

Asset-based Dynamic Flood Risk Assessment: Case Study of London Downtown

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Introduction

- Flooding poses significant risks to urban centers, with particular challenges faced by business hubs where disruptions can have devastating consequences on economies.
- Business hubs are the lifeblood of economies, and during flood events, disruptions faced by businesspeople obstruct daily operations and ripple through financial systems.
- However, there is a lack of comprehensive real-time assessment of asset vulnerability to flooding, considering population density [3].

Key Findings

- The results indicate that, despite the presence of advanced systems for monitoring rainfall and water levels, a significant number of critical assets in downtown London remain vulnerable to flooding (Figure 3).
- If a water level sensor indicates a flood flag at any time step, the surrounding assets are also assigned a red status for flood vulnerability in subsequent time steps (Figure 3).
- The water flows from left to right, and the figures show that, over time, the water level sensors begin to signal flooding sequentially in the same direction, enabling the prediction of asset vulnerability to flooding (Figure 3).

Aim and Objectives

This study aims to develop a comprehensive framework for the dynamic assessment of flood risk to assets, focusing on the real-time evaluation of the vulnerability of each economically critical asset to flooding.

Methodology

- This study employs a three-step framework for dynamic flood risk assessment. A case study of downtown London, illustrated in Figure 1, features nine economically critical assets identified as vulnerable to flooding.
- The first step involves flood forecasting using rainfall and water level sensors, which calculate the water level at each marked location in 15-minute intervals. The flood status at each point is categorized into three levels: red (flooding), yellow (rising water levels), and green (no flooding).
- The second step assesses the vulnerability of each asset based on population density data, which can be retrieved from the Google API for each structure. Vulnerability is likewise classified into three categories: red (very crowded), yellow (crowded), and green (deserted).
- The third step integrates the results from flood forecasting and population vulnerability using the risk matrix presented in Figure 2. Based on this matrix, assets are classified into three risk levels: red (high risk), yellow (medium risk), and green (low risk). These classifications support decision-makers in flood risk management by helping prioritise emergency response actions based on real-time risk levels.

