Evaluation of a Relationship Between Land Use Change and Groundwater Level in Mueang Khon Kaen and Ban Haet Districts, Khon Kaen Province

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The amount of groundwater is changing because of climatic factors and being significantly influenced by human activity. Groundwater levels and budgets can alter because of changes in land use patterns, which is critical for basin management. Khon Kaen is a large city in Northeast Thailand that has recently expanded in urbanization and water resource demands. This study intended to evaluate the relationship between land use and groundwater level changes in Mueang Khon Kaen and Ban Haet Districts, Khon Kaen Province. The groundwater level data from the Department of Groundwater Resources database with a time range from 2005-2020 in eight monitoring wells throughout the study area were statistically examined using a linear regression analysis. As a result, groundwater levels were higher in a relative recharge system in the southeastern part of the study area and relatively lower in the north. Groundwater level (2005–2020) changes in the study area differed in two main regions. The groundwater levels significantly declined in the northern part of the study area with a coefficient of determination (R^2) of 0.85. Groundwater levels in the southern part marginally increased with no significance (R^2 = 0.05). Regarding land use classification, the satellite images throughout the region were retrieved from Landsat 7 and 8 in the years 2005, 2010, 2015, and 2020. The land use practices were classified into five categories: urbanization, forest, agriculture, barren land, and water—which were evaluated by a supervised classification technique using an Object-Based Image Analysis (OBIA) technique. Comparing land use practices between 2005 and 2020 revealed two primary land use practices that have increased in the total area: a 39.49% growth in urbanization and a 36.50% increase in agriculture. Ground truth data and satellite images well verified the land use classifications. The research indicated groundwater depletion as a result of urbanization and industrialization expansion, particularly the increase in industrial water demand in the north part of the study area. Although some urbanization and agricultural practices are spreading in the south, there has been no substantial change in groundwater levels. Groundwater levels in the southern part were dominated by precipitation according to a temporal statistical comparison between groundwater level change and precipitation pattern. This correlation between groundwater level and land use change informs policymakers of the significance of land use regulation for groundwater resource management. In addition, data from groundwater usage surveys is suggested for determining groundwater consumption, which can be related to groundwater level fluctuations in more detail. The research approach can be applied to other regions for the sustainable management of basins.

Keyword: Land use change; Groundwater level; Object -Based Image Analysis; Trend analysis; Khon Kaen