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GIS-Based Approach to Identify High Risk Zones for Floods and Evacuation Centres

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Abstract

Urban areas are vulnerable to both natural and man-made disasters, which can put the lives of the population at risk. In order to protect them, an effective evacuation plan must be in place. This research study proposes a GIS-based system that utilizes a multi-criteria analysis method to identify safe areas for evacuees and determine the best evacuation routes from the disaster site to the designated safe areas. The aim is to minimize the time required for the evacuation process to be completed. Jaffna is one of the areas that suffer from seasonal flood disaster annually. The suitability of evacuation centres can be determined based on several criteria such as Elevation, LULC pattern, distance from road, distance from water bodies, slope and rainfall. The aim of the study was to identify suitable evacuation centres after calculating required resources for all evacuees, create short and safe routes for navigation in a disaster situation. ArcGIS Pro main software was used for final route analysis along with network analysis tools and ArcMap package was used for all layer creation and multi-criteria analysis. Multi-criteria evaluation method was chosen to analyse the suitable areas and Analytical hierarchical process was used to assign the weights for each primary criterion. Those are providing suitable evacuation centres with 80% validity and found the route risk zones to evacuation centres. The weights for primary criteria were assigned by using pairwise comparison matrices. All these layers were overlapped according to their weights and final suitable weighted overlay map was prepared and it was reclassified as 1, 2, 3, 4 and 5 where 1 is less rating and 5 is high rating. More suitable locations were found as the best evacuation centres. Closest evacuation shelter area from all flood hazard regions were identified by using closet facilities under the network Analysis. Hazard residents was taken as incidents and evacuation buildings Points are chosen for facilities. Nearest evacuation shelter facility for a hazard area was identified by analysing the attribute table of routes in closet facilities. The result of the study suggests a number of disaster management processes for the administration and general public.

Keywords: Flood, Risk, GIS, Analytical hierarchical process, Disaster management