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GIS-based Landslide Risk Analysis in the Havran River Basin (Western Turkey)

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Landslides, defined as the mass movement of rock, debris or earth down a slope, are as one of the major natural hazards, claim people's lives almost every year and cause huge property damage in mountainous areas. Globally, landslides cause approximately 1000 deaths a year with property damage of about US$4 billions. Moreover, landslides pose serious threats to settlements, structures that support transportation, natural resources management and economic activities. They do considerable damage to lifelines and especially to highways, railways, waterways and pipelines. Different methods and techniques have been developed and proposed for evaluating landslide occurrences. A statistical method, which is one of techniques, uses the combinations of factors that have led to landslides in the past. Overlaying of parameters and calculating of landslide densities form the core of the statistical analysis. Geographic Information Systems (GIS) play an important role to produce parameters and analysis of them using overlaying functions.

This study focused on landslide risk analysis at basin scale. For this reason, Havran River Basin was chosen as a case study. The purposes of this study involve development of landslide hazard map indicating landslide prone areas in the basin and using of the hazard map to extract which elements will be affected from probable landslides. To carry out these purposes, topographic maps scaled to 1:25000 and dated year 2000, a 10m Digital Elevation Model (DEM), geological maps scaled to 1:100000, Spot XS images dated year 2005, rainfall data of meteorological stations, soil maps scaled to 1:25000, Landsat ETM+ images dated year 2000, GPS measurements in the field, transportation maps, utilities maps (electricity, telecommunications), settlement areas and agricultural lands of the basin were used. To create landslide hazard map

of the basin, some preparatory factors such as elevation, curvature, geology, slope, aspect, land use/land cover, NDVI, rainfall, lineament, roads and soil data were analysed using statistical index method in GIS. Final hazard map were classified in five classes namely none or extremely low, very low, low, medium and high using minimum distance cluster technique to use in the final risk analysis. Roads, settlement areas, electricity, telecommunication, agricultural lands of the basin were used as inputs to develop vulnerability indicators of the basin. Consequently, landslide risk map of the Havran River basin was created with the combination of the both hazard and vulnerability maps of the basin using GIS technology.

This study reveals that agricultural lands and road network will be more affected from probable landslides in the area depending on their distribution. For landslide risk analysis at a basin, medium scale is adequate to get satisfactory results. In addition, GIS technology is of a great help in analysing of the landslide risk with supporting efficient and effective the large amount of data capture, storage, management, retrieval, analysis, integration and displaying.