Urban resilience planning and mainstreaming approach: 
*Gorakhpur and Guwahati cities*

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Raina Singh
Associate Fellow,
Sustainable Habitat Division, TERI
Urban resilience planning - Why and How?
1. Urban resilience planning – Why and How?

2. Examples of Planning tools for building climate resilience

3. Case studies – Guwahati and Gorakhpur cities
Climate change and Cities

- Sea level rise
- Increase of storms/cyclones
- Increase of heavy precipitation events
- Increase of extreme heat events & droughts

Climate Change
Urbanization and climate risk – Why does it matter?

Urban areas are concentration of large population, economies, infrastructure: central to growth of the nation or the region

Urban areas are growing at an unprecedented rate - often unplanned and unregulated on vulnerable land, prone to hazards

Over 50% of India’s GDP is derived from cities - Climate change impacts can wipe out development gains and significantly reduce quality of life

Climate related Disasters cost an estimated $370 billion USD globally in 2011 (80 per cent of this was in Asia alone)

Associated social costs - Vulnerable groups are the most affected
But what is ‘Urban’?
The Urban System

Glacial Lake Outburst Flood (GLOF)

Natural drainage systems

Telecomms

Energy

Food and Agriculture

Drought

Water networks

Sanitation

Ground water table

Shelter

River Flooding

Community systems for information exchange

Health Care Facilities

Transportation

Coastal defences

Coastal Flooding

Sea-Level Rise

Storms/Cyclones

Livelihoods

Underlying Non-Structural Systems

Vector borne Diseases

Disaster Response

Governance

Finance

Education

Climate Change and Natural Hazards
How to climate proof cities

• Strengthening the adaptive capacity

• Reducing the vulnerability of the urban system against climate change

• Developing strategies and policy instruments for building resilience of our cities
  – Sensitized planning and management practices – climate resilience on agenda
  – Long term resilience building – integrated approach to sector wise climate change adaptation
  – Ensuring flow of planned investments for climate resilience
Development challenges for cities

In-migration, unplanned growth and urban sprawl

Inadequate infrastructure and limited access to:

- Housing
- Basic services
- Employment opportunities

Marginalization of vulnerable groups

Environmental Degradation

Poor quality of life

Limited resources and capacities of city governments

Source: Francesco Terzini Flickr Creative Commons
Urban Resilience Planning for Climate Risk Management: Approach

- **Understanding Risk and Vulnerability**
  - Risk Assessment
  - Vulnerability Assessment
  - Climate Research

- **Knowledge Management**
  - Informed Public
  - Stakeholder Engagement
  - Sector Coordination

- **Value Added**
  - Inclusiveness
    - Inclusive Land Use Planning
    - Credit for Marginalized Groups
    - Service Provision
  - Natural Capital
    - Urban Environmental Management
    - Ecosystems for DRR
    - Resource Efficiency

- **Adaptive Capacity**
  - Resilient Infrastructure
  - Managing Shocks and Stresses
  - Resilient Systems Capacity

- **Monitoring**
Video: It's time to take actions now!
Examples of Planning tools for building climate resilience
Regulatory Tools – Land use plans

- Legal spatial policy which designates use of land, typically by:
  - Residential
  - Commercial
  - Industrial
  - Governmental
  - Infrastructure
  - Green/Open Space
  - Mixed Use

- The function of land can be limited due to characteristics related to risk or other geographic features

- Can be limited in dynamic settings

Source: Government of Singapore, online database
Regulatory Tools – Building codes

- Ensure that new development does not occur unless structures are designed and built to withstand the impact of hazards.

- Can be implemented at various levels.
  - Ward
  - City-wide
  - Provincial/State
  - National

- Many are hazard specific but some regulations can provide support from various hazard sources.
Restriction Tools – Transfer of Development Rights

• The transfer of a property’s development potential under current zoning provisions from one site or property to another.

• The development potential can be relocated to another area of land or parcel not at risk.

