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## A GIS-based DRASTIC model for assessing aquifer vulnerability in Kakamigahara Heights, Gifu Prefecture, central Japan

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### Abstract

Vulnerability assessment to delineate areas that are more susceptible to contamination from anthropogenic sources has become an important element for sensible resource management and land use planning. This contribution aims at estimating aquifer vulnerability by applying the DRASTIC model as well as utilizing sensitivity analyses to evaluate the relative importance of the model parameters for aquifer vulnerability in Kakamigahara Heights, Gifu Prefecture central Japan. An additional objective is to demonstrate the combined use of the DRASTIC and geographical information system (GIS) as an effective method for groundwater pollution risk assessment. The DRASTIC model uses seven environmental parameters (**D**epth to water, **R**echarge, **A**quifer media, **S**oil media, **T**opography, **I**mpact of vadose zone, and **C**onductivity) to characterize the hydrogeological setting and evaluate aquifer vulnerability. The western part of the Kakamigahara aquifer was dominated by “High” vulnerability classes while the eastern part was characterized by “Moderate” vulnerability classes. The elevated north-eastern part of the study area displayed “Low” aquifer vulnerability. The integrated vulnerability map shows the high risk imposed on the eastern part of the Kakamigahara aquifer due to the high pollution potential of intensive vegetable cultivation. The more vulnerable western part of the aquifer is, however, under a lower contamination risk. In Kakamigahara Heights, land use seems to be a better predictor of groundwater contamination by nitrate. Net recharge parameter inflicted the largest impact on the intrinsic vulnerability of the aquifer followed by soil media, topography, vadose zone media, and hydraulic conductivity. Sensitivity analyses indicated that the removal of net recharge, soil media and topography causes large variation in vulnerability index. Moreover, net recharge and hydraulic conductivity were found to be more effective in assessing aquifer vulnerability than assumed by the DRASTIC model. The GIS technique has provided efficient environment for analyses and high capabilities of handling large spatial data.

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