Disaster Risk Reduction
Towards Flood Resilience in Surabaya, Indonesia

Empowered lives.
Resilient nations.

ICLEI Local Governments for Sustainability

Key Messages

- Floods pose the most significant threat to Surabaya city, and it is anticipated that its impacts would be further exacerbated under projected climate scenarios
- The city requires a climate-sensitive disaster management plan, with a focus on flood management, that can draw on the assessments of loss and damage at the national and provincial level
- Integrating climate concerns in the city disaster management plan in Surabaya requires coordination between all relevant governmental and non-governmental stakeholders which can be facilitated through the 'Shared Learning Dialogue' process

City Introduction

Surabaya (Figure 1) is the capital of Jawa Timur (East Java) province in Indonesia. It is the second-largest city in Indonesia with a population over 2.9 million spread across an area of 374.78 km^2. It is located on the north-eastern Java island, along the edge of the Madura Strait. Surabaya is divided into thirty one administrative divisions. It is known as the centre of industries such as shipping, electronics, home appliances, cosmetics, traditional herbs, handicrafts and ceramics.

Photo Credit: Google images

Approach

Data available from online national disaster loss and damage database (http://dibi.bnph.go.id/DesInvestar/profiletab.jsp) was analysed. The database was established with UNDP support and is

Figure 1: Location of Surabaya in Indonesia

now maintained by the BNPB, the National Disaster Management Agency of Indonesia. The data analysis aimed at correlating trends in loss and damage from disasters to the country and district levels to assess whether these could help prepare resilience strategies for cities. The database was used to identify the most impacted provinces and a prominent city within each was selected for further analysis. Impact on human life due to natural disasters was considered of prime concern while prioritizing the impacts and given the highest weightage, followed by the number of injured people, followed by the number of victims (a wider population that incurred varying range of losses) and finally the damage to and destruction of houses due to the disaster. Provinces were thus prioritized and two top ones selected. The capital city in each was taken up for detailed study. The steps followed are summarized in the figure below:

