



BHARATHIAR UNIVERSITY

AHP-GIS BASED GARBAGE VULNERABILITY ZONE MAPPING: A CASE STUDY FROM COIMBATORE CITY, INDIA

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COIMBATORE CITY MUNICIPAL CORPORATION

RESEARCH MOTIVATION

The rapid increase in urbanization globally has led to a surge in municipal solid waste (MSW) generation, which has a direct impact on the environment, economy, and health of urban residents. Inefficient MSW management can cause severe negative impacts such as soil, water, and air pollution, increasing health risks, and damaging the natural habitat of various species. The need for effective waste management in urban areas is vital to minimize these negative impacts on urban ecosystem. Prioritizing garbage vulnerable zone (GVZ) mapping is essential for effective municipal solid waste management. Waste generation in urban areas is influenced by various factors such as population density, cultural diversity, and commercial activities, making it

challenging to manage efficiently. Identifying vulnerable regions using AHP-GIS based approaches can help target waste management strategies and resources to the areas that need it the most.

Mapping the garbage vulnerable zones allows for a better understanding of the waste generation patterns and characteristics of an area, such as the amount and types of waste generated, the presence of open dumping and garbage bins, and the local population's behavior and attitude towards waste. This information is crucial for designing and implementing effective waste management strategies, such as waste segregation, composting, and recycling programs.

By prioritizing the garbage vulnerable zones, waste

management authorities can target their resources, such as waste collection and disposal facilities, in the areas that need it the most. This approach reduces the transportation costs and the environmental impact associated with transporting waste to distant facilities, thus reducing the overall carbon footprint of waste management.

Moreover, prioritizing garbage vulnerable zones can help to improve the overall cleanliness and hygiene of urban areas, reduce the risk of disease outbreaks, and improve the quality of life for residents. It also encourages public participation and community involvement in waste management, raising awareness about waste reduction, segregation, and recycling.

AIM & OBJECTIVE

The aim of this project is to develop an AHP-GIS based approach for mapping garbage vulnerability zones in urban areas to aid in effective municipal solid waste management.

- To assess the factors contributing to MSW generation and accumulation in Coimbatore city.
- To determine the weightage of each criterion using the AHP pairwise comparison method.
- To map the garbage vulnerability zones (GVZ) spatially using GIS.
- To identify highly vulnerable clusters in the study area.
- To provide insights into the spatial distribution of garbage accumulation to develop effective waste management strategies.

STUDY AREA



COIMBATORE CITY...

Coordinates : 10° 54' 57"N to 11° 06' 12"N & 76° 51' 22"E to 77° 04' 01"E

Area : 256.7 km²

Number of Zone : 5

Number of Wards : 100

Population : 29,35,000 (Aprx.)

Coimbatore city is the 2nd Largest in Tamil Nadu and 16th Largest in India.

Coimbatore is known for its pleasant climate, scenic beauty, and cultural diversity, and attracts many tourists every year.

METHODOLOGY INFOGRAPHICS

Data Collection and Processing

The European Space Agency's Sentinel-2A data was utilized to perform a land use and land cover (LULC) classification for the year 2020 using a support vector machine algorithm. The resulting classification accuracy was found to be 85%, with a kappa coefficient of 0.77.