• Usually requires a cost-benefit analysis from the local government and developer.

Source: Jakarta city, Online database
Natural Protection Tools - Mangroves and Wetland Creation/Restoration

- The natural functions of wetlands and mangroves create a buffer to reduce wave energy, which can greatly reduce the impact of cyclones, storm surge, and flooding.

- Planting trees or other vegetation that can withstand high-speed wind from cyclones and other storms.

- Less of a negative impact on environment when compared to “hard” engineering solutions.

- Also fosters biodiversity and can contribute to livelihood development.

Source: IFRC, Vietnam
Enriching natural sand dunes provide an effective defense against coastal erosion and flooding by dissipating floodwaters from coastal or riverrine sources.

Less of a negative impact on environment when compared to “hard” engineering solutions.

Can be difficult to implement in areas that thrive on beach front development, notably for tourism.
Case Studies
Case study

- Project on “Risk Assessment and Review of Prevailing Laws, Standards, Policies and Programs to Climate Proof Cities”

- Part of the Rockefeller Foundation’s Asian Cities Climate Change Resilience Network

- Goals:
  - **Assess risk** of the city to climate change impacts
  - Review the **regulatory environment** and
  - Suggest **resilience measures** and ways to **integrate them into city planning** – City Resilience Strategy

- Study cities- Gorakhpur (UP) and Guwahati(Assam)
Guwahati:
Twin city to Dispur - Capital city of the State of Assam
Population – 11.9 lacs (UA area, 2011)
Location- 26°10’ N and 92° 49’ E, on the banks of the Brahmaputra River
Undulating topography
District HQ for Kamrup Metropolitan Distt
JnNURM city
Guwahati – Risks and Challenges

PUBLIC HEALTH AND SANITATION ISSUES

PRONE TO LANDSLIDES

Source: english.samaylive.com

PRONE TO URBAN FLOODING

Source: ibnlive.in

DRAINAGE ISSUES

DEGRADATION AND ENCROACHMENT OF WETLANDS AND WATERBODIES

LACK OF WASTE DISPOSAL SYSTEM

GUWAHATI CITY

Source: http://rahconteur.wordpress.com/2010/12/20/dispur-is-thatpur/

LACK OF SEWERAGE SYSTEM

UNAUTHORISED AND INFORMAL SETTLEMENTS

UNPLANNED AND UNREGULATED GROWTH OF THE CITY
TERI’s Approach to Resilience Strategy

• What are the critical assets in the city which might be at risk due to flooding or any other disasters?

• What are the sectors impacted by the ‘future and current risks’?

• Which are the vulnerable class subjected critically to risks?

• What are the governance parameters that can help build resilience?
Framework for Risk Assessment

Identification of Hazards and Stressors

Vulnerability Assessment

Identification of climate sensitive hotspots including vulnerable communities

Future climate projections

Current and future risk profile of the city

Institutional Analysis

Identification of adaptation and resilience strategies

Identification of means of integrating and mainstreaming policies for risk reduction in the existing policy framework
Climatic stressors – Past trends

- Increasing trend for both maximum and minimum temperature for Guwahati city
- Decreasing trend seen in seasonal mean rainfall for monsoon months over Guwahati
- Increase in extreme rainfall events especially in the last decade

Source: Regional Meteorological Centre, Guwahati
Climatic stressors - Future Projections
A1B scenario for 2030s

- Projections of temperatures for the whole district shows an increasing trend for the future in 2030s as compared to the baseline period of 1970-2000.
- The city of Guwahati shows an increase of about 1.2° in maximum and about 1.3° in minimum temperature.
- Slight insignificant decreasing trend seen in percentage precipitation change.

