

Assessment of discharge and sediment transport from different forest cover types in lower Himalaya using Soil and Water Assessment Tool (SWAT)

J. V. Tyagi, Rai S.P., NuzhatQazi and M. P. Singh

ABSTRACT

The present study was carried out to examine the applicability of Soil and Water Assessment Tool (SWAT) in estimating daily discharge and sediment delivery from mountainous forested watersheds and to assess the impact of forest cover types on stream discharge pattern and sediment load. The study watersheds namely Arnigad and Bansigad, comprising of dense Oak forest (80%) and degraded Oak forest (83%) respectively, are located in lower Himalaya (India). Apart from hill topography, deforestation in the watersheds results in huge loss of productive soil and water as runoff. Daily discharge, sediment concentration and other hydro-meteorological data were monitored at the outlet of each watershed. SWAT was calibrated and validated for daily discharge and sediment concentration using the observed data. The performance of the model was evaluated using the statistical measures of coefficient of determination (R^2) and Nash-Sutcliffe efficiency (ENS). The statistical analysis of calibration results for Arnigad watershed showed very good agreement between observed and simulated daily values, with an R^2 value of 0.91, and an ENS of 84.48% in discharge simulation; and an R^2 value of 0.89, and an ENS of 83.11% in sediment simulation. The model also exhibited high performance on Bansigad watershed with an R^2 value of 0.91, and an ENS of 89.74% in discharge simulation; and an R^2 value of 0.86, and an ENS of 82.07% in sediment simulation. The model performed equally well on validation data and estimated the discharge and sediment yield very close to the observed data. The simulated mean annual water yield and sediment yield were also comparable to observed values in both the watersheds. The mean annual surface runoff and water yield over the entire study period were simulated as 6 and 59.4% respectively of the mean annual rainfall in Arnigad watershed; and 6.9 and 63.7% respectively in Bansigad watershed. The results of the study indicated that SWAT is capable of estimating the discharge and sediment yield from Himalayan forested watersheds and can be a useful tool for assessing hydrology and sediment yield response of the watersheds in the region.