CIVIL ENGINEERING

Evaluation of vulnerability of aquifers by improved fuzzy drastic method: Case study: Aastane Kochesfahan plain in Iran

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Abstract In this study the vulnerability of aquifer is investigated by fuzziness of the different layers. The vulnerable potential of different location within the basin by most accuracy was traced. In this method by the use of max lambda the weights of parameters were become fuzzy and quantity weights parameters has been fuzzy by the use of membership function. The quality weights were done by the discrete functions became fuzzy. The final map showed that some parts of north and northeast parts of the aquifer were most vulnerable locations. The correlation coefficient of vulnerability and nitrate concentration by standard method was estimated 49 percent and in the fuzzy method 53 percent that showed fuzzy method is more realistic. In FAHP method 13.87% of the plain area was by the low vulnerability, 11.96% by low to moderate vulnerability, 41.24% by moderate to high vulnerability, and 32.92% by high vulnerability.

1. Introduction

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Peer review under responsibility of Ain Shams University.

Vulnerability of an aquifer is known as easily getting of pollutant material from the soil surface to them [1]. In another words the vulnerability of an aquifer, is its absorption potential of it against pollutant. There are various methods of evaluation of vulnerability of aquifers classified into 3 categories such as Description, Statistic and panel data's. The most important and usual methods of ranking are as follows: GOD, IRISH, AVI, DRASTIC [2–5], and the most practical and popular method among them is DRASTIC model, since
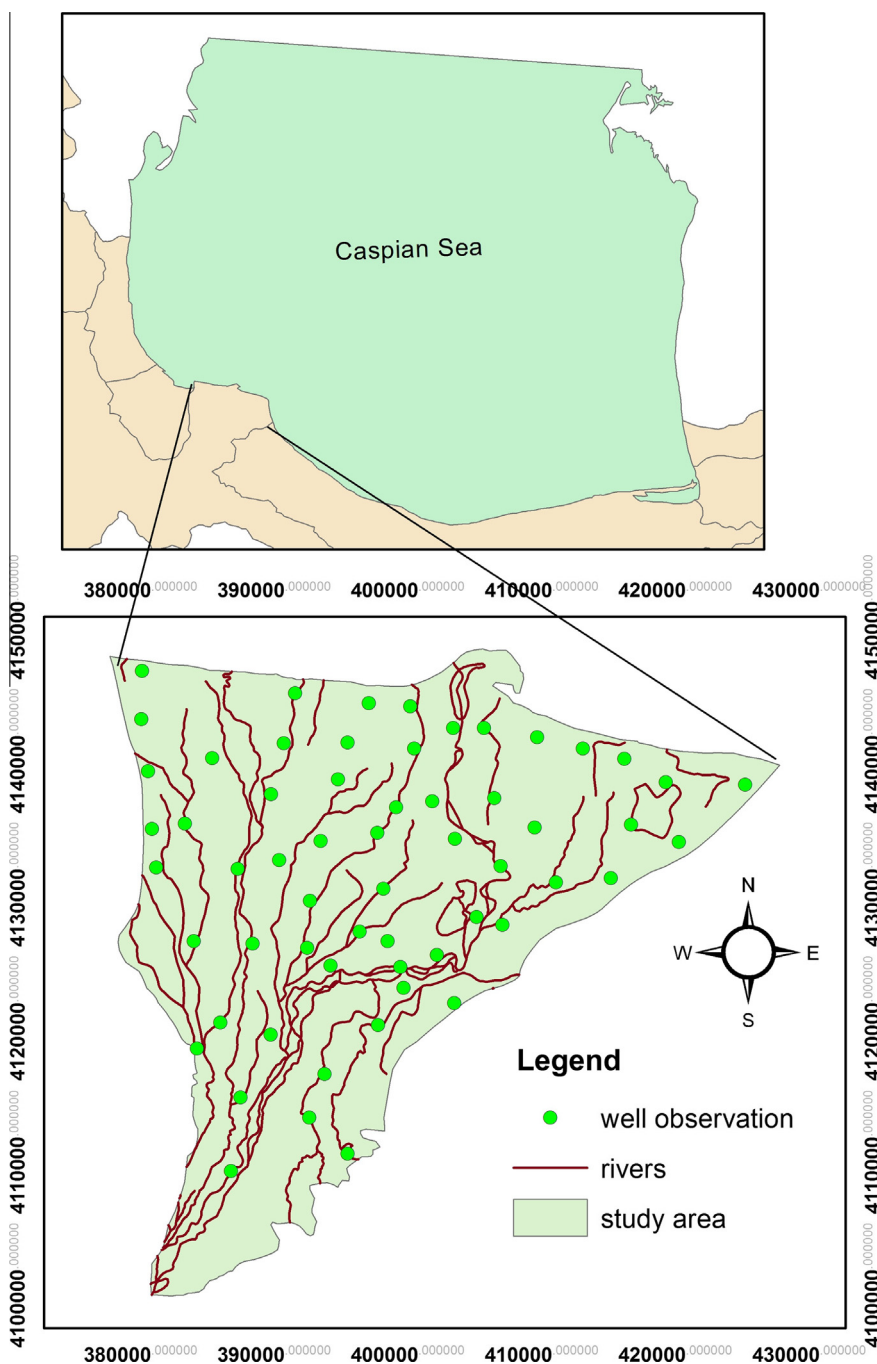
Figure 1 The situation of Astanea-Kochesfahan plain.

the expenditure of its application is less and low information data were required for vulnerable location in the vast areas [5]. This method has very usage in various regions, but contains some limitations such as assuming a constant range and weight of parameters for each regions. To resolve this problem, the AHP method was used, but this method is recommended to apply in unfuzzy or crisp decision making, that unbalances scales of judges and also does not consider the uncertainties in the process in this model [6]. The modeling of these uncertainties in the FAHP is the ultimate method. To overcome the limitations of AHP methods Wenlarhon

and Pedris applied fuzzy logics in analysis of hierarchal processes [7]. FAHP is as strong method in multi-objection decision making.

The application of the Analytical Hierarchy Process (AHP) has been involved in many fields, i.e. Sensitive Analysis of Optimized Infiltration Parameters in SWDC model [24], Optimize of all Effective Infiltration Parameters in Furrow Irrigation Using Visual Basic and Genetic Algorithm Programming [25], fuel blend in fish oil biodiesel for the IC engineering [8], resource allocation [9], alternative waste treatment policies [10], talent promotion [11], human migration