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Title: A GIS-based comparison of neural networks and neuro-fuzzy models to predict ground water vulnerability

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Abstract

There is a need to develop new modeling techniques that assess ground water vulnerability with less expensive data that are robust when data are uncertain and incomplete. Integrated system of GPS, Geographic Information Systems, remote sensing, neutral networks (NN), fuzzy logic and uncertainty analysis could provide a frame work from which assessment of non-point source pollution can be made in two-three-four dimension and results can be seen in spatial context. The specific objective of this study was to develop models using Neuro-fuzzy (NF) and NN techniques in a GIS to predict ground water vulnerability. NF modeling is an approach where the fusion of NN and Fuzzy Logic find their greatest strengths. The vulnerability models were developed using plausible parameters such as: depth to ground water, recharge of ground water, thickness of the claycap, soil hydrologic group, soil structure, bulk density and landuse. The models were validated using a set of coincidence reports generated between vulnerability maps and well water quality data (pesticides) collected at 55 wells. Use of NF model reduced the preprocessing time usually required by a fuzzy rule based system. Integration of GIS to NF model was straightforward, compared to the integration of NN model. Limitations of file size of the NN software used in the project made the GIS integration a time consuming process.