Sea Level Rise and Coastal Infrastructure

Gujarat Institute of Disaster Management

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Climate risks-Why does it matter?

- Recent calamities have drawn attention towards the fact that development goals are seriously undermined by climate change impacts.
- Climate related Disasters cost an estimated $370 billon globally in 2011 (80 per cent of this was in Asia alone)
- India was among the top three most disaster-hit countries in 2015, with economic damages worth $3.30 billion due to climate hazards.
- Need to be prepared to withstand climate change related gradual impacts such as sea level rise, change in precipitation, temperature.
- Need to be equally equipped to respond to climate induced disasters and extreme events

Drive towards sustainable development encompassing environmental benefits

Infrastructure and Climate Risks

- Significant proportion of the **economic costs of an extreme weather event are attributed to its impacts on public and private infrastructure.**
- Infrastructure provides critical social and economic services for sustaining the development needs of people and the economy.
- Infrastructure investments have an **economic life expectancy of 30 years or more** - sensitive to climatic conditions prevailing at the time of its construction as well as to the climate variations over the decades of its use.
- **Need to integrate climate change concerns** to address climate variability and change without compromising on present development challenges.
- Climate proofing infrastructure to make it more resilient and resistant to **anticipated scenarios of long-term climate change**, as well as the **risks associated with climate variability and extremes.**
- Internalization of the risks and opportunities that alternative climate change scenarios are likely to imply for the **design, operation and maintenance of infrastructure.**

Chennai Floods

Hudhud cyclone, Vizag

Mumbai Floods

Coastal Regions Most Vulnerable

Increase in cyclones

Sea level rise

Extreme precipitation events

- Coastal regions, with their concentration of people, infrastructure, and economic activity, are facing unprecedented risks from climate change related natural disasters
- **Thirteen of the world's 20 largest cities** are located on the coast, and more than a third of the world's people live within 100 miles of a shoreline
- **About 2 % of the world's land area is represented by low-lying coastal areas** which houses **13% of the urban population**
- As per the OECD, large coastal cities can expect **a nine-fold increase in flood risk by 2050** and the average global flood losses will multiply from $6 billion per year in 2005 to $52 billion per year by 2050.
- Coastal regions are exposed to additional risks of flooding due to sea level rise (SLR) and high intensity storms.
- India has approximately **171 million population** residing in its coastal districts

Gujarat in the context of SLR and coastal infrastructure

- Gujarat coastline-the longest and is **approximately 22% of the total coastline** of India
- The long coastline of the State serves as a major industrial hub and strategic location. Coastal Gujarat housing almost **37 per cent of the total population**.
- Data predicts a probable **mean sea-level rise along the Indian coast of around 1.3 mm/year.**
- Imperative that **coastal infrastructure is safeguarded**; Special impetus has been given to this thematic area in SAPCC
- Sea Level Rise studies, Costal infrastructure(risk assessment and protection),Expansion of coastal shipping and Renwable energy application in ports/shipyards/

Climate Preparedness for coastal regions and Infrastructure

Case Studies

- **Regional Infrastructure** – Enhancing climate resilience of National Highways in India
- **Local Infrastructure** – Building climate resilient urban infrastructure services

Enhancing Climate Resilience of National Highways

- Need for a comprehensive policy that foresees the long term challenges and emerging climate risks and provides a **direction for building resilience of highways.**
- Study aligned to assist the Ministry of Road Transport and Highways in this direction
- Aims to guide policy makers and practitioners on enhancing the climate resilience of National Highways.

OBJECTIVES

- Understand and document the impacts of climate change on National highways
- Develop a methodology for vulnerability assessment of highway network.
- Identify engineering and non-engineering interventions for building climate resilient national highways in India.

Non-engineering interventions for mainstreaming climate resilience

- ✓ Institutionalizing a dedicated Climate Change Cell
- ✓ Mainstreaming planning and approval processes
- ✓ Formulation of region-wise construction and maintenance guidelines
- ✓ Updating and enforcement of existing Codes
- ✓ Inter-departmental coordination at national and sub-national levels
- ✓ Data management
- ✓ Research and capacity development

Contd..