Regional model simulations at 25kmX25km resolution carried over the Kamrup district using PRECIS
Non-climatic stressors - Urbanization trend, 1999-2010

Rapid increase in population and spatial extent (built-up) of the city


1991
Population: 646,169

2001
Population: 890,773

2011
Population: 1,193,429
Conversion of sparse built-up into dense built-up
Emergence of pockets of sparse built-up
Northern part of the river has emerged as a new built-up in year 2010.
Decrease in extent of dense forest and conversion of dense to sparse forest
• Encroachment of significant natural features like natural wetlands (Bils), watershed areas and hills.
• Hill cutting in fragile hilly areas which are not fit for development.
• Unplanned and unregulated expansion of the city, especially on hills has added to the vulnerability of the city. 90% of the landslides occur in these areas.
Guwahati: Vulnerability to floods & landslides

Identification of vulnerable infrastructure and services

Identification of vulnerable communities
Non-climatic stressors – Inadequate and inefficient urban services

- Inadequate capacity of existing drainage and sewerage systems
- Siltation, solid waste

- Marginalization of informal settlements and slums while urban planning and service provision

- Inadequate public health management – lack of resources and infrastructure
- Low emergency response capacity
Implication - Increased incidence of Urban Floods, Epidemics & Landslides

Plans in time of waterlogging

Govt to seek IIT help on floods

ARNAJ HANDIQUE

In the Kamrup (metro) district administration will seek the help of IIT Guwahati to conduct a study to find a permanent and lasting solution to bail out the city from recurring flash floods. The recent heavy rain had submerged several low-lying places under floodwaters cutting off these areas from the rest of the city. While Bhuralu as the main drain, through which floodwater can exit from the city, both gates at Bharalimukh Bonda could not be opened this time to let out the water as the level of Brahmaputra was higher than that of the gate.

Flash floods throw city life out of gear

STAFF REPORTER

GUWAHATI, Sept 11 - A heavy spell of rains in the afternoon hours inundated the city of Guwahati city, exposing the face of the Guwahati Development Department, civic bodies and the disaster management. The call to the administration to make Guwahati flood-free, submerged under floodwaters that threw the city out of gear for about an hour, caused a traffic jam.

A waterlogged street in Guwahati on Tuesday evening. - UB Photos

Vehicles plough through a waterlogged street. File picture

Commuters wade through a waterlogged street in Guwahati on Monday night. Heavy rain triggered traffic snarls after vehicles got stuck at several places.

Picture by UB Photos

Throughout the day, floodwaters from the city flooded the roads and warned the public against consuming contaminated water and uncovered street food during this time. "Though street-side vendors serve different edibles..."
Guwahati City Resilience Strategy

Identification of sectors and strategies for intervention

- Housing
- Disaster Risk Reduction
- Infrastructure and Services
- Eco-sensitive Urban Planning

Identification of entry-points for implementation through Institutional and Policy Analysis
Gorakhpur:
Medium sized city in the State of Uttar Pradesh
Population - 692,519 (UA area, 2011)
Location - 26° 45’ N and 83° 24’ E
Height - 80m above sea level
Set in the foothills of the Himalayas, at the convergence of two rivers ‘Rapti’ and ‘Rohin’.
• Water logging is the prime risk for the city and would accentuated in the climate change scenario.

• The other 3 risks either have causal relationship with the occurrence of water logging or are impacted severely by the water logging problem.

• They become an essential components while addressing the overall problem of water logging in the city with climate change scenario or without climate change scenario.
Gorakhpur City Resilience Strategy (CRS)

- City Resilience Strategy prepared by Gorakhpur Environment Action Group with support from The Rockefeller Foundation under ACCCRN
- Targeted physical and institutional actions to improve drainage, housing, health and communications systems
- Calls for information, data and knowledge focused activities to establish the evidence base required for long term planning
- An evolutionary resilience strategy
- Focuses on capacity building
Challenges in CRS implementation

• The CRS identified climate resilience projects. Selected projects funded by the Rockefeller foundation.

• Most part of the strategy remained shelved in the absence of any regulatory or policy backing and as a result could not be integrated in the formal urban planning and development framework nor could all the projects/strategies be channelized to any funding.