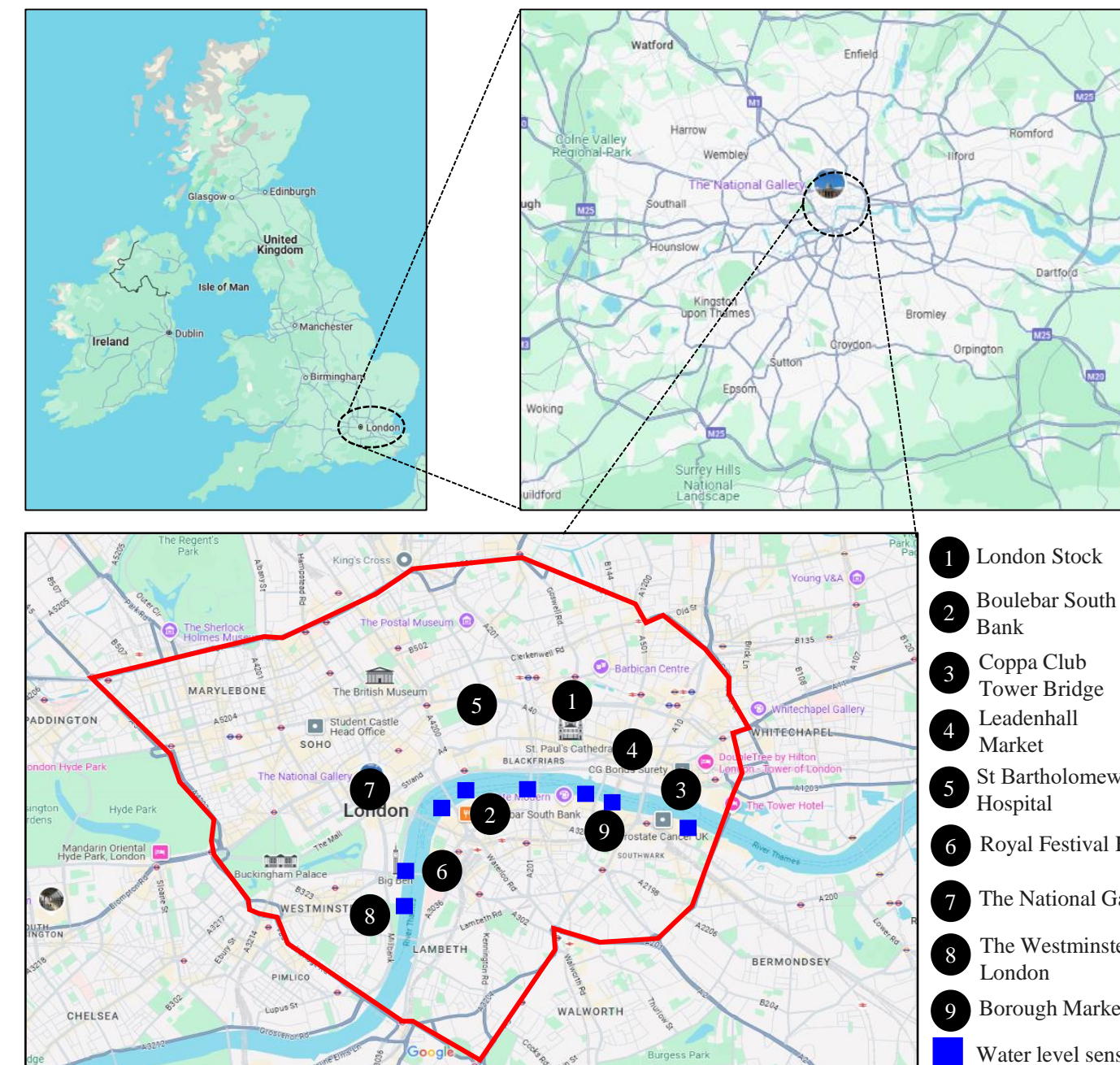


Figure 1. A case study of London Downtown with critical assets and water level sensors

Population density	3	6	9
	2	4	6
	1	2	3
	1	2	3
	(Flooding probability)		

Figure 2. The risk matrix of the vulnerability of assets against flooding

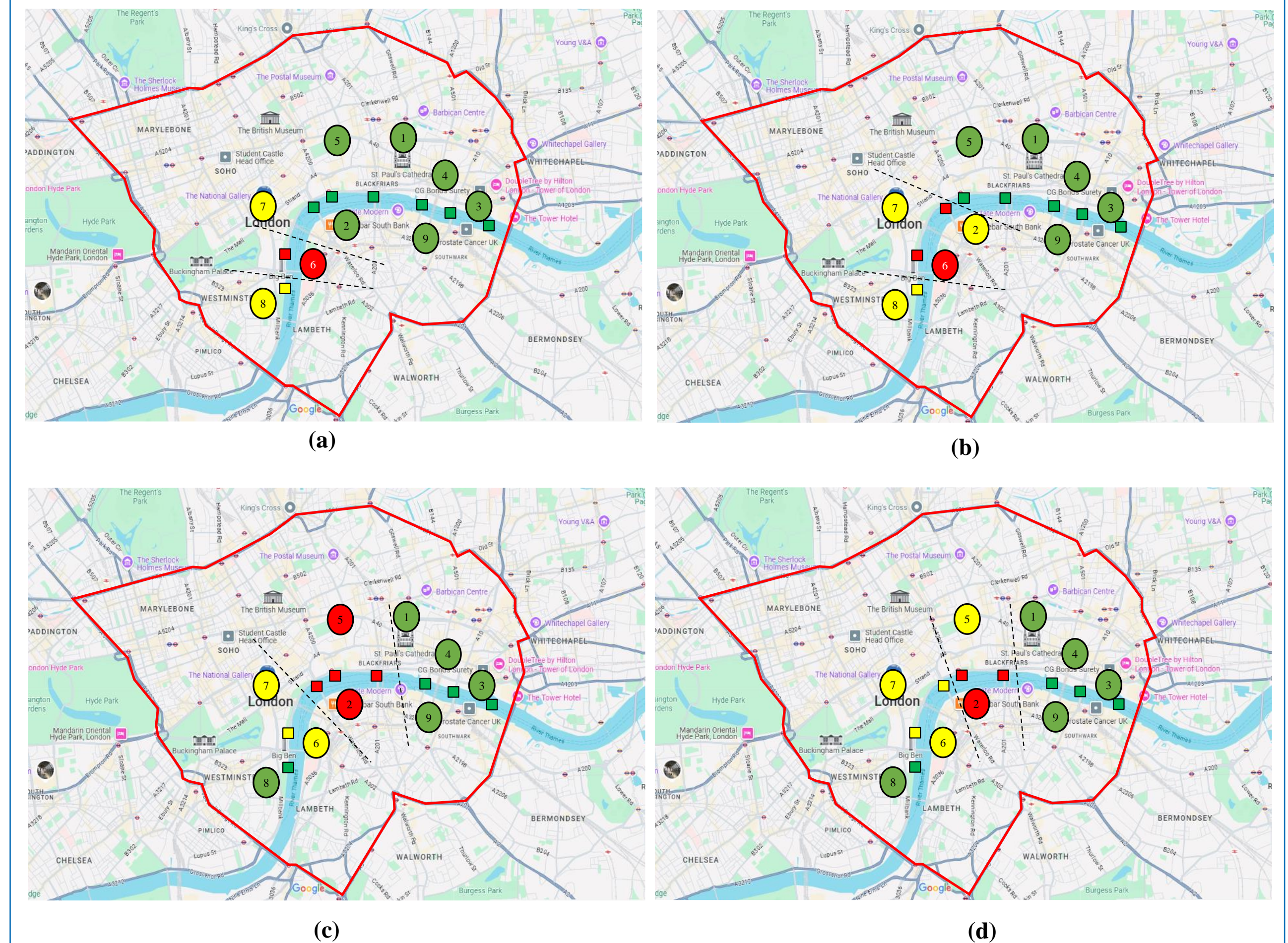


Figure 3. Risk levels for critical assets in London downtown at (a) 30 minutes, (b) 1 hour, (c) 2 hours, and (d) 3 hours after the onset of rainfall