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# SUSTAINABLE RURAL DEVELOPMENT BASED ON GROUNDWATER QUALITY USING FUZZY LOGIC AND GIS. A CASE STUDY: MAKU, IRAN

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## Abstract

Sustainable rural development is essential for countries in terms of economic, social and environmental viability. To establish or develop villages or cities, in addition to the availability of enough fresh water, the suitability of water quality is vital. Because groundwater water quality, fluoride, for expansion of the Maku area, Iran, is essential, we prepared a fluoride concentration zoning map. We found suitable locations for developing rural settlements using the fuzzy logic model and GIS. Standard maps, including fluoride concentration, alkalinity, sodium concentration, distance to rivers, groundwater level, lithology, slope, slope direction, altitude, land use, and distance to roads, were used to prepare a vulnerability zoning map and to locate rural settlements based on geomorphological parameters optimally. After preparing and analyzing the information layers in the Arc GIS software, fuzzy membership functions were used. Then, the standardized fuzzy layers were combined with the fuzzy gamma operator in the GIS environment. We achieved a fluoride concentration zoning map and suitable areas for developing rural settlements. The final map obtained from this model was divided into five zones: very poor, poor, fair, good, and excellent suitability settlement sections. The results of this study demonstrate that in the fluoride concentration zoning map, about 79.3% of the area is in the poor and very poor proportion zones. Only about 13.2% of the region is in the excellent and good zones. Moreover, based on the zoning map for detecting suitable locations for developing rural settlements, about 91.1% of the area is in the poor and very poor suitability zones, and about 4.5% of the area is in the zones with excellent and good suitability.

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