

Title: Future groundwater potential mapping using machine learning algorithms and climate change scenarios in Bangladesh

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Abstract: The aim of the study was to estimate future groundwater potential zones based on machine learning algorithms and climate change scenarios. Fourteen parameters (i.e., curvature, drainage density, slope, roughness, rainfall, temperature, relative humidity, lineament density, land use and land cover, general soil types, geology, geomorphology, topographic position index (TPI), topographic wetness index (TWI)) were used in developing machine learning algorithms. Three machine learning algorithms (i.e., artificial neural network (ANN), logistic model tree (LMT), and logistic regression (LR)) were applied to identify groundwater potential zones. The best-fit model was selected based on the ROC curve. Representative concentration pathways (RCP) of 2.5, 4.5, 6.0, and 8.5 climate scenarios of precipitation were used for modeling future climate change. Finally, future groundwater potential zones were identified for 2025, 2030, 2035, and 2040 based on the best machine learning model and future RCP models. According to findings, ANN shows better accuracy than the other two models (AUC: 0.875). The ANN model predicted that 23.10 percent of the land was in very high groundwater potential zones, whereas 33.50 percent was in extremely high groundwater potential zones. The study forecasts precipitation values under different climate change scenarios (RCP2.6, RCP4.5, RCP6, and RCP8.5) for 2025, 2030, 2035, and 2040 using an ANN model and shows spatial distribution maps for each scenario. Finally, sixteen scenarios were generated for future groundwater potential zones. Government officials may utilize the study's results to inform evidence-based choices on water management and planning at the national level.

Keywords: Groundwater potentiality, Data mining, Ensemble machine learning, Remote sensing, Climate change, Climate sciences, Environmental sciences, Hydrology

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