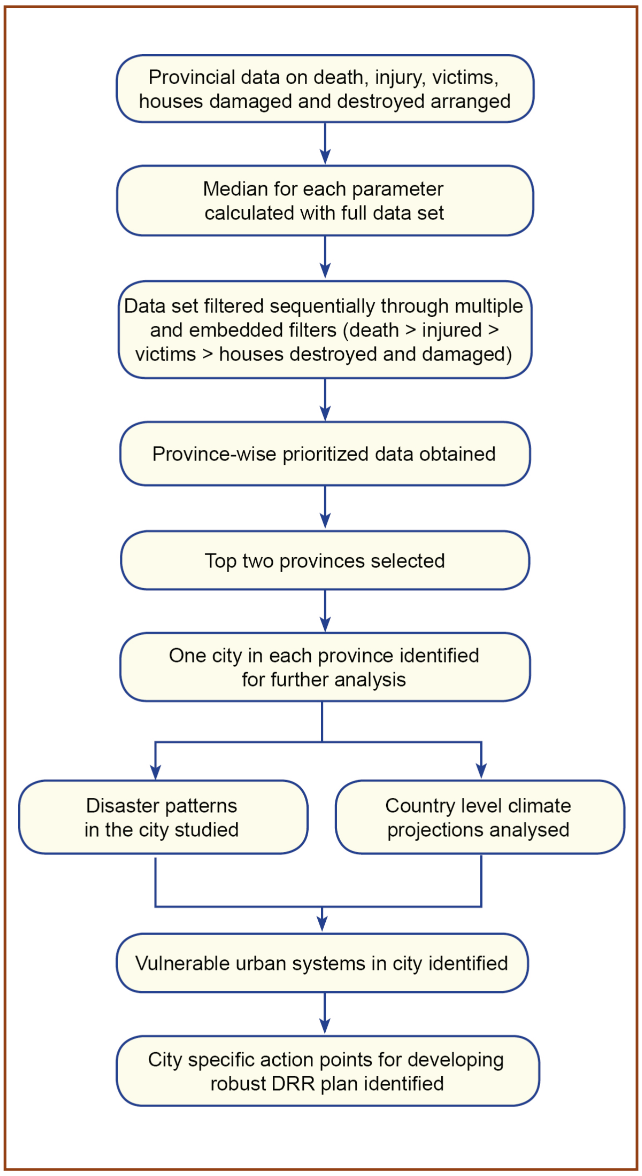

Figure 2: Detailed Methodology

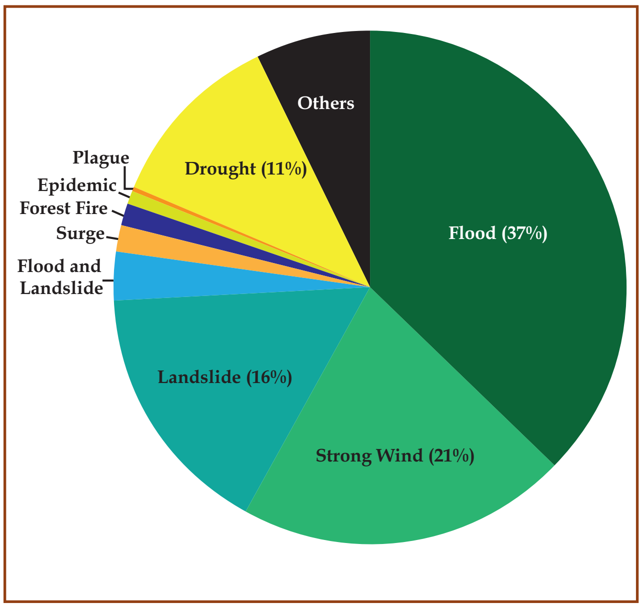

Figure 3: Frequency of Disasters at the country level in Indonesia

Correlating Disaster Patterns and Impacts

An analysis of the disaster patterns at the country level shows that floods are most frequent (37 percent), followed by strong winds, landslides and droughts which have frequency of 21, 16 and 11 percent, respectively (refer Figure 3).

A similar analysis was undertaken at the provincial level and it was found that the Jawa Timur province is affected by floods, strong winds, landslides and droughts. Floods are the predominant disaster. Enquiries at the city level revealed that disasters in the city of Surabaya affect 50 percent of the total city area.

At the city level, the prominent disasters are flood, fire and drought, of which flood is the natural disaster with the highest impacts. Most of the flooding occurs in the months of December to March. The city has 13 areas, of more than 100 ha each, which are most severely affected by floods. The worst among these is the Tenggilis Mejoyo area wherein an area of 286 ha is highly prone to floods, affecting around 43 percent of the residents.

The multi-level analysis of past disaster patterns indicate that floods are the major natural disaster at the national, provincial and city level Therefore, resilience building strategies for flood proofing at the national and provincial level can also inform and guide the necessary city level strategies.

Looking at Disasters through the Lens of Climate Change

The analysis of past patterns of disasters was then reviewed through the lens of anticipated climate change impacts. In the absence of downscaled climate impacts for Surabaya city, the country level projections for Indonesia were reviewed (refer Karmalkar et al, 2006 and Measey. 2010). It was found that the following impacts could be expected:

- An increase in the mean annual temperature by 0.9 - 2.2°C by the 2060s,
- A variation in rainfall by -12% to +20% by the 2090s,
- A sea level rise of 0.18- 0.59 m by 2100

In addition, a review of existing literature as well as direct interactions with city level representatives were undertaken to capture the perceptions on climate change impacts at the city level. It was found that Surabaya has been experiencing a rise in temperature and an amplified frequency of high intensity rainfall along with a decrease in the total number of rainy days. The city has also perceived a rise in the sea level over the last 20 years. These trends are aligned with the national level projections. Considering that floods are currently the natural disaster with the maximum impact in Surabaya, and that climate projections and local perceptions highlight a scenario of increased precipitation, there is a high probability of increased incidences of floods with greater adverse impacts in the city. Urban systems are comprised of the processes by which life in a city is organised and operated. An analysis of the urban systems in Surabaya shows that six systems (water supply, sanitation, food supply, ecosystem, health and transport) are particularly vulnerable to the impacts of increased precipitation (refer Table 1). The most vulnerable people in the city are those working in the informal sector and low income group who account for 50 percent of the total population of Surabaya.

Way Forward

The city of Surabaya has taken some steps to build city resilience to disasters. There are 13 regulations which deal with river and flood management. However, the responsibility of flood control in the city is divided among at least seven different authorities and coordination of all these authorities remains a big challenge. There have been some very successful initiatives like International Cooperation for Organic Waste Management in Surabaya, which has led to a reduction in 30 percent waste production, over a span of five years, along with providing additional livelihood opportunities for the urban poor through preparation and sale of compost. Though the city does not have a disaster management plan, a mitigation action plan exists at the provincial level.

