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Landslide Inventory Mapping in Densely Populated and Forested Environments using UAV LiDAR Data: A Case Study in Zindisi, Surami District, Georgia

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In the country of Georgia, the administrative territories of Surami (Khashuri municipality, Shida Kartli region) are particularly susceptible to the development of landslide processes. Among these areas, the Zindisi district stands out as a focal point for our research due to the occurrence of a significant landslide process in 2007, which remains active and poses periodic threats to residential houses and infrastructure. Zindisi district is characterized by dense forest cover and a high population density. Conducting a detailed landslide survey in such a challenging terrain using standard methods is difficult. Therefore, our research aims to overcome these challenges by employing lidar technology in a similar environment.

The research initiative commenced with the acquisition of high-density point cloud data utilizing UAV lidar surveys. A UAV (DJI- The Matrix 300 RTK) equipped with a lidar camera (DJI Zenmuse L-1), was deployed to scan the study area. This approach allowed for the capture of detailed topographical information crucial for understanding the landslide processes. The obtained dataset serves as the foundation for creating a precise Digital Elevation Model (DEM) with a spatial resolution of 1 meter. This DEM enabled the identification of landslide boundaries by leveraging lidar-derived high-resolution topographic information. Linear structures were mapped based on hillshade, aspect, slope, and other thematic maps, providing a comprehensive understanding of the terrain.

To validate the accuracy of our results, both aerial photos and on-site field investigations were utilized. The combination of lidar technology, high-resolution topographic data, and thorough validation techniques enhances the reliability of our landslide inventory in the Zindisi district. This research contributes valuable insights for effective land management and mitigation strategies in landslide-prone areas. Furthermore, the approach outlined in this research provides a method for landslide mapping in similar environments and demonstrate the potential of UAV LiDAR technology in enhancing landslide risk management in densely populated and forested regions.