

Flood Risk Assessment Using Multi-Criteria Decision Making Based on Dempster-Shafer Intuitive Reasoning (Case Study: Nekarood Basin)

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Received: 12/02/2017

Accepted: 10/12/2017

Extended Abstract

Introduction

Among the natural disasters, flooding can cause heavy losses on the agriculture, fishery, housing and infrastructures. It strongly affects the economic and social activities. The use of modern science, especially remote sensing and GIS techniques helps the planners to assess the risk map of natural hazards such as floods for a region in the least possible time. Multi-Criteria Decision Analysis (MCDA) provides methods and techniques to analyze complex decision problems which often includes non-comparable data and metrics. Nekarood watershed with its special properties is prone to serious and devastating floods. The aim of this study is to assess the risk map of flooding in Nekarood Basin using multi-criteria decision and based on intuitive reasoning.

Materials and Methods

According to the expert opinion, the two sets of effective criteria on flood risk and vulnerability has been used for the study area. Hydro-climatologic, topographic, land cover and geological factors as effective criteria on flood risk and population density are evaluated by remote sensing techniques in this study area. Primary data used in this study are digital elevation model, Satellite images of LANDSAT 8 for different months of 2016 to 2014 to provide vegetation maps, land use map, geological map, iso-rain, road network and waterways network, demographic statistics and information related to agriculture lands and gardens. To evaluate uncertainties in the expert's opinions about the importance of different criteria on flood risk, we used intuitive reasoning theory and Dempster-Shafer model. Then, we have made flood risk map by using the multi-criteria decision method. Using the mean and standard deviation, risk map was normalized for the study area and was classified into five classes; very low, low, medium, high and very high. Finally, the state of sub-basins and land uses was assessed, compared and analyzed in terms of risk.

Results and Discussion

The results show that topographic factors and population density have the highest degree of

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importance on risk and vulnerability. To prepare flood risk map for the study area, the number 0.701 was considered for weight of risk factors and 0.299 for vulnerability weight. The results of the different risk classes show that downstream sub-basin of Neka watershed contains the high and very high risk classes and upstream Neka include the lowest area of high and very high risk classes. Generally, 87 percent of high and very high-risk areas are in downstream sub-basin of Neka. For dense forest, poor forest and rangeland, the area of low and very low risk classes is greater than that of high and very high risk classes. However, in agriculture land uses the area proportion of high and very high risk classes are more than that of low and very low risk classes. Results indicate that 59% of the land use of Nekarood watershed is located in high and very high risk classes. Neka city is located in very high risk class while 90% of Neka city is located in high and very high classes. Nekarood River, with a considerable amount of water discharge, passes through the city of Neka. The river is flowing through mountainous channel, steep slopes and high altitude areas. This volume of water is flowing across Neka city through a single channel and finally discharges into the Caspian Sea. Since this channel has limited capacity during flood time, the flow submerges the channel banks and consequently leads to dangerous floods.

Conclusion

The results indicate that the use of new technologies such as remote sensing and GIS for mapping natural disasters such as flood risk is very efficient and useful. It was revealed that using multi-criteria decision making based on intuitive reasoning is very useful to assess flood risk of Nekarood watershed. The use of this model is possible by using many criteria, the degree of hazard, vulnerability and risk for the study area. Neka city due to its particular position has very high potential for flood risk and vulnerability. The results indicate the necessity that the managers and planners have to pay special attention in various agencies to flooding.

Keywords: *risk, flood, multi-criteria decision, intuitive reasoning, Nekarood.*