

Disaster Risk Reduction Towards Flood Resilience in Banda Aceh, Indonesia



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Key Messages

- Floods pose the most significant threat to Banda Aceh city, and it is anticipated that its impacts would be further exacerbated under projected climate scenarios
- Early warning systems need to be established to reduce the impacts of floods in Banda Aceh
- 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
- Establishment of emergency response and rescue teams equipped with required tools and transport facilities in order to access all areas in Banda Aceh city is the need of the hour
- The city also needs to improve resilience of community by capacity building, knowledge transfer and information dissemination
- Strengthening the ongoing initiatives of incorporating weather anomalies into planning and decision making by the government is the need of the hour



Photo Credit: Google images

Impact of Tsunami in 2004

- More than 2/3rd of city destroyed
- 61,065 people dead and missing
- 21,751 houses destroyed
- 302 km of roads destroyed
- 9 market buildings destroyed
- 25 health facilities destroyed

City Introduction

Banda Aceh is the capital and largest city in the province of Aceh (refer Figure 1). It is located on the island of Sumatra and has an elevation of 35 metres. The city covers an area of 64 square kilometres and had a population of 219,070



Figure 1: Location of Banda Aceh in Indonesia

people, according to the 2010 census. The city has a population density of 3,457/km². The city is divided into nine administrative divisions.

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 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. Provinces were thus prioritized and two top ones were selected. The capital city in each was taken up for detailed study. The steps followed are summarized in the figure below:

