

# Severed Accessibility and Urban Resilience: A multi-scalar analysis of flood risk in Chennai, India

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## Abstract

This paper introduces a spatial methodology to model accessibility loss under extreme flood conditions in Chennai, India. A 100-year return period flood scenario is overlaid on the street network to quantify where movement and access to services collapse. The analysis couples Space Syntax accessibility measures with flood exposure and supporting spatial layers to identify priority corridors and zones for safe shelter allocation and evacuation planning.

## 1 Introduction

Flooding is a rapidly intensifying urban challenge that disrupts essential services and exposes structural inequalities. While many resilience frameworks focus on exposure or engineered protection, fewer capture how flood events dynamically alter everyday accessibility—disconnecting populations from shelters, services, and safe mobility routes.

This paper reframes resilience as the preservation of spatial connection under disruption. Using Chennai, India as a case study, we quantify accessibility loss under an extreme flood scenario and identify spatial priorities for evacuation and shelter planning.

## 2 Study area and data

The study focuses on the Adyar River basin and adjacent urbanised areas of Chennai, Tamil Nadu.

Data layers include: (i) street network data derived from OpenStreetMap; (ii) flood inundation layers representing an extreme event / return period scenario; (iii) land use and settlement context layers; and (iv) candidate shelter locations and key services used to evaluate accessibility under disruption.

All large geospatial datasets are shared via Google Drive (see the repository file `DATA_SOURCES.md`).

## 3 Methods

The workflow combines network-based accessibility metrics with flood exposure overlays.

### Space Syntax accessibility

Segment-based analyses were used to compute accessibility proxies (e.g., global and local measures at multiple radii) for the street network.

## Flood disruption overlay

A flood scenario layer was intersected with the street network to identify segments impacted by inundation. Accessibility was recalculated under disrupted conditions to quantify loss patterns.

## Targeting and prioritisation

Priority zones and corridors were identified by combining accessibility loss with population density proxies, safe-zone indicators, and the distribution of shelters and critical services.

## 4 Results

Results indicate that accessibility degradation is spatially uneven. Compact areas retain more connected movement options under disruption, while dispersed or fragmented areas become structurally isolated.

Comparative mapping highlights where global and local accessibility collapse under the flood scenario, and where safe-zone and shelter coverage may be insufficient.

## 5 Discussion and design implications

By focusing on accessibility rather than exposure alone, the analysis supports actionable planning decisions.

Design and policy implications include reinforcing blue-green infrastructure along critical corridors, prioritising shelter locations that preserve access under disruption, and protecting key connectors that sustain metropolitan-scale movement.

## 6 Conclusion

This paper demonstrates a transferable workflow to quantify accessibility loss under flood disruption and to derive priority intervention corridors.

Future work can extend the approach with scenario ensembles, sensitivity tests on disruption thresholds, and validation against observed service outages and travel constraints during flood events.

## Data and code availability

Large datasets are shared via Google Drive due to GitHub size limits (see `DATA_SOURCES.md` in the repository). This repository contains the curated figures used in the paper and documentation of the workflow.

