ABSTRACT

A Physically distributed hydrologic model ArcSWAT was used to address the effect of land use/land cover (LULC) dynamics, climate change and management of watersheds on hydrologic response of the Damodar catchment and reservoir sedimentation. The model was calibrated and validated for the monthly runoff and sediment yield at the outlets of four watersheds (Barisam, Banikdih, Mahrand, and Nagwan) and then for inflow at the three reservoirs (Konar, Tenughat and Panchet). The input parameters of the ArcSWAT model were generated from DEM, digitized soil and LULC data layers in ArcGIS environment. The performance of the model simulations was rigorously evaluated using graphical and statistical indicators. Based on LULC maps; prepared using remote sensing satellite images of Landsat 4, 5 and 7; it was observed that the LULC of the catchment changed substantially during the period 1972 to 2001. The simulated hydrological effect of LULC dynamics and climate change using ArcSWAT model revealed a gradual increase in reservoir inflow and sediment inflow to the Panchet reservoir during the 1970-2000 with relatively greater influence of climate variability than LULC change. Future projections of the reservoir inflow, reservoir sediment inflow and sedimentation rate into the three reservoirs (Konar, Tenughat and Panchet) showed an increase in future periods (2020s, 2050s and 2080s) with respect to base period (1970-1999), under future climate projections by REMO and HadRM3 model under the A1B scenario. Results revealed that the catchment will be under high threat of soil erosion in future and some management strategies should be adapted to slowdown the impact of climate change on the water resources. For this, best management practices (BMPs) were formulated and their impacts were evaluated on the reservoirs and watersheds of the catchment. The simulation results of individual and combined BMPs indicated reduction in reservoirs inflow, reservoirs sediment inflow and reservoirs sedimentation rate ranging, respectively, between -0.03% to -35.83%, -9.81% to -80.43% and -10.00% to 84.69%, under the future climate projections by REMO and HadRM3 models under A1B scenario. Adaption of the identified BMPs proved to be effective under predicted future climate, from both the RCMs, for increasing the water availability and reducing the soil erosion from the catchment, and thus in reducing the reservoir sedimentation rate. The outputs of this research work substantiate our current understating on the effect of LULC and future climate change on the catchment response at regional scale. It will also enable the policy and decision makers to formulate proper management practices in the region so that the environmental sustainability of the catchment can be maintained under future climate change.

Keywords: *Hydrologic models, ArcSWAT, Runoff, Sediment yield, LULC change, Climate change, Best management practices*