Identification of potential natural aquifer recharge sites in anjkora river basin, Pakistan, by integrating GIS and RS techniques

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Pakistan is the 4th biggest groundwater puller in the world. Its annual groundwater withdrawal is assessed at 65 BCM (Billion Cubic Meter), and its yearly sustainable groundwater assets are assessed at 55 BCM. The need for water is mostly fulfilled through groundwater sources, such as water bores and commercial tube wells. Hence, identifying recharge sites for natural aquifers is a significant component of groundwater required to overcome the water crisis. Therefore, this study aims to identify potential sites for natural aquifer recharge by using Multi Influencing Factor (MIF), and fuzzy logic methods. To achieve the stated objective, seven local influencing factors including soil, slope, water table, population density, land use land cover (LULC), drainage density, and elevation have been utilized in this study. MIF was utilized for the evaluation of the relative importance of the above-mentioned factors, while fuzzy logic was applied for the standardization of these factors. Finally, the MIF and fuzzy logic approaches were used to merge factor maps to identify suitable sites for natural aquifer recharge in Panjkora River Basin. Two different suitability maps were constructed from both techniques, and on each of the resulting maps, the subregions were categorized into five classes: not suitable, less suitable, moderate, suitable, and most suitable. Based on the MIF results, 25% of the whole study area is deemed most suitable for natural aquifer recharge (NAR), whereas from the fuzzy logic results, 30% of the study area is marked as most suitable. In contrast, 20% and 32% of the whole study area were identified as suitable by the MIF and fuzzy logic methods, respectively. While both techniques can obtain satisfactory outcomes, the suitability map from fuzzy logic has produced more precise results. The results of the study were recommended to soil and water conservation and agriculture engineering department to construct the recharge wells.

Keywords: Multi influencing factor; Geographic information system; Groundwater; Fuzzy Overlay; Arc GIS