

ACRS 2025 Enhancing Flood Resilience:

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A GIS-Based Analysis of

1. INTRODUCTION

Flood events in Malaysia have become increasingly frequent and intense, largely driven by climate change and urbanisation. According to the Department of Irrigation and Drainage Malaysia (DID), the country has experienced an average of 50 significant flood events annually over the past decade, with the most catastrophic floods occurring in December 2021, resulting in economic losses estimated at RM1.4 billion.

Many evacuation centres face critical challenges, including inadequate infrastructure and poor site selection. Frequently located in flood-prone areas, these centres often lack the safety specifications required to protect displaced populations effectively during emergencies.





Classify...

This study seeks to assess the geospatial criteria for evacuation centres in Kuantan through a GIS-based multi-criteria analysis. The urgency of this undertaking is underscored by Kuantan's vulnerability, given the large population at risk and the persistent shortcomings in evacuation centres revealed during past flood events.

3. METHODOLOGY

Reclassify

Input raster

Reclassification

49 - 109

Data Preparation

Spatial datasets were gathered from various authoritative sources:

Topographic Data: Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM).

Land Use Data: Extracted from PLANMalaysia datasets.

Hydrological Data: River networks and flood-prone

Hazard Data: Landslide susceptibility zones.

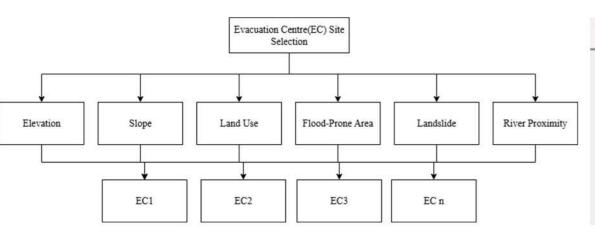
All datasets were projected into the same coordinate system and processed in ArcGIS to ensure consistency.

Analytical Hierarchy Process (AHP)

The AHP was used to assign relative importance (weights) to each criterion.

Final weights:

Elevation (17%), Slope (16%), Land Use (16%), Flood-Prone (16%), Landslide (16%), River Proximity (16%).



Raster	% Influence	Field	Scale Value
Slope_Class0807	16	Value	2
		1	1
		5	5
		7	7
		9	9
		NODATA	NODATA
★ Elevation_Class08	16	Value	2
		1	1
		3	3

Spatial Analysis (Weighted Overlay Analysis - WOA)

All criteria layers were reclassified into a common suitability scale (1-5). Layers were then weighted and combined using Weighted Overlay Analysis (WOA) in ArcGIS.

The result produced a composite suitability map, classifying areas into five categories: Extremely Suitable, Very Suitable, More Suitable, Moderately Suitable, and Less Suitable.

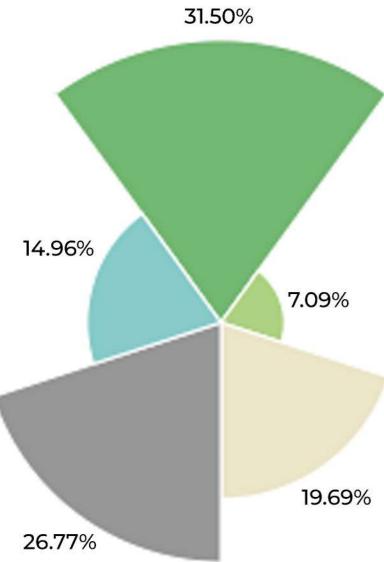
Validation and Interpretation

The location of 127 existing evacuation centres in Kuantan was overlaid on the suitability map.

Each EC was evaluated based on its suitability class, providing a quantitative measure of current planning effectiveness.

Findings were interpreted to highlight vulnerable ECs and propose priority areas for improvement or relocation.

4. RESULTS & DISCUSSION



and AHP produced a comprehensive EC Suitability Map for Kuantan District. The map categorised areas into five suitability classes: Less Suitable, Moderately Suitable, More Suitable, Very Suitable, and Extremely Suitable.

