The Soil and Water Assessment Tool Model to Assess the Impact of Land Use Changes on Groundwater Recharge Potential : A Case Study of the Hat Yai Basin, Songkhla Province

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Songkhla province is located in the Hat Yai basin area, southern Thailand. This area has a densely populated, economic, and industrial center in the southern, resulting in the inflation of water demand for various natures of usage. Therefore, water resource management is essential for the future development of the area, especially groundwater use and groundwater recharge. This study uses the soil and water assessment tool (SWAT) model to assess the impact of land use changes on groundwater recharge potential in the Hat Yai basin and uses land use data from 2000, 2011, and 2018 for the hydrological response units (HRUs) creation. First, we perform the calibration process by using runoff data from three measurement stations in the watershed, X.44, X.90, and X.112 stations. By comparing between the measured runoffs and values from the model simulation, we find that the coefficient of determination (R^2) is acceptable (0.7). The model found that the groundwater recharge potential in Hat Yai basin in 2000, 2011, and 2018 are approximately 283, 244, and 240 millimeters, respectively. These numbers correspond to land use associated with the station locations. By comparing land use change from 2000 to 2011 (12 years) and 2011 to 2018 (8 years), we find that forest area was decreased by ~10% during 2000-2011 and by ~1% during 2011-2018. For residential area, we find that it was increased by ~3% during 2000-2011 and ~1% during 2011-2018. The area decreased in the forest and the area increased in residential area result in reducing groundwater recharge potential by ~8% during 2000-2011 and ~2% during 2011-2018. Land use changes by expanding residential area and diminishing forest areas. In the forest, there are a variety of vegetation species that have root systems to create voids promoting high water infiltration underground. When the forest area decreases, the rate of water infiltration also decreases and leads to promote runoffs resulting in lowering groundwater recharge potential. We conclude that groundwater recharge potential tends to contract and runoff tends to raise due to the expansion of community area and discounting forest area.

Keywords: Soil and water assessment tool, Groundwater recharge, Land use