Landslide hazard assessment and causal factor analysis in Chania Prefecture, Crete Island, Greece

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Crete Island in Greece is characterized by complicated geological structure with intensive tectonic fragmentation. Although Chania Prefecture of Crete Island suffers from severe landslide phenomena because of its geological and geomorphological setting coupled with intensive human activities, a complete landslide hazard zonation study lacks. The main landslide triggering factors are considered to be the geology, the fluvial erosion, the intense rainfalls and the human activities (e.g. excavations, loading). In this study we present landslide susceptibility analysis in the whole extent of Chania Prefecture using several approaches. Firstly, a landslide inventory map of more than 100 landslide locations was created using data coming up from field investigation, documented events and Google Earth satellite images interpretation. Geological, topographical, vegetation, precipitation, and satellite data were collected, processed and introduced in a Geographic Information System. Many terrain attributes such as slope angle, aspect, relative relief, and stream network were computed using the digital elevation model of the study area. The following landlside occurrence factors were finally selected: geological formations, slope, aspect, curvature, precipitation, distance to faults, distance to roads, distance to rivers, land use type, normalized difference vegetation index (ndvi). At a first step, a relative weighting – rating approach was used for landslide hazard zonation and the landslide inventory map was used for validation reasons. Furthermore, multiple regression analysis between the depended (landslide occurrence) and the independed parameters was applied revealing slope angle, land use and road network as the major causal factors of landslide phenomena in the area. Finally a network analysis approach was applied using the 80% of the inventory map landslides as the training set and the rest 20% for accuracy assessment purposes. The final results showed that the western part of Chania Prefecture is of high landslide hazard with the most hazardous zones to be proximal to the main road network which connects the northern Chania Prefecture areas with the southern touristic destinations. This fact indicates that the exposure factor is high mainly during the summer periods and a careful attention of the Prefecture authorities needs to be paid.