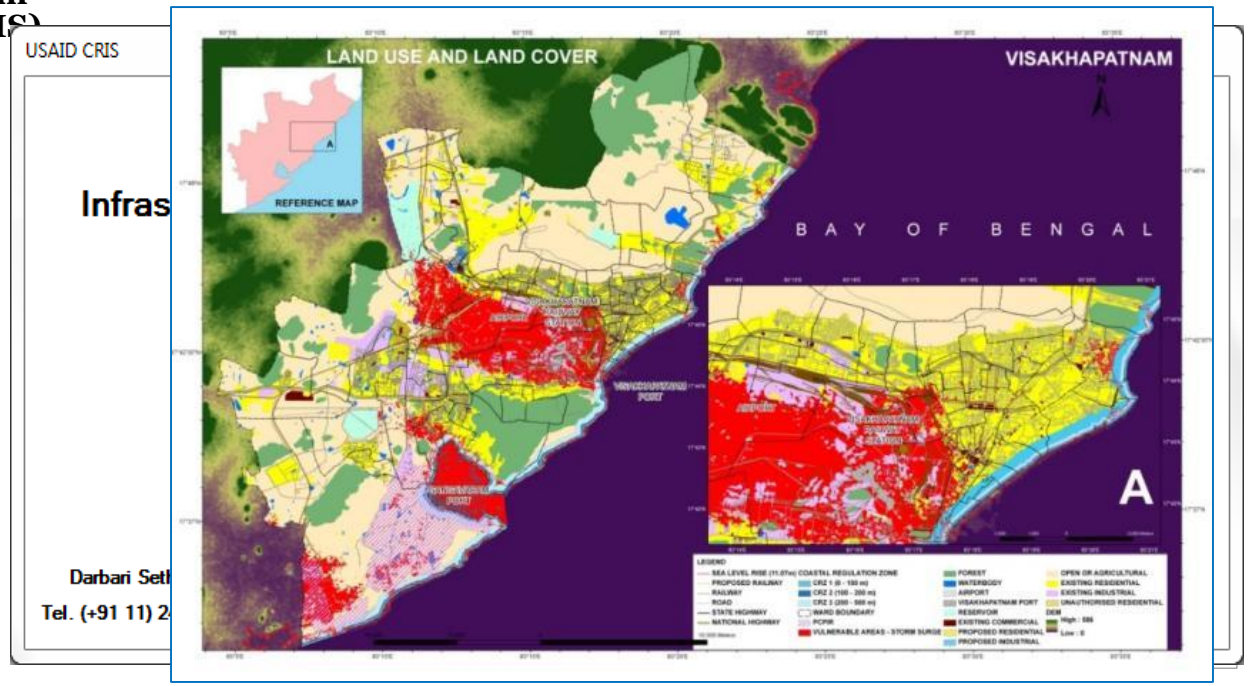
Climate Resilient Infrastructure Services: Panaji and Visakhapatnam

USAID-Climate Change Resilient Development (CCRD Program)

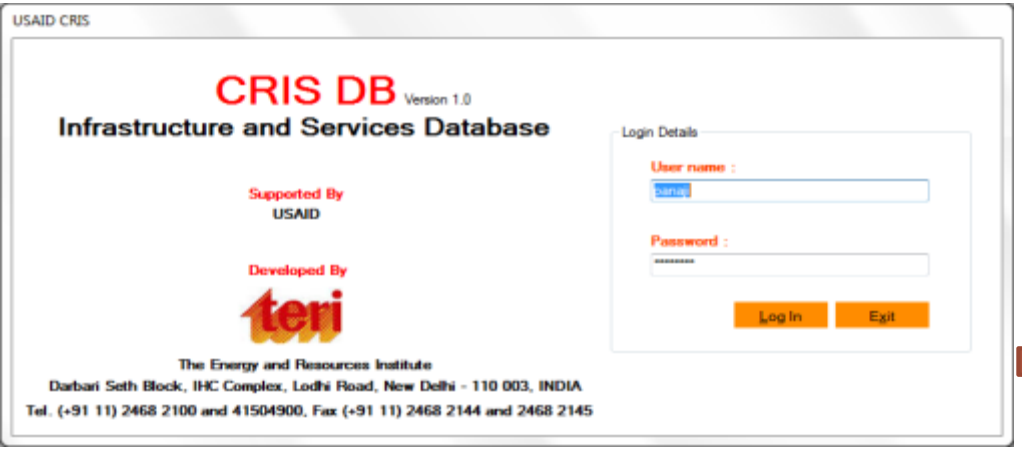
Inventorying and mapping of infrastructure assets

