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Evaluating groundwater resources in Jalalabad: A GIS-based hydrogeological study

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Abstract

One essential resource that makes a substantial contribution to the yearly total water supply is groundwater. It enables agricultural irrigation and provides billions of people with their main source of drinking water. But overuse of groundwater has decreased its supply and, in certain places, resulted in soil subsidence. Evaluating groundwater potential is crucial for the sustainable management of water resources, particularly in dry and semi-arid regions. This study focuses on groundwater potential in Jalalabad and surrounding areas using Groundwater Potential Sites (GWPS) mapping. Geographic Information System (GIS) techniques were used to study the hydrogeological characteristics (geology, drainage density, rainfall, lineament density, land cover, soil type, and slope). Each parameter was assigned a weight and rating based on how it affected the possibility of groundwater recharge. The GWPS map divides the research region into five zones: very low, low, moderate, high, and very high groundwater potential. To validate the GWPS model, regression analysis was used to examine the relationship between the GWPS index and the measured water table depths in the research area. The results suggest that the GWPS index and the water table depth have a significant inverse relationship ($R^2 = 0.3926$), indicating that locations with higher GWPS indices tend to have shallower water tables. These findings provide insight into the geographical variability of Jalalabad's groundwater resources and provide a valuable tool for groundwater management and planning. It is confirmed by this work that groundwater resource identification and management may be accomplished with success by using GWPS mapping, and it highlights the importance of including many hydrogeological components in the groundwater potential evaluation.

Keywords: Geographic Information System (GIS), groundwater Potential Sites (GWPS), Groundwater Recharge, Hydrogeological Parameters, Regression Analysis, Water Table Depths

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