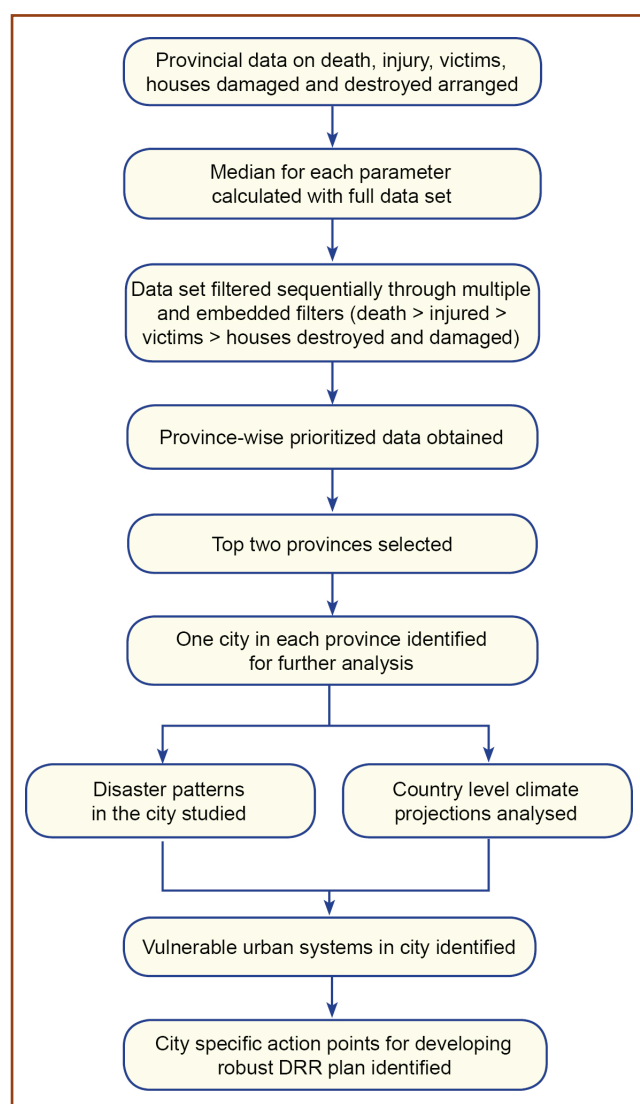


Figure 2: Detailed Methodology

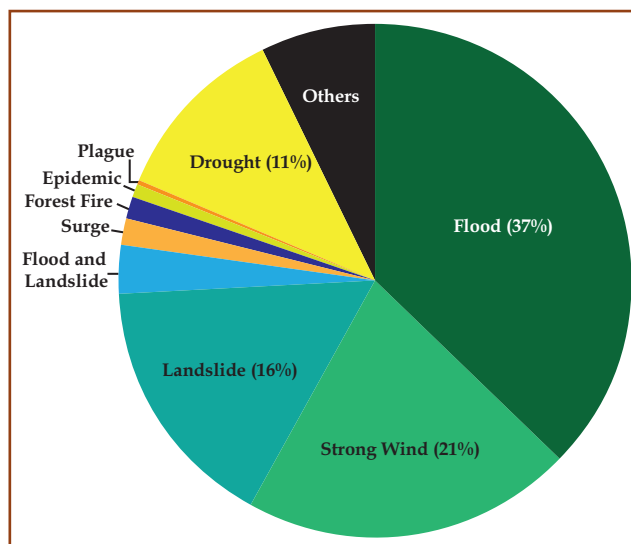


Figure 3: Frequency of Disasters at the country level in Indonesia

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 Aceh province is affected by floods, strong winds, landslides and droughts. Floods are the predominant disaster. Enquiries at the city level revealed that Banda Aceh is highly vulnerable to natural disasters. Topographically, Banda Aceh city consists of lowlands which are exposed to impacts of earthquake, tsunami, flood inundation, tidal waves, tornado and drought. Banda Aceh city is included in the top 15 of high risk category based on Indonesian Disaster-Prone Regions Index. Around 92 percent of the city is prone to flooding. The city had also witnessed a major tsunami in 2004, due to the Sumatra Andaman Earthquake. Apart from the rampant damage caused, by the tsunami in the city, it also led to drop in the coastline by around 1 metre. The latest flood that the city has experienced has been in the year 2014. 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 Banda Aceh 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 Banda Aceh has been experiencing:

- A rise in temperature
- A rise in sea level over the last 20 years
- An amplified frequency of high intensity rainfall along with a decrease in the total number of rainy days.

These trends are aligned with the national level projections. Considering that floods are currently the natural disaster with the maximum impact in Banda Aceh, 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 Banda Aceh through literature review shows that five systems (water supply, storm water drainage, health, transport and food supply) have been impacted severely due to floods and are thus extremely vulnerable to the impacts of increased precipitation (refer Table 1). Particularly vulnerable in the city are the informal settlements and the lower income groups.

Way Forward

The city of Banda Aceh has taken some steps to build city resilience to disasters. There are four escape buildings (Alue Deah, Deah Gelumpang, Lambung and Gampong Poe) to be used as disaster rescue buildings, the information of which has been communicated to all citizens. In addition, capacity building initiatives for civil servants in DRR, along with efforts to increase community participation in DRR have also been carried out. The issuance of the Strategic Plan for Banda Aceh's DRR agency 2012-2017, drafted on the basis of the mid-term developmental plan (RPJMD) will serve as the guidelines for the DRR agency to prepare their work plans. The city also has access to information generated by the Indonesian Agency for Meteorological, Climatological and Geophysics. This agency possesses climate projection data for all regions across Indonesia. The city government is also very active with regard to incorporating weather anomalies into its planning and decision-making, which is exemplified from plans like the five years development plan, sanitation

Table 1: Fragile urban systems in Banda Aceh

Urban System	Current Status	Climate Change Scenario: Increased Precipitation
		Potential Impacts
Water Supply	80 percent of the city has access to drinking water through the local government's supply.	Increased flooding situations resulting in contamination of potable water
Food Supply	There is dependence on surrounding areas as well as peri-urban areas of the city for agricultural supplies and food security	Flooding and water logging could affect access to the city and also lead to crop failure, leading to decrease in food supply in the city
Health	City infrastructure not adequate enough to address to an epidemic	Water logging/flooding which will increase chances of water/vector borne communicable diseases
Transport	High vehicle density due to increased wages which leads to congestion and increased emissions, threatening the micro climate	Flooding situation leading to congestion and in extreme cases loss of connectivity/access.
Storm Water Drainage	Network exists in city, but pipes have narrow diameter and prone to clogging.	Increased water logging due to clogged pipes with narrow diameter which will increase health hazards and create further damage to infrastructure.

master plan, Qanun Banda Aceh city No.4 year 2009 concerning Spatial Planning of Banda Aceh city 2009-2029 and Qanun Banda Aceh city No. 3 year 2011 concerning Organisation Structure and Working Procedure of local DRR agency. The residents as well as city officials are actively involved in measures with regard to waste water and solid waste management, along with taking up initiatives on transportation and health issues. Though the city does not have a disaster management plan, a mitigation action plan exists at the provincial level.

In addition to the ongoing initiatives, the preparation of a City Resilience Strategy with implementable actions is the need of the hour in Banda Aceh 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
- <http://dokumen.tips/documents/wilayah-rawan-banjir-kota-banda-aceh.html>
- 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	Storm Water Drainage	Food Supply	Health	Transport
Infrastructural Measures	<ul style="list-style-type: none"> ● Improvement in the piped water supply infrastructure to ensure 100 percent city coverage ● Installation of rain water harvesting systems ● Allocating green spaces 	Revamping existing network through laying of fresh and broader diameter pipelines	<ul style="list-style-type: none"> ● Improved storage facilities (cold storage) in the city using renewable energy / clean energy ● Allocating land for urban agriculture 	Improved health facilities in the city	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 on importance of storm water drains and necessity to keep them clean	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 public transport and non motorised transport
Strengthening disaster preparedness and response	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Per capita water supplied (lpcd) ● Quality of water: total number of tests passed/total number of tests conducted 	Incidences of water logging / flooding (number)	Food shortage duration (Nil; 0-2 days; 3-5 days; more than 5days)	<ul style="list-style-type: none"> ● Mortality (numbers) ● Morbidity (numbers) 	<ul style="list-style-type: none"> ● Length of roads destroyed (km) ● Duration of access lost (hrs) ● Incidence of waterlogging and flooding (numbers)

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