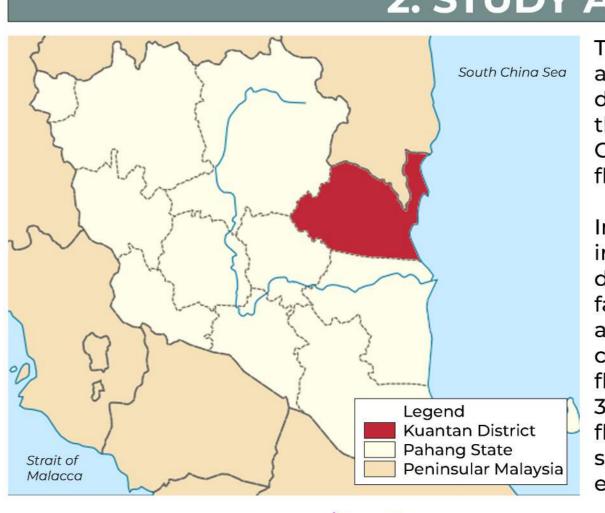
The GIS-based Multi-Criteria Evaluation (MCE)

An overlay analysis of the 127 existing evacuation centres revealed notable spatial disparities in suitability. Approximately 31.50% of ECs were located in Less Suitable zones, 7.09% in Moderately Suitable, 19.69% in More Suitable, 26.77% in Very Suitable, and only 14.96% in Extremely Suitable areas.

Further spatial examination demonstrated that distance from rivers alone does not guarantee safety, as several ECs located over 400 meters away from rivers still fall within flood-prone areas. This finding highlights the complex nature of flood dynamics and the importance of integrating multiple spatial parameters, such as elevation, slope, and hazard zones, into site selection decisions.

The results affirm that elevation and flood-prone areas are the most influential factors in determining EC suitability, followed by land use and slope. Areas with higher elevation and moderate slope tend to show greater suitability for evacuation infrastructure.

2. STUDY AREA



The Kuantan District in Pahang was chosen as the focus of this study because it is designated as a high-risk flood area under the National Physical Plan 3, with Kuantan City identified as particularly vulnerable to flooding.

In addition, the Kuantan Local Plan 2035 indicates that most residential zones in the district are prone to flood hazards. These factors emphasize the urgent need to assess the suitability of existing evacuation centres to strengthen the region's overall flood resilience, where approximately 355,140 residents are exposed to recurrent flooding and are frequently compelled to seek refuge in evacuation centres during each monsoon season.

