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Debris Flow Risk Mapping Based on Geographic Information Technologies: a case from SW Turkey

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The effective mitigation of risk sourced from mass movements requires systematic approaches. In large mapping scale or single mass movement case risk assessment can be performed based on conventional geotechnical risk assessment methods, either quantitatively or qualitatively However, in medium to large scale mass movement risk assessment, risk zoning is required which is still very difficult. The main reasons are; lack of systematic methods for mapping of hazard, which involves spatial and temporal evaluation of mass movement probability and lack of mapping methods for potential consequences or worth of losses. In this study, a risk assessment method for qualitative zoning of risk is proposed for the debris flow risk in a selected area from the Western Taurid region of Turkey, because the study area is under debris flow threat. The hazard map is prepared by subjective probability assignments of potential debris flow zones in the study region. The potential debris flow zones are obtained by processing aerial photos and field survey data in geographic information system (GIS) framework. Then a thematic hazard map is prepared in GIS with hazard levels of low, medium and high. The second component of risk, which is consequence or worth of loss mapping, is performed by initially identifying the elements at risk in the study region. The region covers two medium scale towns (Uluborlu and Senirkent) and three villages (Yassioren, Ortayazi and Garip), a forested area under protection, which contains endangered trees of Southwestern Turkey, a main road connecting town and villages to the main city of Isparta and an irrigation channel constructed by The State Hydrolic Works (DSI). The boundaries of residential area are obtained by using Google Earth Technology, and RGB true color composite of Landsat ETM

image. The boundary of forested area is extracted by using Normalized Difference Vegetation Index (NDVI) values of Landsat ETM image. The road and the irrigation channel in the study area are also obtained by processing GIS and remote sensing (RS) data. Once the elements at risk are mapped and the hazard map is overlaid by this map to obtain a potential damage map. The potential areas to be affected by any debris flow are identified. Then the percentage of element at risk which could be damaged are obtained and classified as low, medium and high. Finally the resultant risk map is prepared by constructing a risk matrix of hazard levels and potential damage level. The proposed quantitative risk assessment methodology is rather systematic, simple and low cost, which is suitable for early stage of planning. Moreover, although the use of GIS and RS technology in debris flow risk assessment could be costly, this study illustrates effective use of low cost GIS and RS technology for debris flow risk mapping, which could be followed in every developing country for any medium scale planning purpose.