Level Rise (SLR) is a gradual process unlike flash floods and cyclones, and regional SLR projections face several uncertainties.

In light of climate change, for an urban environment a new layer of uncertainty is added. An urban environment faces a number of uncertainties, primarily because of the rapidly changing variables such as socioeconomic and demographic indicators, land-use patterns, resource demand and utilization patterns, lifestyle changes, policy and regulatory reforms, etc. Hence, policies that are directed towards building and enhancing resilience in the urban systems need to be abled to capture this complexity and dynamicity to enable resilience in the long-term.

6 Governance issues (National-State-City/ULB level)

The state-level Town and Country Planning Office (TCPO) typically prepares development plans, focusing on socioeconomic development, which are further disaggregated to zonal-level plans. Municipal corporations in each city then prepare zonal plans. In principle, the 74th Constitutional Amendment provides for devolution of planning functions to municipal corporations by devolving funds, functions, and administration (including technical expertise of various departments) to municipal corporations. Yet in practice, the progress of devolution, decentralization, and implementation of the 74th Constitutional Amendment has been slow.

In areas within the jurisdiction of municipal corporations, the flagship urban programs of the national government (such as JnNURM) provide large funding to municipal corporations for development of city infrastructure (water supply, drainage, solid waste management, etc.) in 65 selected cities in India. However, access to funds is generally slow, due to limited capacity of municipal corporations to develop and manage projects, and the delays in implementation of institutional reforms such as the 74th Constitutional Amendment.

The responsibility and capacity at different levels of government underlines the need to engage stakeholders at both state and municipal levels, while remaining aware that institutional changes may affect the development planning process in coming years. In addition, while nominal authority for planning may technically exist within municipal corporations, in practice, the power and capacities to implement may not.

So far ULBs across India vary between jurisdictions, reflecting differences in state and union territories, legislative and regulatory frameworks. As a result, ULBs in India are characterised by a high degree of diversity in terms of their geographical locations, functions and revenue bases. These factors in turn affect their ability and capacity to respond to present-day climate risks and to plan for future climate change risks. Some of the key Climate change responsibilities at ULB level may be noted as below:

- Administer relevant state legislation to promote resilience as required, including the application of relevant codes, such as the Building Bye-Laws, Building Codes, Development Control Regulations, Coastal Zone Regulations etc.
- Manage risks and impacts to public assets owned and managed by ULBs.
- Manage risks and impacts to service delivery.
- Collaborate across regions/ jurisdictions and with state and UT governments to manage risks of regional climate change impacts.
- Ensure policies and regulations under their jurisdiction, including local planning and development regulations, incorporate climate change considerations and are consistent with State and National Government approaches.
- Facilitate building resilience and adaptive capacity in the local community, including through providing information about relevant climate change risks.
- Work in partnership with the community, local and relevant non-government organisations, business and other key stakeholders to manage the risks and impacts associated with climate change.
- Contribute appropriate resources to prepare, prevent, respond and recover from detrimental climatic impacts.

7 Efforts towards Climate Change Resilience in India

A number of specific climate change resilience responsibilities are associated with effective governance by the ULBs. Some of the ULBs have initiated key actions to respond to climate risks, which include (a) policy; (b) City resilience strategies; (c) sector specific action plans; (d) establish/ earmark key institutions at a regional level to oversee the effective actions materialized on the ground over a longer time-frame; and (e) leverage funds for the implementation of resilience projects and action plans.

Since 1998, India has undertaken a few national assessments of climate change risks, including an assessment of impact, and adaptation and mitigation options. But local level adaptation actions or policy interventions do not exist. However, the National Action Plan for Climate Change (NAPCC) introduced by the Prime Minister's Office of the Government of India, which outlines existing and future policies and programmes that address climate mitigation and adaptation. Eight core "national missions" have been identified, which identify measures that promote development objectives while also yielding co-benefits for addressing climate change effectively.

It has opened up certain entry points; and a few international agencies such as the World Bank, the International Council for Local Environmental Initiatives (now known as ICLEI–Local Government for Sustainability), the World Wide Fund for Nature (WWF), the Asian Cities Climate Change Research Network (ACCCRN) and the Urban Climate Change Research Network (UCCRN) also have started pilot projects in some Indian cities.

National Mission on Sustainable Habitat (NMSH) – one of the NAPCC's eight missions, prepared by the Government of India's Ministry of Urban Development, the plan addresses adaptation and mitigation interventions as a critical area of engagement for Indian cities, and the financial and institutional back-up for the same.

Highlights on lack of knowledge on climate change and possible implications at ULB level which is key for implementation of actions at local level, need for capacity building at ULB level, specific mention on decision-making at ULB level, involvement of community in the process, legal issues concerning climate change/ environment (directly or, indirectly related), linkages with evolving national level policy landscape on climate change.

8 Engagement of ULB and Citizen

ULBs can play a critical front-line role in India's response to the impacts of climate change. The priority policy need is for the governance, technical, financial systems that will enable the ULBs to deliver what is an interestingly broad range of responsibilities. Direct and indirect impacts of climate change pose significant challenges to the urban communities of India, albeit with very little impact depending on the location. These impacts will affect all areas of ULBs' functional critical areas. An enabling environment for ULBs to effectively undertake resilience planning, strategies and response is therefore required.

Scenario Development for Resilience Planning in Surat and Indore

Indian cities used scenario planning method/tool to address the uncertainties of both urban development and climate. Critical uncertainties were determined by the city stakeholders and the members of the City Advisory Committee (CAC constituted under the project). Through a series of discussion meetings and workshops, four storylines emerged to form the basis of future urban scenarios for the city. Storylines were created on two chosen critical uncertainties. In Surat, economic growth (low or high) and social cohesion (conflicts or harmony) was chosen; in Indore, type of migration (whether "push" from impoverished rural areas or "pull" from increased demand for skilled labor and services) and efficiency of infrastructure management (poor or efficient) were picked for developing story lines.

