



Groundwater vulnerability assessment using an integrated DRASTIC model using frequency ratio and analytic hierarchy process in GIS

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Groundwater contamination is becoming a major environmental problem in South Korea with the marked expansion of the industrial base and the explosive growth of the population. Even in rural areas, the increased use of fertilizers and pesticides, the presence of acid-mine drainage, and increase of volumes of domestic waste waters are adding to groundwater pollution. The evaluation of the possibility for groundwater contamination is a very important step to develop the water resources. This study was aimed to analyze groundwater vulnerability using an integrated DRASTIC model with a frequency ratio (FR) and an analytic hierarchy process (AHP). The FR was used for DRASTIC model rates, whereas AHP was used for DRASTIC weights. The FR-DRASTIC, and FR-AHP models were developed and applied to evaluate groundwater vulnerability in South Korea. In addition, nitrate samples from the same month in different years were used to validate the suitability and reliability of the models. Based on these data, Pearson's correlation factors among the resultant vulnerability maps were analyzed to select the best vulnerability maps regarding the study area conditions. The original DRASTIC vulnerability correlation was 0.42. After optimization, correlations for the FR-DRASTIC and FR-AHP models were 0.72, and 0.81, respectively. The validation results indicated that using FR approach improved the correlation between vulnerability index and nitrate concentration compared with original DRASTIC vulnerability correlation. The groundwater vulnerability mapping for nitrate can be helpful for better management of groundwater resources in the study area. In addition, these results may give planners and decision makers an opportunity to prepare appropriate groundwater investment plans for sustainable environment.