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Water and Sediment Yields for Wala Dam Catchment Area

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Wala Watershed occupies the upper part of Al-Mujib Basin, Jordan, with Mediterranean climate, sparse inhabitants and moderate agriculture.
The area, in spite of its limited water resources, is considered as an
important water supply as it encompasses Al-Heidan springs and pumping
wells, which supply Amman city with a considerable amount of water, it
also includes Wala Dam that has been constructed for groundwater recharge purposes. Recognizing the threats of water and soil loss with the consequent sedimentation problems, and the benefits of watershed modeling techniques in studying such topics, this study comprised an application of the Soil and Water Assessment Tool (SWAT), associated with the Geographic Information System (GIS) to simulate the hydrology, soil erosion and sedimentation of Wala Dam Catchment Area. A set of hydrological techniques was utilized to simulate various components such as the Curve Number Method, the Rational Method and the Universal Soil Loss Equation (USLE) and modified USLE models. The use of such techniques in a GIS environment required certain types of data, which were collected and prepared either as database files such as the daily rainfall records, or as analytical GIS layers of soil, landuse/cover, drainage pattern and Digital Elevation Model (DEM). A weather generator was incorporated to generate any missed weather data. The area was discretized into 43 subbasins and 82 hydrologic response units. Two simulation series were performed using annual and monthly printout frequency. Several results were obtained including water and sediment yields at Wala Dam location with the respective delivery ratios, and spatial representation of precipitation, surface runoff, soil erosion, sediment and water yield on subbasin level. Model calibration and verification were carried out using flow rate and sediment yield data observed at Wala flow station and the results were satisfactory, indicating that this model can represent well the climatic and physical conditions of the area. Two prediction scenarios were performed, both indicated that the western and northern subbasins yield more water to the dam and are more susceptible to soil erosion and sediment generation. The study resulted in some recommendations to enhance the built model and suggest soil conservation and sediment reduction measures to control soil loss and maintain storage in Wala Dam reservoir, in addition to protecting its bottom against clogging through which the process of groundwater recharge might malfunction.