• Current vulnerability too pronounced – difficult for city managers to take precautionary approach to future vulnerabilities.

• Lack of awareness and capacity at city level to address its vulnerabilities.

• Lack of funds at city and state level to address basic infrastructure related issues.
## TERI’s Action Plan for CRS implementation

### 1. Analytical Review of Secondary literature
- Resilience strategy
- Vulnerability Report
- Geohydrology study
- Includes:
  - Climate analysis
  - Risk
  - Vulnerability
  - Resilience options

### 2. Review of institutions and regulatory environment
- Review of state and city level regulations
- Institutional assessment
- Stakeholder consultation at Gorakhpur
- Consultation with GEAG team

### 3. TERI’s Action plan to help implement resilience strategy
- Scoping exercise
- Identifying sectors for implementation
- Assessing current sectoral status
- Sectoral Recommendations
  - Structural/physical
  - Regulatory and institutional
- Overall recommendations
Scoping

- Basic services (water, drainage, solid waste management and services to poor)
- Ecosystem conservation and flood management
- Water logging
- Housing and urban planning
- Health
Institutional and regulatory analysis
Need of integrating environmental/disaster risk reduction concerns in the Development Act/Rules of the State.

Need of implementation of 74th CAA for dissolution of powers to ULB for Disaster Management/Resilience Planning at city & ward level.
Phased action points for CRS

### Risk Assessment and Review of Prevailing Laws, Standards, Policies and Programs to Climate Proof Cities - Summary of Suggested Action Points to State

Submitted to the PS (UD), Govt. of Uttar Pradesh

The following table gives a summary of action points that the State of Uttar Pradesh can take up for mainstreaming climate resilience based on TERI’s study.

#### Urban Planning

<table>
<thead>
<tr>
<th>Time frame</th>
<th>Actions</th>
<th>Institutions</th>
<th>Supporting Regulation/policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium term</td>
<td>Include a chapter on climate change resilience in the Master Plan of cities in the state. Revisit and evaluate land-use planning in existing urban areas to reduce city's vulnerability. Revisit 'Impact Fee' rule. Bring in environmental impact assessment of any land-use change that is proposed deviating from the Master Plan and restrictions on the same if the environmental criteria are not met with. (Right now, the rule does say that impact fee is levied in return to the anticipated impacts of change in land-use on traffic infrastructure and environment. It also says that the 90% of the fee collected will be sent to the infrastructure fund. However, it does not specify that the funds so collected will be used for mitigation of the impacts that will happen.)</td>
<td>Housing and Urban Planning Department, Government of UP</td>
<td>Amendment in the UP Urban Planning and Development Act 1973</td>
</tr>
<tr>
<td>Long term</td>
<td>State adopts and implements 74th Constitution Amendment Act</td>
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#### Drainage and Sewerage:

<table>
<thead>
<tr>
<th>City</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium term</td>
<td>Drainage and Sewerage in the cities: Option 1: Revisit the drainage (storm water drainage) project sanctioned under UIDSSMT to allow for disintegration points and channels to ensure disintegration of storm water drains appropriately with the new sewer drains when they are sanctioned for. Conduct feasibility analysis for a centralised dual system. Option 2: City goes for decentralised systems- DEWATS at level of residential units/wards. Strict action on encroachment of drains.</td>
</tr>
<tr>
<td>Long term</td>
<td>Constitute an interdepartmental committee to oversee technical and financial details of various projects and also to resolve the jurisdictional overlaps and other coordination issues.</td>
</tr>
</tbody>
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1 Section 1.7, 1.8 Gorakhpur Master Plan 2021, UP Model Zoning Regulations, Section 1.7 to 1.10
2 Section 1.7 Gorakhpur Master Plan 2012
3 UP Model Zoning Regulations, section 1-10(1.10.2)
Video: Tales of Gorakhpur
Thank you!

Raina.singh@teri.res.in