

# Optimizing emergency responses: developing operations research tools for Flood response in Bangladesh

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## Abstract:

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## 1 INTRODUCTION

### Idea generation :

Brainstormed (Mahbub & Tanmoy)

1. Collect data (GIS map, and
2. Information needed on depo, warehouse storage location (supply), affected area, and population (demand)
3. Build the conceptual and mathematical models
4. Column generation to solve the optimization problem

## 2 METHOD

### 2.1 Data:

#### 2.1.1 Summary of the case study (present situation)

As of today (Aug 25, 2024), more than 500,000 people have taken refuge in around 3,500 shelters in the 11 flood-hit districts, where nearly 750 medical teams are on the ground to provide treatment (ReliefWeb 2024; Paul 2024). Most affected communities are from Feni, Noakhali and Khagrachhari districts; 193,864 people are in 3170 shelters.

Challenges (Brainstormed with Riad):

1. Most Bangladesh Army base locations are NOT open-source
2. Emergency response in Bangladesh is often at community level (getting data at national level is almost impossible, partly due to security reasons)

Working on:

1. Collecting GIS map & .json/.shp files of flood impacted regions ++

### Some useful links (ref. everyone):

1. <https://protirodh.net/flood> (you need to drag the map to the right). Note: view is different in Safari vs Chrome.
2. <http://biwta.port-log.net/live/Map.php>
3. Flood Forecasting & Warning Centre <http://www.ffwc.gov.bd>
4. Water level [data](#)

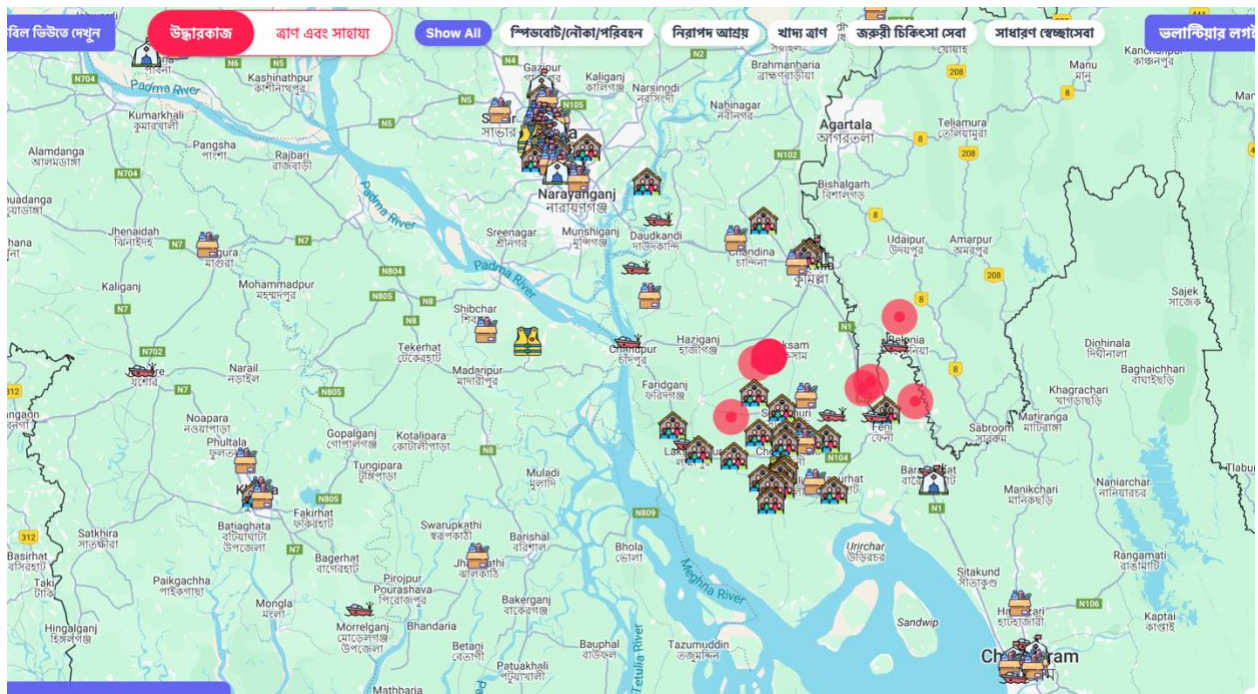


Figure 1 Affected regions in Bangladesh (Source: protirodh.net 2024)

### 2.1.2 Data needed for the optimization model

**Table 1 Metadata and database schema**

<i>Category</i>		<i>Specifics</i>	<i>Data points/ type</i>
Affected region	Road Network Data	Traffic Data: Real-time or historical traffic patterns, congestion data, and road closures. Accessibility: Information on road conditions, including roads that may be flooded or inaccessible.	
		<b>Shelters:</b> Locations of emergency shelters and their capacities. <b>Hospitals:</b> Locations, capacities, and current status (operational or flooded). Locations of communication towers, especially in areas with poor signal coverage.	Geolocation of shelters (& their capacity) Note: Current occupancy in this shelters are location of demand points for our model.
Supplier		<b>Depots/Warehouses:</b> Locations of resource storage facilities.	Geolocation of depot
Affected people (demand)			

### 2.1.3 Dataset of our case-study

**Table 2 Dataset of flood-affected region**


## 3 RESULT & DISCUSSION

Supplementary

<https://github.com/tanmoyie/Optimizing-flood-reponse-in-Bangladesh>

### AUTHORS' CONTRIBUTION:

**Md Mahbubar Rahman:** original research idea, optimization model development, solution algorithm; **Tanmoy Das:** optimization model development, data curation and analysis; **Riad Alam:** Domain experience, data collection; **Hafizur Rahman:** model deployment, validation

### REFERENCE

- Paul, Ruma. 2024. "Twenty Dead, 5 Million Affected in Bangladesh Floods." Yahoo News. 2024. <https://au.news.yahoo.com/twenty-dead-5-2-million-145537062.html>.
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- ReliefWeb. 2024. "Flooding in Eastern Bangladesh (Feni, Comilla, Noakhali, Habiganj, Moulvibazar, Khagrachhari and Rangamati)." 2024. <https://reliefweb.int/report/bangladesh/flooding-eastern-bangladesh-feni-comilla-noakhali-habiganj-moulvibazar-khagrachhari-and-rangamati-briefing-note-24082024>.