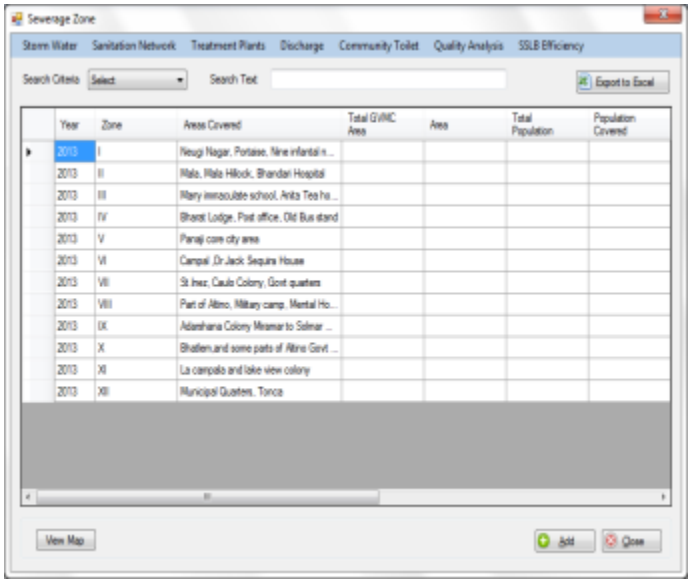
Database Management System (DBMS)

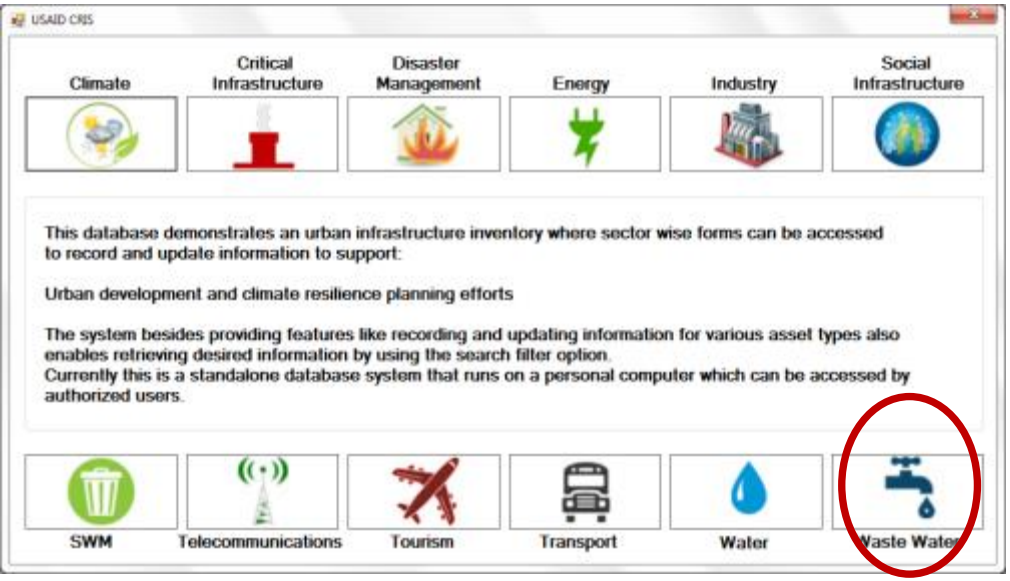
Vulnerability mapping w.r.t sea level rise

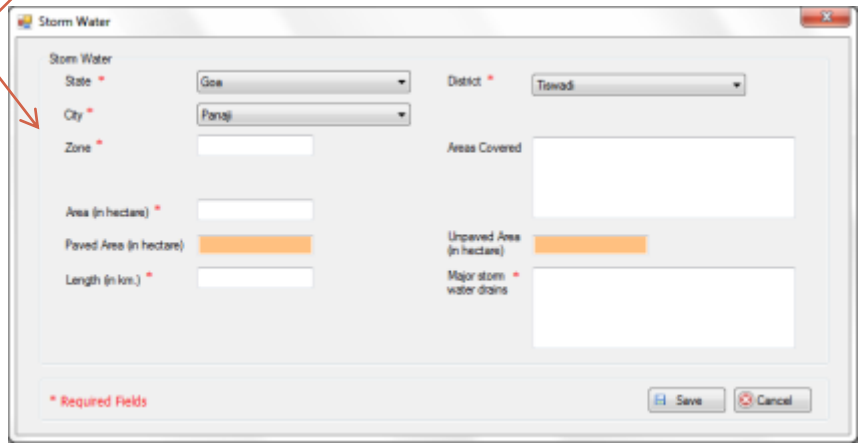


Database Management System for urban climate resilience planning









Vulnerability Mapping

DEM

DEM data set was downloaded from open data sources - ASTER Global Digital Elevation Map (2011) at 30m resolution

