



Application of factor analysis in identification of the relationship between land use and groundwater quality

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Groundwater is abundant and widely used for public consumptions, irrigation, and aquaculture in the Lanyang Plain in northeastern Taiwan. However, it is subject to contaminations by various anthropogenic activities and natural processes. Moreover, overexploitation has led to land subsidence in the eastern costal area of this plain. Therefore, establishing a sound plan for groundwater resource management in the Lanyang Plain is becoming increasingly urgent and is necessary for the safe and sustainable use of groundwater to meet multipurpose requirements. This study aims to present a sound management plan for multi-purpose groundwater utilization in the Lanyang Plain. This plan is developed based on information about the quality and quantity of groundwater and current land use patterns. First, the groundwater quality parameters are spatially mapped and regions where groundwater quality meets the standards for different utilization purposes are geographically determined based on the water quality criteria for drinking, irrigation, and aquaculture. Subsequently, the drawdown index which is defined as the ratio of the actual groundwater utilization rate to the transmissivity is spatially demarcated and low drawdown index regions are geographically visualized. Information about the regions where groundwater quality is suited to the different groundwater utilization purposes and the regions where drawdown index is low is integrated to create a map for the production of a sound management plan for multi-purpose utilization of groundwater in the Lanyang Plain. Comparisons between our created map and current land use information can provide a basis for improving water resource management and land use strategy by prioritizing the regions where new measures need to be adopted such as replacing groundwater withdrawal with a supply of treated surface water to avoid unsafe groundwater or high drawdown index caused by the overexploitation of groundwater resources or where the current land use practices are subject to change.

Keywords: multi-purpose groundwater utilization, kriging, water quality, drawdown index, land use