UNIVERSITI TEKNOLOGI MARA

LANDSLIDE SUSCEPTIBILITY MAPPING INCORPORATE CLIMATE PARAMETERS: A CASE STUDY IN SELAYANG, SELANGOR, MALAYSIA

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ABSTRACT

This study evaluates landslide susceptibility in response to climatic dynamics within Selayang, Selangor, a rapidly urbanizing sector of the Klang Valley increasingly affected by slope instability due to intensified rainfall and rising temperatures. Utilizing an integrated approach of geospatial analysis, remote sensing, and statistical modelling, the study investigates the interaction between independent climate parameters (rainfall and temperature) and dependent geospatial parameters (elevation, slope angle, aspect, curvature, lithology, soil type, land use/land cover, and normalized difference vegetation index) to identify and classify zones susceptible to landslides. High-resolution elevation data were collected via Unmanned Aerial Vehicles (UAVs) equipped with Light Detection and Ranging (LiDAR), producing Digital Terrain Models (DTMs) with a 3-meter spatial resolution. Vegetation health and land cover data were derived from Sentinel-2A imagery at 20-meter resolution. Multivariate regression was applied to examine the correlation strength between parameters, revealing R^2 values ranging from 0.26 to 0.96, with rainfall exhibiting the strongest correlation. A sum ranking technique was used to normalize the influence of each parameter, indicating land use as the most influential factor (normalized weight = 0.25), and curvature as the least (0.036). The Frequency Ratio (FR) model further quantified susceptibility, where commercial/industrial/infrastructure of land use classes recorded the highest FR value of 9.44, while high NDVI showed the lowest at 0.21. The resulting Landslide Susceptibility Index (LSI) categorized the study area into five zones very low to very high susceptibility highlighting steep, urbanized terrain near Batu Dam and the Sg. Batu Water Treatment Plant as high-risk zones. Model validation using landslide inventory data yielded an AUC-SRC of 0.72 and a PRC of 0.56, suggesting moderate predictive performance, possibly affected by limited ground truth sampling. This study demonstrates the effectiveness of integrating LiDAR-based terrain modelling, multispectral satellite data, and spatial statistics within a GIS environment to produce a reliable and scalable framework for landslide risk assessment. The findings provide critical insights for urban planners, infrastructure authorities, and disaster risk agencies in formulating slope hazard mitigation and climate-adaptive development strategies. Moreover, this study supports the objectives of United Nations Sustainable Development Goal 13 (Climate Action), offering a transferable geospatial methodology for managing slope-related hazards under evolving climate conditions.

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CHAPTER 1
INTRODUCTION

1.1 Research Background

Climate change has emerged as one of the most pressing global challenges of the 21st century, with far-reaching consequences for the natural environment, ecosystem and human societies. According to recent survey made by Iseas et al. (2019) revealed that climate change ranks third among the top security concerns (51.6%) after domestic political instability (53.7%) and ethnic and religious tensions (52.9%)'. Additionally, in terms of awareness and concern among Malaysian citizens about this issue, the country is ranked fifth at 47.3%. This positions Malaysia behind Vietnam (62.9%), the Philippines (62.2%), Laos (62.1%), and Singapore (61.7%), (Hasnan, 2019) as depicted in Figure 1.1.

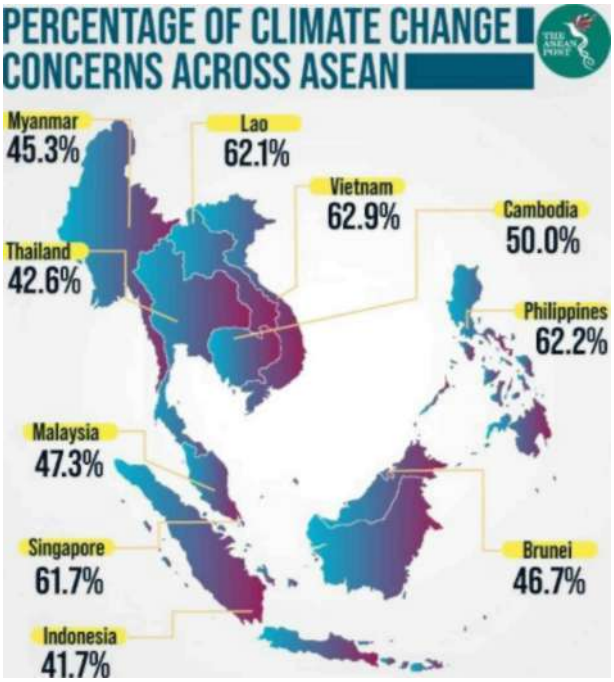

Figure 1.1 Climate change awareness and concerns across Asean (Iseas et al., 2019)