Derna Deluge Dossier: A Flood Analysis Initiative

PROBLEM STATEMENT & MOTIVATION

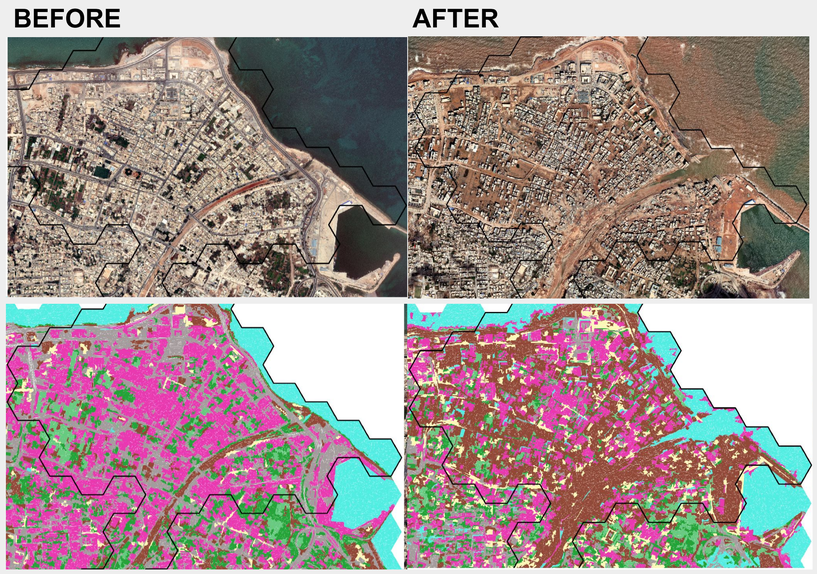
Our motivation stems from the pressing need for disaster mitigation and management, highlighted by the recent Derna Dam collapse in Libya. Our project's goal is to demonstrate how GIS and remote sensing data can enhance urban flood loss assessment and recovery planning, fostering vibrant and prepared communities in the face of future crises. With an estimated death toll of over 10,000, it is crucial to evaluate measures for future disaster mitigation and urban recovery in Libya.

APPROACHES

Object-based Image Analysis (OBIA) was conducted on GeoEye 1 satellite imagery to understand land cover changes as a result of the flood. Separately, **K-means classification and Google Places API** was used to classify building types. The combined information enabled identification of the worst affected area and the severity of building damage.

Network analysis was conducted to analyse **accessibility** to amenities and **network coverage** of evacuation centres utilising Derna's road network pre and post flood (based on the OBIA analysis of damaged roads). This enables identification of rebuilding priorities in the short and long-term.

DAMAGE EXTENT

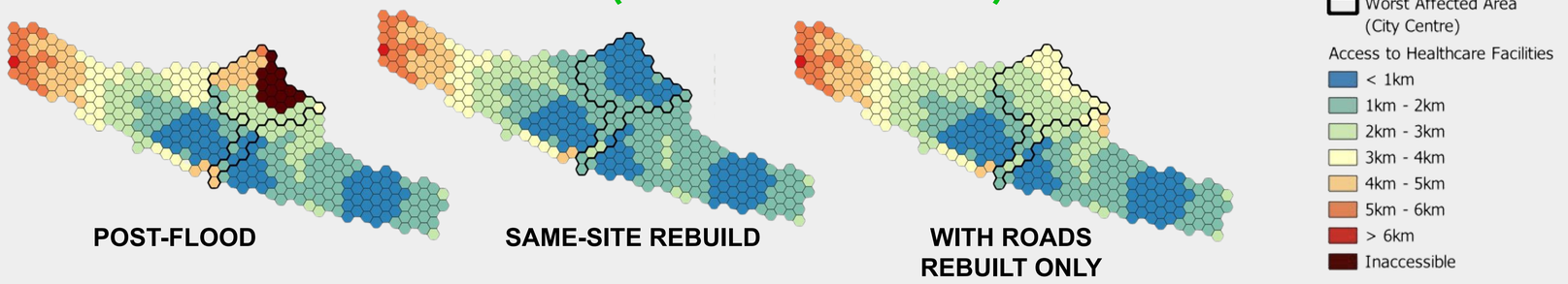


OBIA classified **7 distinct land cover types** - buildings (pink), barren land (brown), water (blue), paved (grey)and dirt road (beige), farm (light green) and vegetation (dark green). Post flood, **bare land coverage increased 264%** while **building coverage decreased 40%** in the city centre, indicating its **exposure to the flood and its devastation**. The change in land cover can also indicate the complete destruction of buildings especially near the Wadi Derna.

BUILDING & ROAD DAMAGE ANALYSIS & LONG TERM PLANNING RECOMMENDATIONS

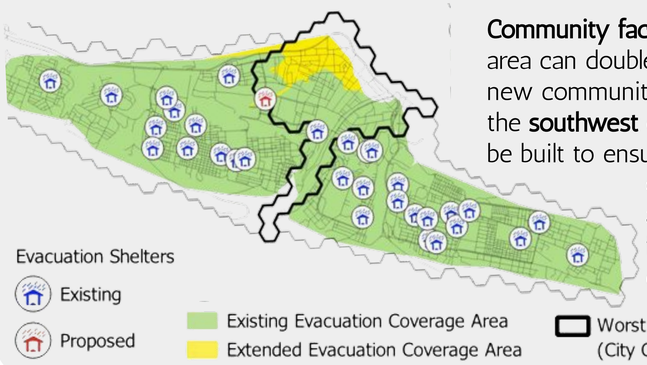
Analysis of OBIA results revealed **3680 / 5215 structures** in the city centre (11 Cultural, 252 Economic, 18 Governance, 9 Health & Safety, 3390 Humanitarian) partially or fully covered by mud, indicating significant loss and damage to human life and property and heavy disruption to normal urban function. **26.68km of roads** in the area were damaged, including **all 4 bridges across the Wadi Derna**, which significantly impairs relief and rebuilding efforts. **Short term efforts should prioritise restoration of major roads and bridges** to restore access and economic function to the city centre. **In the long run,** recommendations include a **50m no-build buffer from the bank of Wadi Derna** where damage was most significant. A no-rebuild policy in the rest of the city centre is unrealistic given its economic importance and **mitigation measures** such as **raising structural entrances, implementing evacuation plans and limiting building density** to balance restoration of urban function and safety should be enacted.

AMENITY REBUILD RECOMMENDATION (HEALTHCARE FACILITIES)



Network analysis with analytical hexagon of Derna and its road network was conducted. Post flood, a large portion of the city centre remains inaccessible to healthcare. In the **short run**, **rebuilding of the road network** in the affected area is crucial to restore access. In the **long run**, a **same-site rebuild of the city centre hospital and clinic** with mitigation measures offers the **best balance between safety and restoring urban life in Derna.**

EVACUATION CENTRE COVERAGE ANALYSIS



Community facilities outside the affected area can double up as **evacuation sites.** A new community / evacuation facility to the **southwest** of the city centre should be built to ensure good evacuation coverage in the city centre, and provide a new space for community activities during peacetime.

FUTURE WORK

Our findings are limited due to the **lack of accurate pre and post-flood data**. By introducing models to classify the existing data, we may introduce bias to the results. To address this limitation, future efforts should prioritise primary data collection.

SMU Singapore Management University | School of Computing and Information Systems

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Nicolas Tang | Eleora Lim | Jerric Chan