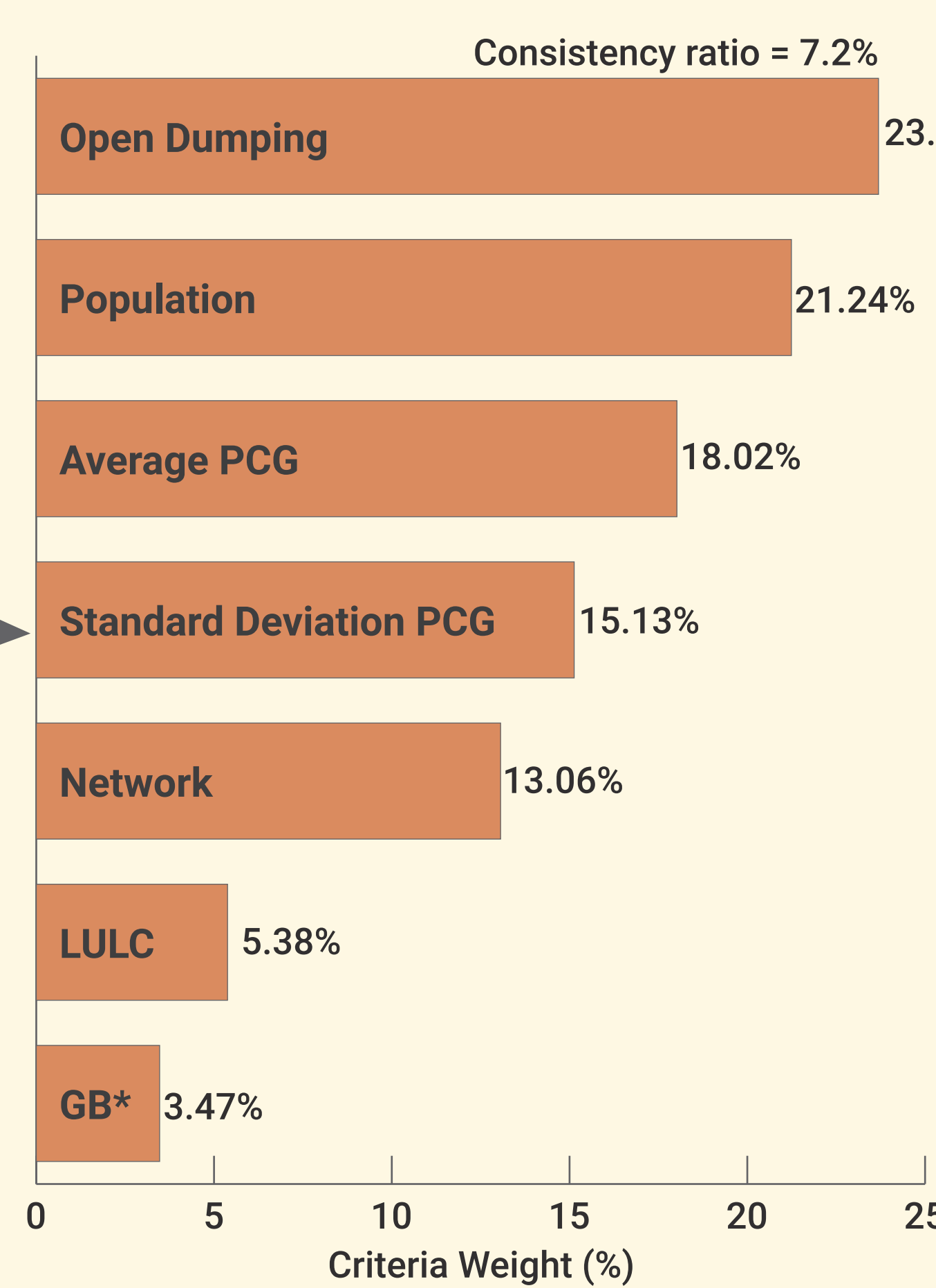
For the period spanning from November 2020 to August 2021, 316 samples were obtained through a door-to-door collection method. These samples were analyzed to determine the per capita waste generation data (PCG), and the resulting averages and standard deviations were calculated.

In 2021, a survey was conducted to determine the locations of open dumping sites and garbage bins, which were then processed for further analysis.

The road and railway network maps of Coimbatore city were acquired from the municipal corporation office.