Plotting SLR and storm surge scenarios

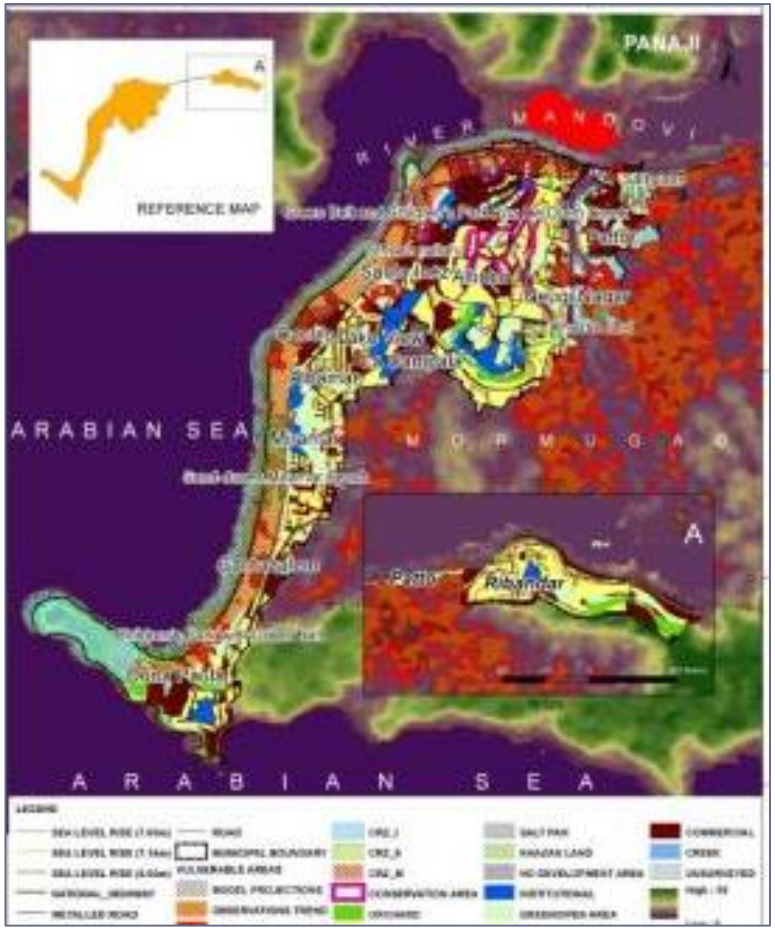
- SLR values (in m) from TERI's model projections
- Observed SLR values with GIA correction (in m)
- 1 m SLR (based on literature review)
- 4 m storm surge in case of cyclonic events

Vulnerability mapping

- Scenarios plotted on DEM were overlayed on thematic maps for the 2 cities
- Areas with elevations lesser than projected SLR/ storm surge were delineated as 'vulnerable' hotspots

