## Delineation of groundwater potential zones with Analytic Hierarchy Process based geospatial modelling approach in metropolitan expanse

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## ABSTRACT

Groundwater is a vital natural resource that is essential for the survival of humans and ecosystems alike. However, the depletion of the global water table has become a significant cause for concern. Hence, it is imperative that groundwater monitoring is managed in a systematic and sustainable way to ensure its long-term availability. Geospatial mapping is considered one of the most crucial tools in the field of subsurface water studies because it aids in finding, observing, and monitoring water levels in underground reservoirs. The purpose of this study is to classify the potential areas for groundwater use for agricultural development in the metropolitan district of Lahore in Punjab, Pakistan. To delineate groundwater potential areas, ten parameters are used including groundwater depth, geology, lineament density, slope, soil type, rainfall, drainage density, Topographic Wetness Index, land use/land cover and roughness. The weighted overlay technique is used to integrate the selected ten parameters for the delineation of groundwater potential zones. The contribution and influence of each parameter on groundwater recharge are considered, and potential groundwater recharge areas are classified into five classes ranging from very low to very high. Finally, the efficiency of the modeled groundwater potential zones is validated with the *in-situ* groundwater depth data from 40 wells distributed in the study area. The classification of recharge areas into distinct categories provides a useful framework for decision-making, enabling policymakers and stakeholders to prioritize areas for conservation and management based on their potential for groundwater recharge.

*Keywords:* Analytic Hierarchy Process; Groundwater potential zone; Weighted overlay analysis; Geographic Information System; Remote sensing

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