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Impact assessment of land use land cover changes on rainfed watershed hydrology using Remote sensing, GIS and SWAT

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ABSTRACT:

Assessing the impacts of land use and land cover (LULC) and vegetative vigor changes on watershed hydrology are critical for planning and management of rainfed watershed. In the present study, LULC analysis is carried out for Kaddam watershed, which is located in Godavari river basin in India, is a typical rainfed watershed characterized by water scarcity with average annual rainfall of 745 mm and frequent drought conditions. Normalized Difference Vegetation Index (NDVI) fused with digital image classification techniques is employed to describe the spatio-temporal characteristics of LULC and vegetative vigor using multi-spectral remote sensing data. A physically based semi-distributed hydrologic model, Soil and Water Assessment Tool (SWAT) is employed for hydrological modeling, and simulated surface runoff and sediment yield at monthly and daily time scales, and validated with data for three monitoring stations in Kaddam watershed. The effect of LULC changes on Kaddam watershed hydrology for two different LULC scenarios (i.e., for the years 1996 and 2010) are analyzed. The results of runoff and sediment yield simulation from the outlet of sub-watersheds to lake Kaddam showed a high variability due to changes in LULC. Most of the sub-watersheds showed a greater increase in runoff, varies from 2% to 63%. The results also showed increase in sediment yield, varies from 4% to 50%. The impact of vegetative vigor on hydrological variables is analyzed by newly defining Change Detection Vegetative Index (*CDVI*), thereby assessed the change in vegetative status of forest lands, fallow lands and agricultural lands, and used for change detection in runoff and sediment yields. Results of the study demonstrated the utility of integrating remote sensing, GIS and SWAT model for assessing watershed condition and the relative impacts of LULC transitions on hydrologic response.

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