Application of fuzzy logic and analytical hierarchy process (AHP) to landslide susceptibility mapping at Haraz watershed, Iran

ABSTRACT

The main goal of this study is to produce landslide susceptibility maps of a landslide-prone area (Haraz) in Iran by using both fuzzy logic and analytical hierarchy process (AHP) models. At first, landslide locations were identified by aerial photographs and field surveys, and a total of 78 landslides were mapped from various sources. Then, the landslide inventory was randomly split into a training dataset 70 % (55 landslides) for training the models and the remaining 30 % (23 landslides) was used for validation purpose. Twelve data layers, as the landslide conditioning factors, are exploited to detect the most susceptible areas. These factors are slope degree, aspect, plan curvature, altitude, lithology, land use, distance from rivers, distance from roads, distance from faults, stream power index, slope length, and topographic wetness index. Subsequently, landslide susceptibility maps were produced using fuzzy logic and AHP models. For verification, receiver operating characteristics curve and area under the curve approaches were used. The verification results showed that the fuzzy logic model (89.7 %) performed better than AHP (81.1 %) model for the study area. The produced susceptibility maps can be used for general land use planning and hazard mitigation purpose.

Keyword: Landslide; Susceptibility mapping; Fuzzy logic; AHP; GIS; Haraz; Remote sensing; Iran