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Spatiotemporal Variability of Landslides as a Consequence of Land Cover Changes: A Case Study from Kegalle District

Perera C.^{1*}, Gimhani K.¹, Gunaratne C.², Kuruppuarachchi P.³

¹*Department of Regional Science and Planning, Sanasa Campus, Hettimulla, Sri Lanka*

²*HEI SL Cell, Sanasa Campus, Hettimulla, Sri Lanka*

³*Faculty of Management and Finance, Sanasa campus, Hettimulla, Sri Lanka*

**chinssu@gmail.com*

Abstract

Landslides are the results of the complex spatial-temporal interaction of various landslide causative factors such as rainfall distribution, geology, hydrology, geomorphology, and land cover type. However, among the landslide causative factors, land cover change is a highly dynamic factor. According to National Building Research Organisation (NBRO) of Sri Lanka, 70% of the landslides in Sri Lanka are human-induced. Humans control most of the land cover changes from home gardens to large extent plantations especially in the Wet zone, Sri Lanka. Including, as many researches claim, the gradual increase in landslides in this region. Therefore, this study is focused to assess the spatiotemporal variability of landslides as a consequence of land cover changes as a case study from Kegalle District. In this study, land cover change was analysed by using multi-temporal satellite images for the year 1988, 1997 and 2017 obtained from Landsat 5, Landsat 8 respectively. Satellite images were classified into forest, croplands/irrigated, mosaic croplands/vegetation, and artificial areas to extract the conversion of thick vegetation to thin vegetation using supervised classification method. Statistical analysis of landslide frequency was combined with a Geographic Information System (GIS) to determine the relationship between, landslide frequency and land cover change. Results found that 1,242 km² of thick vegetation gradually decreased to 945 km² from 1988 to 2017 while showing upward trend in landslide frequency. Maximum changes occur in Aranayake (67%) and Ruwanwella (60%) from 1988 to 2017. Kappa statistics shown that, 83% of landslides occurred in areas subjected to convert thick vegetation to thin vegetation. According to Spearman's correlation coefficient, frequency of landslides and land cover change show strong positive correlations ($r=0.7$, $P<0.05$). It can be concluded that land cover change leads to an increase in landslide susceptibility. The results suggest that conscious land management system might contribute to reduction in landslide susceptibility within the area.

Keywords: Land covers change, Landslides, Satellite images