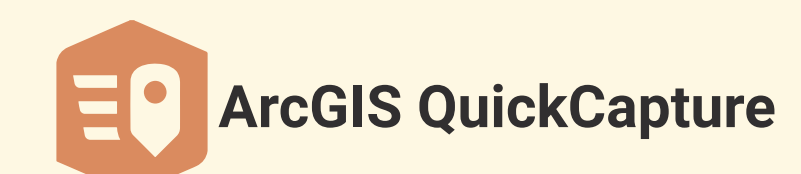
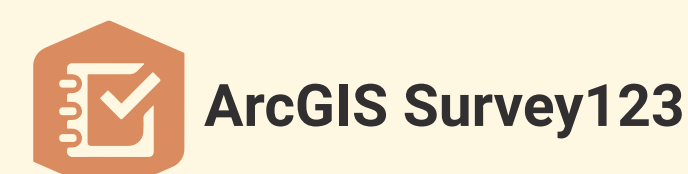
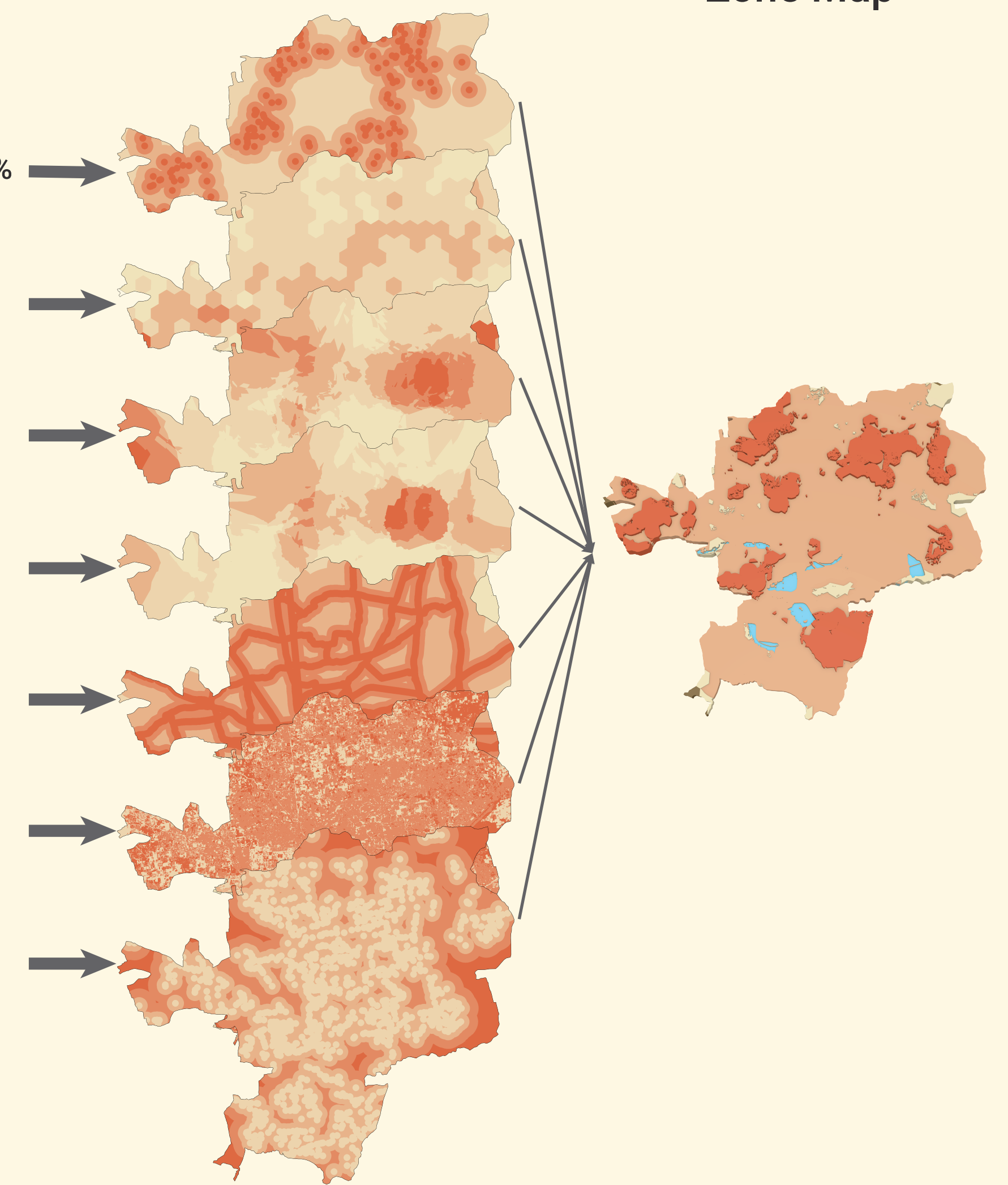
Population data at a spatial resolution of 400m H3 hexagons obtained from the Kontur Population Dataset.

