

Detection of Flood Prone Areas Using Multi Criteria Evaluation, Geographical Information Systems and Fuzzy Logic. The Ardas Basin Case

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Abstract : The severity of extreme phenomena is due to their ability to cause severe damage in a small amount of time. It has been observed that floods affect the greatest number of people and induce the biggest damage when compared to the total of annual natural disasters. The detection of potential flood-prone areas constitutes one of the fundamental components of the European Natural Disaster Management Policy, directly connected to the European Directive 2007/60. The aim of the present paper is to develop a new methodology that combines geographical information, fuzzy logic and multi-criteria evaluation methods so that the most vulnerable areas are defined. Therefore, ten factors related to geophysical, morphological, climatological/meteorological and hydrological characteristics of the basin were selected. Afterwards, two models were created to detect the areas prone to flooding. The first model defined the gravitas of each factor using Analytical Hierarchy Process (AHP) and the final map of possible flood spots were created using GIS and Boolean Algebra. The second model made use of the fuzzy logic and GIS combination and a respective map was created. The application area of the aforementioned methodologies was in Ardas basin due to the frequent and important floods that have taken place these last years. Then, the results were compared to the already observed floods. The result analysis shows that both models can detect with great precision possible flood spots. As the fuzzy logic model is less time-consuming, it is considered the ideal model to apply to other areas. The said results are capable of contributing to the delineation of high risk areas and to the creation of successful management plans dealing with floods.

Keywords : analytical hierarchy process, flood prone areas, fuzzy logic, geographic information system

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