# An Integrated Approach for Potential Natural Aquifer Recharge Sites Demarcation in Panjkora River Basin, Pakistan

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Pakistan ranks fourth globally in terms of groundwater extraction. Its annual sustainable groundwater assets are evaluated at 55 billion cubic meters (BCM), but the groundwater withdrawal (annual) is 65 billion BCM. The majority of the water needed is obtained from groundwater resources, such as commercial tube wells and water bores. Finding natural aquifer recharge sites is therefore essential to provide the groundwater needed to address the water crisis. Therefore, the purpose of this study is to use fuzzy logic and the Multi Influencing Factor (MIF) method to find possible areas for natural aquifer recharging. Seven influencing factors (locally derived) water table, soil, slope, land use land cover (LULC), population density, elevation and drainage density are incorporated in this research in order to meet the stated purpose Fuzzy logic was used to standardize the aforementioned parameters, and maximum important factor (MIF) was employed to assess the components' relative importance. Lastly, factor maps were combined using the MIF and fuzzy logic techniques to identify natural aquifer recharge (NAR) sites in the Panjkora River Basin. Using both approaches, two distinct maps of appropriateness were created, and the maps were divided as: unsuitable, less suitable, moderately suitable, suitable and high suitable. The results indicate that 25% (MIF) and 30% (fuzzy logic) of the entire region is highly suited for natural NAR, while 20% (MIF) and 32% (fuzzy logic) of the study region was found to be suitable. Both the approaches can yield plausible results, nevertheless, the fuzzy logic suitability map has comparatively exhibited more accurate results. The study's findings are helpful to the concerned authorities and departments for planning NAR related campaigns in the study area and beyond.