AHP Based Criteria Weight



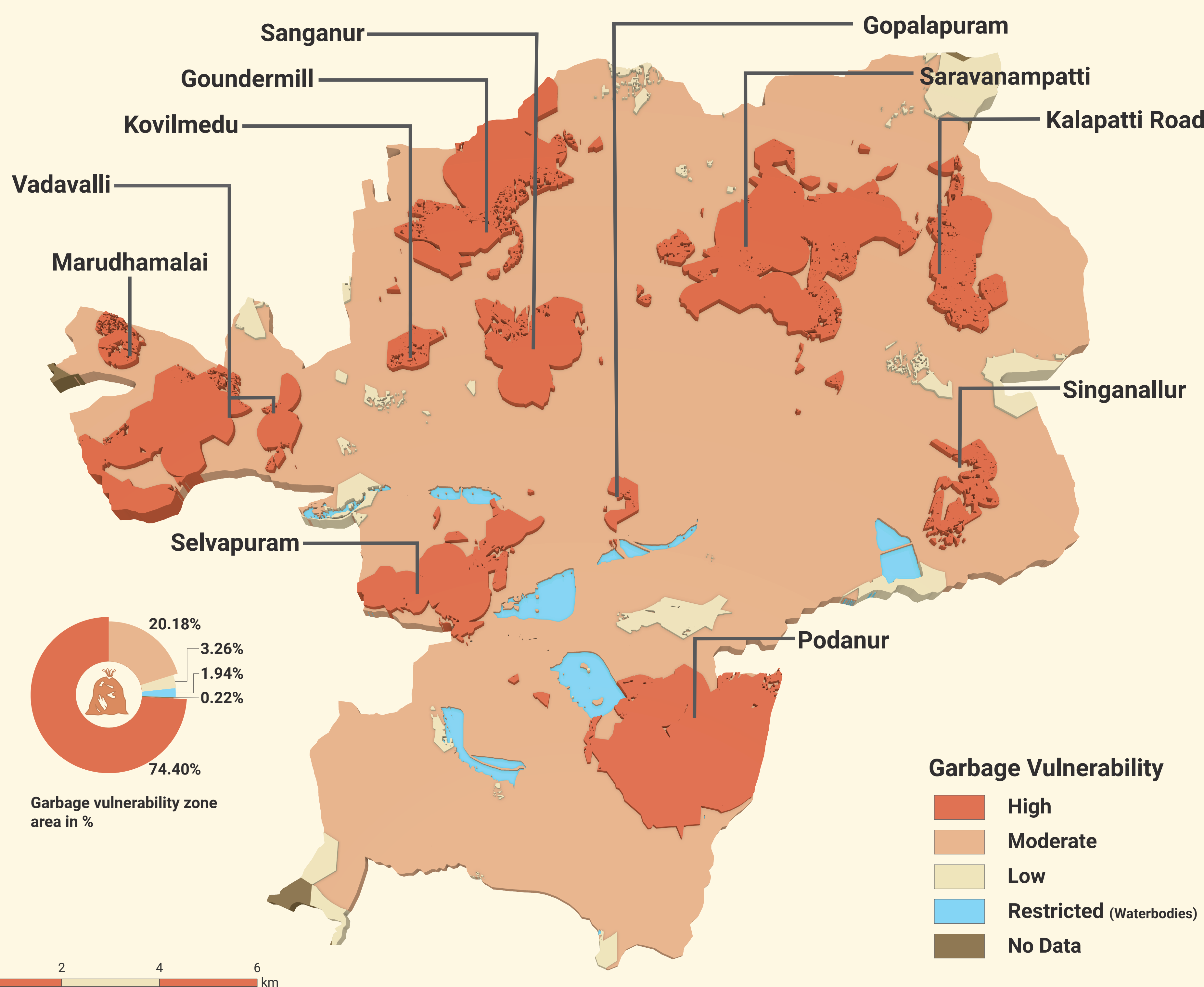
GIS Overlay Analysis

Garbage Vulnerability Zone Map



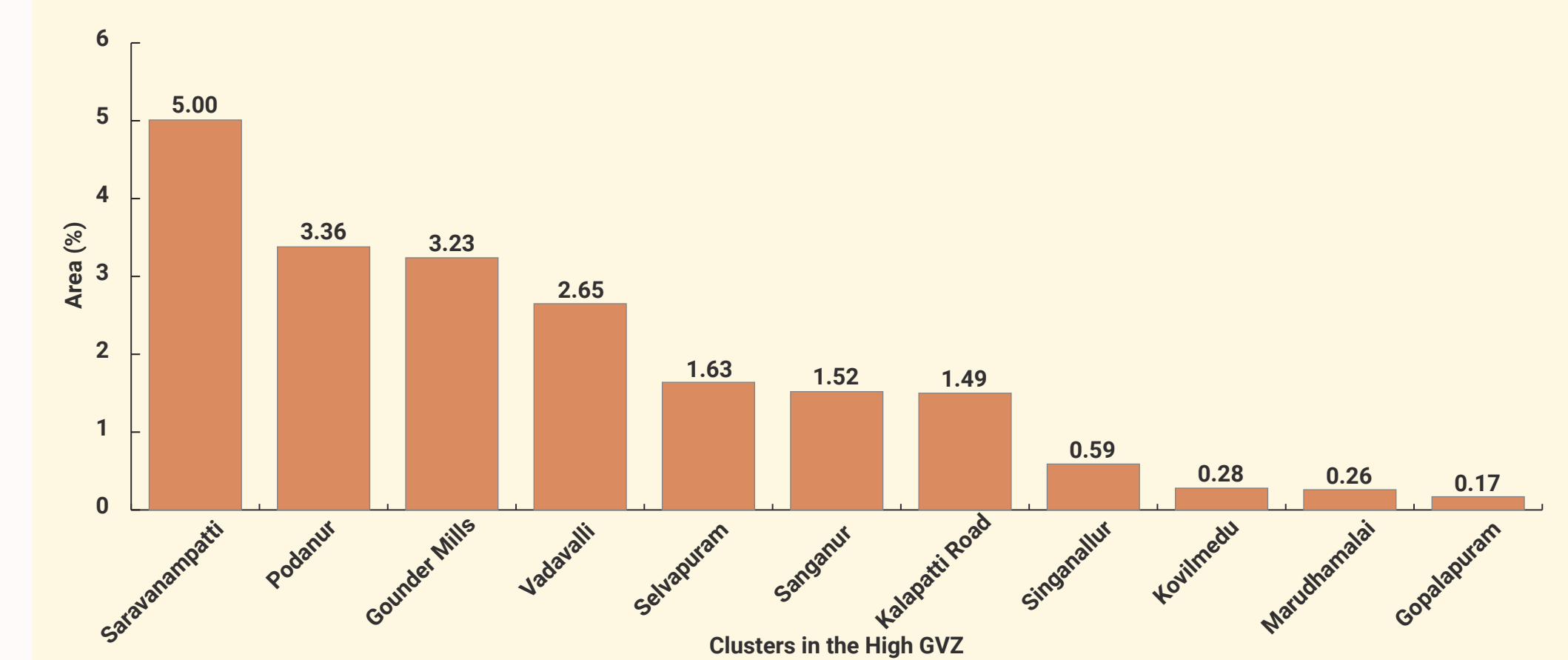
*GB = Garbage bin

GARBAGE VULNERABILITY ZONE MAP



RESULT & DISCUSSION

- The study found that a large portion of Coimbatore city, 94.58%, is at risk of municipal solid waste generation and accumulation. Of this, 20.18% is highly vulnerable, and 74.40% is moderately vulnerable.
- Only 3.26% of the area is considered low vulnerable.
- Waterbodies, which make up 1.94% of the area, were excluded from the model due to renovation under the smart city scheme and authorities' control over open dumping.
- Eleven clusters were identified in the high GVZ, with Saravanampatti cluster being the most vulnerable, covering 5% of the area.



CONCLUSION

- This study used an innovative approach to identify garbage vulnerability zones in Coimbatore city, different from previous landfill-focused studies.
- The results provide valuable insights into the spatial distribution of garbage accumulation, which can help develop effective waste management strategies.
- Densely populated residential areas, commercial areas, and transportation hubs were identified as the most vulnerable zones.
- The study's findings are useful for stakeholders and policymakers to develop policies to reduce garbage production at the source and promote sustainable MSW management practices.
- The methodology used in this study can be replicated in other urban areas with similar MSW challenges.

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