## Figures

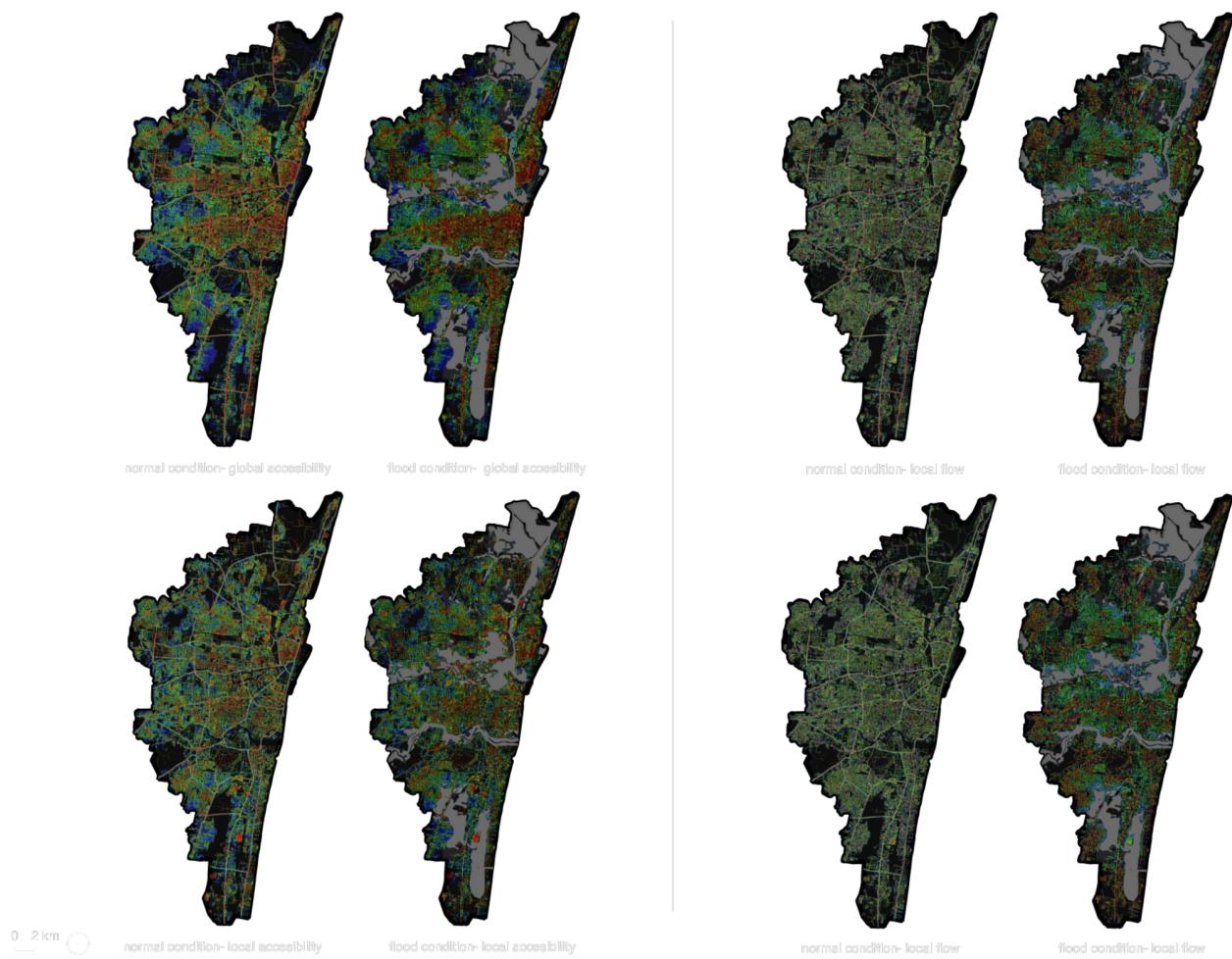


Figure 1: Accessibility under normal conditions versus a flood scenario (global and local measures).

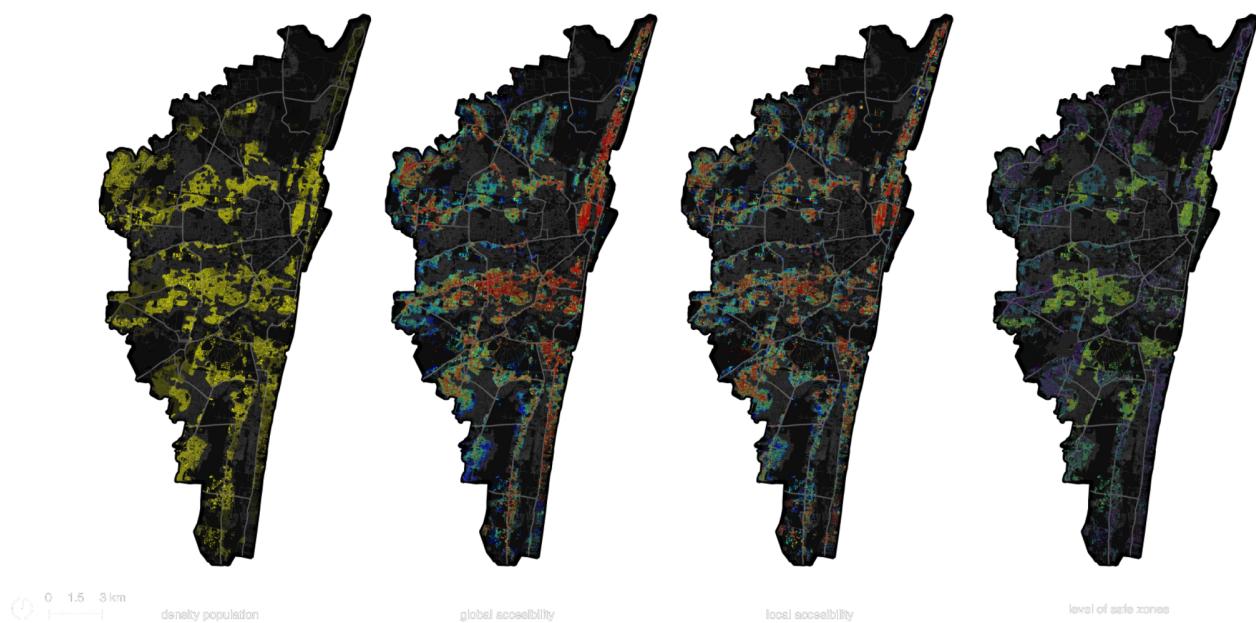


Figure 2: Population density, accessibility patterns, and safe-zone indicators.



Figure 3: Intervention targeting by combining accessibility loss, exposure, and critical destinations.