Table 1: Fragile urban systems in Surabaya

Urban System	Current Status	Climate Change Scenario: Increased Precipitation Potential Impacts
Water Supply	City water supply (for all purposes, including drinking) is sourced from the Surabaya river	Increased flooding situations resulting in contamination of potable water
Sanitation: Solid Waste and Waste Water Management	There is no sewerage system existing presently and infrastructure for garbage collection and processing and industrial waste processing is limited	Heightened unhygienic conditions and health hazards due to increased incidences of water borne diseases
Food Supply	There is dependence on surrounding areas for agricultural supplies and food security	Flooding and water logging could affect access to the city and decrease in food supply to the city
Ecosystem	Loss of mangroves due to rapid urbanization	Changes in the brackishness of the water effecting mangrove survival and regeneration
Health	Increasing numbers of private and commercial vehicles in the city is causing poor air quality	Water logging/flooding which will increase chances of water/vector-borne communicable diseases
Transport	High vehicle density due to increased wages and absence of legal restrictions on new vehicle registration which leads to congestion and increased emissions, threatening the micro climate	Flooding situation leading to increased congestion and in extreme cases loss of connectivity/access.

The city utilizes information–based geographical tools (institutional maps, hazard maps, socio-economic profile maps and GIS based planning tools), but city-level climate change projections are not available.

An improved understanding of climate risks, especially from floods, and the preparation of a City Resilience Strategy with implementable actions is the need of the hour in Surabaya in order to address issues related to flood management and mitigation, vulnerability reduction and improvement of preparedness and adaptation. Steps which the city needs to take in order to build a robust DRR plan are summarized in Table 2.

References

- DIBI, http://dibi.bnph.go.id, BNPB Indonesia
- Karmalkar, C. McSweeney, M. New and G. Lizcano. UNDP Climate Change Country
- Measey M. 2010. Indonesia: A Vulnerable Country in the Face of Climate Change Global Majority E-Journal, Vol. 1, No. 1 (June 2010), pp. 31-45

Table 2: Towards Disaster Resilience

City Specific Action Points						
	Urban Systems					
	Water Supply	Sanitation	Food Supply	Health	Ecosystem	Transport
Infrastructural Measures	• Improvement in the piped water supply infrastructure to ensure 100 percent city coverage • Installation of rain water harvesting systems • Allocating green spaces	• Improvement in garbage collection infrastructure to cater to entire city • Development of sanitary landfill • Installation of sewerage system in the city	• Improved storage facilities (cold storage) in the city using renewable energy / clean energy • Allocating land for urban agriculture	Improved health facilities in the city	• Plantation of mangroves • Introduction of native brackish water flora and fauna	Construction of roads with permeable material and concrete.
Social Empowerment	Capacity building of city officials and community members in water conservation, rain water harvesting, water purification	Capacity building of city officials and community members in waste segregation; maintenance of sewerage system	Capacity building of city officials and community members in roof top gardens; vertical farming	Capacity building of city officials and community members on importance of hygiene and measures to maintain the same	Capacity building of city officials and community members on importance of mangroves and the need to conserve the same	Capacity building of city officials and community members on importance of public transport and non motorised transport
Strengthening disaster preparedness and response	• Developing hazard maps, socio-economic profile maps • Usage of GIS based planning tools • Access to climate projection data at provincial and city levels • Development of early warning systems to address floods • Intensification of research on development of climate resilient crop varieties					
Risk reduction through continuous assessment and monitoring **Blue: data already being collected by city** **Red: data collection required by city**	• Per capita water supplied (lpcd) • Quality of water: total number of tests passed/total number of tests conducted	• Percent waste water treated • Efficiency of solid waste collection (%) • Scientific solid waste disposal (%) • Extent of recovery (% treated / recycled)	Food shortage duration (Nil; 0-2 days; 3-5 days; more than 5days)	• Mortality (numbers) • Morbidity (numbers)	• Total area of the water body • Species monitoring (density and diversity)	• Length of roads destroyed (km) • Duration of access lost (hrs) • Incidence of waterlogging and flooding (numbers)

For more information, please contact:

ICLEI Local Governments for Sustainability

ICLEI - Local Governments for Sustainability, South Asia
Ground Floor, NSIC-STP Complex, NSIC Bhawan
Okhla Industrial Estate, New Delhi - 110020, India
Tel: +91-11-4106 7220; Fax: +91-11-4106 7221
E-mail: iclei-southasia@iclei.org; Web: http://southasia.iclei.org/
www.facebook.com/ICLEISouthAsia; www.twitter.com/ICLEISouthAsia

This document has been developed as part of a project on disaster risk reduction, funded by UNDP Bangkok Regional Hub.