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Application of Geospatial Technology to Urban Tree Risk Assessment for Sustainable Urban Green Space Management: Special Reference to Colombo Municipal Area

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Abstract

Urban trees play a vital role in environmental quality, urban resilience, and human well-being within rapidly growing cities like Colombo, Sri Lanka. However, an increased frequency of urban tree failure, particularly during extreme weather events, indicates the need for an efficient tree risk assessment and management process within urban green spaces. This research intends to fill the gap in the use of geospatial technologies to assess the risk of urban trees in the Colombo Municipal Area. The primary aim is to evaluate and manage urban tree risk in an urban environment utilizing geospatial technology. The specified objectives are to identify and map the location of risky trees, to assess the level of risk and contributory factors, and to develop strategies to improve equity and sustainability relating to urban green space management. Data collection was completed along the examined main roads of the Kurunduwatta and Thimbirigasyaya Grama Niladhari Divisions within the Colombo Municipal Area, purposely sampled based on tree density and activity in the urban area. The methodology used involved mapping the location of trees and canopy characteristics through a combination of observation on the ground, GIS, and LiDAR data. A range of geospatial analysis techniques, including weighted overlay, buffer analysis, hotspot and kernel density mapping, and correlation and regression analysis, were used to assess risk. Risk scoring and indexing techniques were used to rank hazardous trees, along with Multi-Criteria Decision Analysis to identify sustainable urban tree management techniques. The results indicate a high concentration of hazardous trees along examined roadways and around buildings that may pose risks to public safety and infrastructure. The main risk factors were related to tree characteristics, tree defects, and often, various environmental conditions. Overall, there were a total of 75 trees identified as high risk, 29 trees classified as moderate risk, and 19 trees determined to be low risk. The results reveal that an active geospatial framework improves tree risk assessment, enhances public safety, and improves sustainable tree management of urban green space in the Colombo Municipal Area.

Keywords: *Colombo municipal area, Geospatial technology, Spatial analysis, Urban tree risk, Sustainable tree management*

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