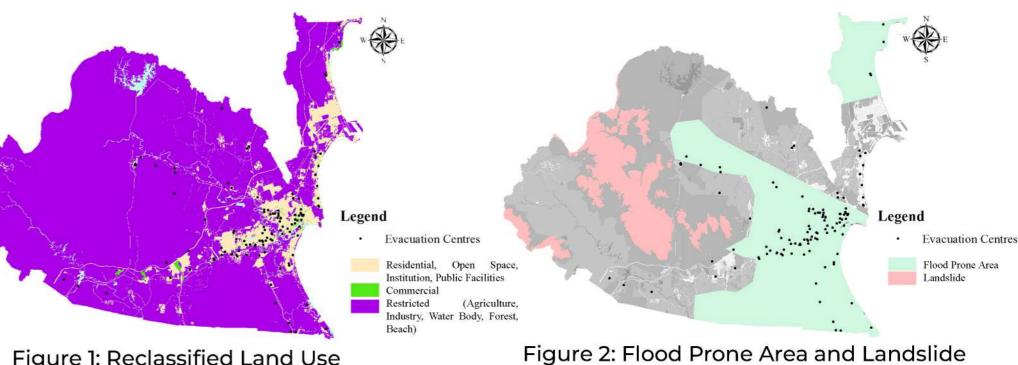
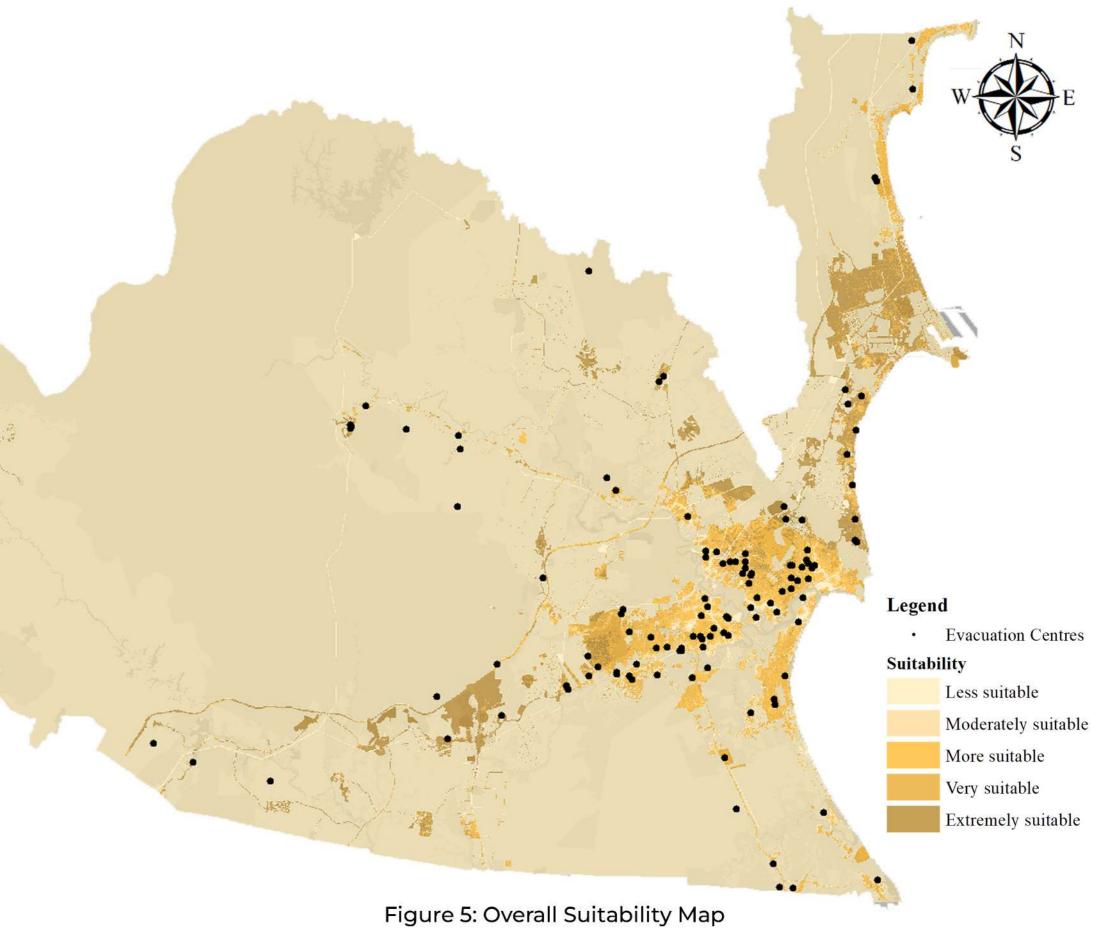


Figure 1: Reclassified Land Use Legend Evacuation Centre Figure 3: Elevation Figure 4: Slope

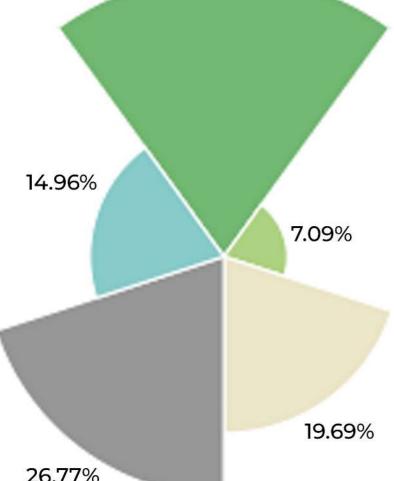


5. CONCLUSION

This study highlights the effectiveness of integrating GIS and AHP in assessing the suitability of ECs within flood-prone areas. The findings reveal that nearly one-third of existing ECs in Kuantan are located in less suitable zones, emphasizing the need for better spatial planning. The generated suitability map serves as a valuable tool for guiding resilient urban development and disaster preparedness. Overall, the GIS-AHP framework supports data-driven decision-making and aligns with SDG 11 (Sustainable Cities) and SDG 13 (Climate Action).

6. ACKNOWLEDGEMENT

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- Less Suitable
 Moderately Suitable
- More Suitable Very Suitable
- Extremely Suitable