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Selection of Suitable Landfill Site in Colombo District, Sri Lanka using Geographical Information Systems (GIS) based Multi-Criteria Decision Analysis (MCDA)

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Abstract

With urbanization, waste disposal has become an emerging problem in the modern world. Therefore, landfill sites have become a popular solution for this. Disposal of urban waste was a serious problem in the Colombo district, Sri Lanka, and it led to catastrophic events like the *Meethotamulla* garbage landslide. Landfill site selection is a complex task, and many different factors need to be considered. Therefore, the use of Geographical Information Systems (GIS) emerged as a powerful method for the selection of suitable landfill sites. This study aims to identify suitable landfill sites in the Colombo district using GIS with Multi-Criteria Decision Analysis (MCDA). The whole Colombo district was selected as the study area. In this study, road network, river network, soil type, and proximity to towns were considered as the main criteria. Each layer was assigned equal weight using the Analytical Hierarchy Process (AHP) to ensure efficiency and well-balanced weightage of the factors influencing the suitability of the site. The weighted overlay analysis was applied to combine the spatial data, and the generated suitability map was categorized into four classes: restricted, least suitable, suitable, and most suitable areas using ArcGIS 10.8. The results of the analysis reported that a total area of 362 km² of the Colombo district was restricted for landfill use, because of its proximity to sensitive locations such as water bodies and densely populated areas. Only 1 km² was identified as the least suitable area and it suggests that minimal potential in this category. The suitability map identified that 179 km² was suitable for landfill dumping, while 122 km² area was determined to be the most suitable. These most suitable areas are the areas that provide the best combination of access to road and transportation networks, adequate distance from water bodies and towns, and favorable soil conditions for sustainable landfill development. This study efficiently demonstrates the effectiveness of using MCDA in GIS for landfill site selection, providing a good approach to balancing environmental, social, and economic aspects. The results of this study will be important for policymakers and urban planners in the Colombo district in selecting potential locations for sustainable waste management to reduce the environmental impact of improper landfill site selection. Future research could be expanded by adding additional factors, such as geology and rainfall factors, etc.

Keywords: *Landfill site selection, GIS, MCDA, Colombo district, Waste management*