

# Research Notes

## Climate Influence on Municipal Solid Waste Disposal Sites in Selangor, Malaysia

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Landfills endangered by climate-related hazards can have adverse effects on the public and on natural resources. Exposure of local landfills to such hazards is still not well studied in Malaysia. Selangor generates the largest amount of municipal solid waste per capita in the country, and has numerous landfills. This study evaluates the exposure and susceptibility of municipal solid waste disposal sites in this state to hazards such as slope failure, floods, and coastal erosion. It also recommends adaptation measures to address the threat of such hazards. The exposure pathways and implications on the community and its environment has been investigated through a case study. Methods employed in the study include exposure and susceptibility evaluation through desktop screening, field investigation as well as impact assessment using the source-pathway-receptor-consequence approach. Exposure screening of 21 historic and operating landfills in Selangor reveals that there are six landfills currently exposed to floods, two to slope failure and two to coastal erosion. Field investigation indicates that the inherent features of the exposed landfills make them vulnerable to the hazards. The case study of Panchang Bedena shows potential for high pollutant release from the landfill through inundation and erosion, and consequently, widespread impact on the community and its environment. The study recommends a revision in the "Guidelines on the Design and Conservation of Environmentally Sensitive Areas (KSAS) for Former and Solid Waste Disposal Sites" to include these types of hazards in order to reduce future risks. It is recommended that Selangor adopt Act 672 to streamline the management of municipal solid waste in a more sustainable way. The review of existing land-use plans in Selangor should also take this aspect into account. In addition, communities located near landfills should be made aware of these potential hazards so that appropriate emergency measures can be put into place to enhance their resilience to disasters.

## Spatial Modeling in Slope Failure in Pulau Pinang, Malaysia

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Over the years, the number of hill-side projects has increased in Pulau Pinang. This has contributed to a higher incidence of landslides which has, in turn, resulted in environmental and socioeconomic challenges. Slope failure has become a serious threat, accelerated by rapid development of hilly areas, highway construction, mining activities and river bank instability. The project studied problems related to extensive development of hilly terrain. Factors related to slope failure include increased rainfall, rising river levels, topography, slope angles and soil type, among others. Solutions lie in slope monitoring and planning. Currently, forward planning is being implemented to avoid development in hazardous areas. Slope failure modeling can help planners and developers determine safe locations to develop. Spatial modeling of slope failure is important in reducing unnecessary disasters. The combined efforts of experts in academia, engineering and planning can help cut down the risk of deaths due to such disasters.

## Climate Change and Floods in the Klang River Basin

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The Klang River Basin is located in the State of Selangor Darul Ehsan and Federal Territory of Kuala Lumpur. The total stream length is approximately 120 km with a catchment area of about 1,288 km<sup>2</sup>. The estimated population of the basin is about 3.6 million, representing 21% of the national population and the growth rate is almost 5% per year. Continuous development and increasing population have contributed to the exploitation of flood prone areas and narrowing of certain stretches of the river. These actions have exposed the basin to floods, especially after a heavy rain. Structural measures to mitigate flooding include two dams on the upstream of Klang River, namely Batu Dam and Klang Gates Dam, the Stormwater Management and Road Tunnel (SMART) and several retention ponds including the Batu-Jinjang Ponds for flood diversion. Flood hazard maps are also used as a tool for flood risk assessment and disaster preparation. There are several studies linking climate change and floods in the Klang River Basin. In one such study, statistical downscaling was used to project the probable variability in rainfall characteristics for an observed period (1975-2001) and compared to three future projections under climate scenarios for the periods 2020s, 2050s and 2080s. The study was conducted at the Kampung Sungai Tua station, in the upper part of the Klang River Basin. The findings indicate that climate change will likely result in increased intensity and frequency of rainfall events, as reported in other similar studies. Therefore, there is a need to update the flood hazard map more frequently to accommodate changes in climate as urbanisation proceeds in the basin.