

Hydro-Ecological Modelling and Sustainability Assessment Of A Himalayan Catchment Under The Impact Of Climate Change

M. Sathyaseelan, Sanjay Kumar Ghosh* and CSP Ojha
[ORCID: 0000-0002-2448-6063], [*ORCID: 0000-0001-7849-9313] and [ORCID: 0000-0003-3364-0429]

Department of Civil Engineering, Indian Institute of Technology Roorkee, Uttarakhand – 247667, India.
msathyaseelan@ce.iitr.ac.in; sanjay.ghosh@ce.iitr.ac.in (*Corresponding. Author); and c.ojha@ce.iitr.ac.in

Keywords: SDGs, Hydro-ecological Modelling, LULC, WGENs, CMIP5 and RCP.

Abstract

Sustainability defines the prudent use of resources alongside fostering economic growth, especially for developing nations like India, experiencing the impacts of climate change. Analysing hydro-environmental processes for distinct hydrological units considering climate change, along with SDG, may facilitates sustainability. This study carries out hydro-ecological modelling and its sustainability of Upper Ramganga in Central Himalayan region for 1990, 2000, 2010, and 2020, and projecting for 2030. The catchment has been chosen for its diverse terrain, climatic conditions, soil composition, and LULC variations. Using SWAT model, along with Stochastic Weather Generators (SWGGENs) for the period 1985-2030, enables simulation of climate change impacts. Future projections from 2020 to 2030 utilize the climate change scenario of CMIP5 dataset of the RCP 2.6. LULC datasets for 2000 and 2020 play a pivotal role in influencing hydro-ecological processes in conjunction with soil and DEM datasets. Two models have been proposed using LULC of 2000 and WGEN1 (Model-I) and LULC 2020 and WGEN2 (Model-II) for assessment of sustainability. The models are capable of simulating PET, AET, soil moisture and discharge. Calibration and validation of the two models against observed discharge data for 1985-2005 and 2006-18, yield R^2 as 0.71 and 0.72, NSE as 0.7 and 0.71, PBIAS as -8.3 and 3.9 and RSR as 0.54 and 0.56 respectively. Thus, the proposed models are suitable for assessing sustainability.