Output

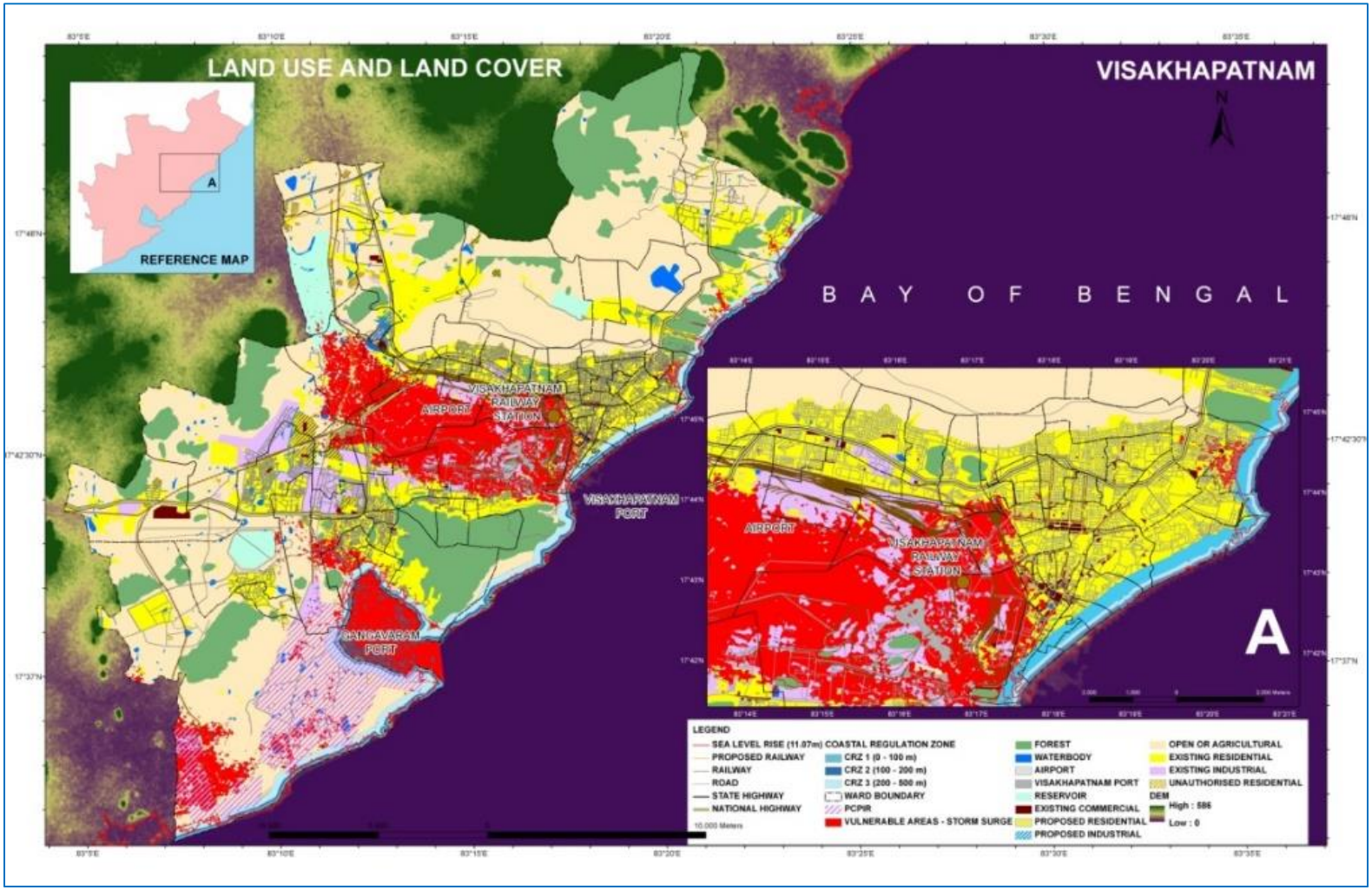
- Vulnerability maps for 2 cities
  - Shape files in Arc GIS platform
  - Layouts in .jpeg format



Scenarios mapped

- Scenario 1: Based on TERI's SLR model projections
- Scenario 2: Based on observed SLR trend (with GIA corrections)
- Scenario 3: Based on 1 meter sea level rise assumption
- Scenario 4 (For Vizag only): In case of cyclonic events with surge height of 4m

Vulnerability Mapping



Recommendations and Strategies

Identification of critical infrastructure

- Infrastructure assets critical for relief/ response in case of extreme events
- Infrastructure assets lying in the Coastal Regulation Zones or vulnerable/ sensitive areas as per the zoning done by different city level plan documents (CDP, Master Plans, Disaster Management Plans, PCPIR Master Plan (in case of Visakhapatnam), etc.)

Sector specific recommendations

- Cover man-made and natural infrastructure assets
- Provide inputs on
- Planning considerations
- Regulatory requirements
- Capacity needs

Key challenges and barriers

- ✓ **Policy and mandate** at national and state level
- ✓ **Integration of climate agenda** with development agenda
- ✓ **Institutionalization** of climate resilience planning.
- ✓ **Local expertise** to generate context specific locally driven solutions
- ✓ **Capacity building and awareness generation** to generate momentum and facilitate action at all levels
- ✓ **Access to knowledge** on climate variability and change
- ✓ **Data management** and updating to facilitate decision making
- ✓ **Fund allocation** for climate proofing infrastructure

Way Forward…

- **Mainstreaming in ongoing Missions and schemes**
  - Technical and Financial Convergence
- **Roadmaps for building climate resilient infrastructure services**
  - Identifying immediate and long term action
- **Performance monitoring and evaluation**
  - SDG sub indicators as KPIs for assessment
- **Sensitization and capacity building**

Smart City
MISSION TRANSFORMATION

अमृत
Atal Mission for Rejuvenation and Urban Transformation

THANK YOU!