A GIS-Based Multicriteria Analysis in Modeling Optimum Sites for Rainwater Harvesting

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Abstract

In order to select suitable rainwater harvesting sites within the study area, rainwater harvesting criteria needed to be determined, defined, and structured. Several criteria played an important role in selecting the most suitable rainwater harvesting sites. A multicriteria analysis (MCA) approach, which is widely used to classify potential rainwater harvesting sites, was chosen to help select potential sites in the Wadi Horan region of Iraq. An MCA approach offered a systematic methodology focused on mathematics as well as professional expertise to organize and evaluate complex decisions. Unfortunately, there is no method for choosing among them the most appropriate for a given decision problem, as the choice remains a subjective task. This study used a geographic information system (GIS)-based approach with remote sensing to identify the optimal sites for rainwater harvesting. Four indices: evaporation, cost–benefit, sediment, and hydrology were selected in order to compare the potential sites. The analytic hierarchy process (AHP), fuzzy AHP, and rank order method (ROM) were used to assign weight to the study criteria. The results were then compared using a statistical (variance inverse (VI)) method. A sensitivity analysis was done to test the uncertainties and robustness of the results for each method. The results showed that the ROM and VI methods affected the ranking priority and considered all of the criteria that were sensitive to impact in the ranking process at the different levels compared to the methods of AHP and fuzzy AHP