Geo-spatial Approach for Assessing the Impact of Land-Use and Land-Cover Change on Groundwater Recharge: A Case Study in Akaki Catchment, Central Ethiopia.

Abstract

Land-Use Land-cover (LULC) changes are the major factors influencing catchment hydrology and ground water resource. Thus, understanding the potential impact of LULC on ground water resource particularly recharge is important for making carful management of water resources. The main objective of this study was to determine the LULC change of Akaki catchment between the vear1986–2015 and to evaluate the impact of these LULC changes on ground water recharge using a geospatial approach. To analyze the changes in area over the time, a set of satellite images was obtained for the years 1986 (TM), 2000 (ETM+) and 2015 (OLI-TIRS) and hydro meteorological data for 1986–2014 years was taken and used for the trend analysis of these factors. The methodology to evaluate LULC change effects on ground water recharge consists of three steps. In the first part landcover maps of the year 1986, 2000 and 2015 were compiled. Secondly, the relationship between hydro meteorological elements and ground water recharge have investigated by analyzing the temporal and spatial trend patterns of some of the hydro meteorological elements that have a great impact on groundwater recharge conditions. Finally, a water balance modeling, WetSpass and GIS, was applied to estimate the past and present seasonal and annual ground water recharge. The model was run for the three different years LULC maps keeping the other parameters constant hence; the result reflects impact of LULC cover change on the ground water recharge. The simulated results of the model indicates that the mean annual ground water recharge was decreasing from 268.6 mm/y for land-use map of 1986 to 264.9 mm/y and 260 mm/y for land-use maps of 2000 and 2015, respectively. Study outputs indicated that ground water recharge in the catchment did not change significantly. However, LULC had remarkable variation in the period between 1986 to 2015.

Keywords: GIS, RS, Akaki catchment, Ground water recharge, WetSpass, Surface Runoff

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