The CACs discussed the interactions of the climate and urban development scenarios to identify "issue-impact matrices" for Surat and Indore, which were subsequently used for identifying and prioritizing resilience building options across scales and sectors.

The scenarios served as tools for the CACs and local experts to determine alternative futures. This enabled the CACs to identify how they could shape deliberate choices of governance and investment in order to avoid climate impacts and foster positive socioeconomic development, build city resilience.

9 Key Recommendations to Make Indian Cities Resilient

Leadership, consistency and integration

1. Provide clarity on roles and responsibilities for urban resilience planning across all levels of government

- Nationally coordinated governance percolating down to the regional and ULB level (addressing the urban-regional linkages)
- Development of a clear and effective framework outlining the roles and responsibilities of the governments at various levels. The factor of uncertainty need to be fundamentally reduced.

2. Promote a shared approach and long-term commitment to manage the impacts of climate change, there is a need for development of

- Mechanisms, bodies and activities to support and promote establishment of committed partnerships and collaboration to address the impacts of climate change in all tiers of government, different regions, jurisdictions etc.

3. Understand legal liabilities for past and future decisions

- Support in understanding legal liabilities, which may include: exploring exposure through test cases in court, clarifying liabilities within particular legal frameworks at a regional level; sharing knowledge between different regional legal entities on legal decisions; developing a nationally uniform legislative framework; and last but not the least, utility of all these and other approaches in clarifying legal responsibilities for ULBs should be explored and established over a period of time.

Capacity Building: Financial, Technical and Organizational

4. Provide sustained, long-term financial support for resilience planning

- A review of long-term sustainable financing strategies for resilience; exploration of rage of opportunities etc.
- Mainstreaming of UCCR within other financing schemes (such as DRM funding, Mission funding under NAPCC and others). This will assist ULBs to improve infrastructure needs adequately referring to the agreed upon resilience strategies.

5. Technical support and guidance for development of resilient strategies at ULB level

- Guidance and support to embed UCCR into due diligence across all tiers of government operations (e.g., asset management, O & M and financial management systems)
- Guidance on good practice approaches to mainstream climate change into ULB processes
- Support for ULBs to implement organizational change to ensure climate change is considered in all areas of decision making

6. Provide tools, frameworks and information to support UCCR decision making

- Access to data, information and databases that provide the information to underpin policy, (e.g., low-carbon development, land-use planning, transport planning etc.)
- Technical studies to increase certainty in impact assessments, (e.g., models to assess flood/ cyclone hazard)
- Standardized and nationally consistent methods to incorporate climate change into planning, development and decision-making process at the ULB level. ULB functionaries ideally should be engaged in formulation of these frameworks.

- Support (financially and technically) to acquire and consolidate knowledge to inform decision-making.An important step in understanding future exposure is to first understand existing vulnerabilities.
- Development of tools and capacities to facilitate and direct behaviour change at the local scale, so that communities become more resilient to climate change

Development of framework and knowledge networking platforms (organizations and communities)

7. Development and monitoring of capacity for resilience (Organizations and communities):

Climate change resilience is about facilitating change from individual, to local to regional to national scales. Inconsistent information dissemination/ percolation and lack of support for climate change resilience will only increase challenges for proactive responses by ULBs. A lack of community participation can pose a barrier to resilience planning and development of strategies. There is a need for:

- Political and local leadership to enhance community participation: The community needs to be given more responsibilities for its own resilience.
- Guidance and tools to monitor and evaluate resilience action and capacity: ULBs to be supported with monitoring and evaluation strategies that will provide the evidence base to develop and implement resilience strategies and monitor the effectiveness of implemented resilience actions.

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

References

IPCC, Climate Change 2013: The Physical Science Basis, Summary for Policy Makers, 2013

INCCA. Climate Change and India: A 4X4 Assessment, A Sectoral and Regional Analysis For 2030s Assessment Report, Indian Network for Climate Change Assessment, Ministry of Environment & Forest, Government of India, 2010.

Current Science Journal (Indian Institute of Science) 101, no. 3 (08 2011)

Ministry of Water Resources. Effect of Climate Change on Water Resources. Preliminary Consolidated Report, Central Water Commission, National Institute of Hydrology, New Delhi: Government of India, 2008, 101.

Applegath, Craig. Future Proofing Cities: Strategies to help Cities develop Capacities to absorb Future Shocks and Stresses. ResilientCities.org, 2012

Sanyal, Sanjeev, Sumati Nagrath, and Gorika Singla. The Alternative Urban Futures Report, Urbanisation & Sustainability in India: An Interdependent Agenda. New Delhi: World Wide Fund for Nature (WWF) - India and Mirabilis Advisory Private Limited (MAPL)

Asian Development Bank. Investing in Resilience, Ensuring a Disaster-Resistant Future. Mandaluyong City: Asian Development Bank, 2013.

Vaidya, Chetan. Urban Issues, Reforms and Way Forward in India. Working Paper No.4/2009-DEA, Department of Economic Affairs, Ministry of Finance, New Delhi: Government of India, 2009.

UNDP, UNEP, World Bank and WRI. World Resources Report 2010-2011: Decision Making in a Changing Climate, Adaptation Challenges and Choices. World Resources Series, UNDP, UNEP, World Bank and WRI, Washington DC: World Resources Institute, 2011, 184.

This Policy Brief is written by:**National Institute of Urban Affairs,** www.niua.org
Telephone: +91.11.24643284 / 24617517 Email (ACCCRN Focal point): uraghupathi@niua.org