ABSTRACT

WEPP (Water Erosion Prediction Project) watershed model was calibrated, validated and evaluated for developing best management practices for a small hilly watershed (Karso) of India using satellite data and GIS (Geographic Information System). The watershed and sub-watershed boundaries, drainage, slope, soil map were generated using ARC/INFO GIS. Supervised classification method was used for land use/cover generation from satellite data. Other input parameters of the watershed such as area and slopes of hillslope, channel length and channel slopes were extracted using the various maps (i.e. contour, slope and drainage map). BPCDG (Breakpoint Climate Data Generator) was used for making climate (.cli) file. The delineated watershed was divided into seven sub-watersheds based on drainage network and ridge line. Subsequently, the sub-watershed numbers 1, 2, 3, 4, 5, 6 and 7 were divided into 17, 39, 19, 24, 46, 41 and 25 channels and 28, 69, 31, 41, 79, 70 and 39 hillslopes respectively.

Interrill erodibility and effective hydraulic conductivity were taken into consideration for calibration of the WEPP model for the monsoon season of 1996. The model was validated for daily runoff and sediment yield using the data of monsoon season of the years 1992, 1993, 1995, 1997 and 2000. High value of coefficient of determination (R^2) in the range of 0.86 to 0.91, Nash-Sutcliffe simulation model efficiency of 0.85 to 0.95, per cent deviation values of 7.90 to 15.15 and student's t-test indicate accurate simulation of runoff from the watershed. High value of coefficient of determination (R^2) in the range of 0.81 to 0.95, Nash-Sutcliffe simulation model efficiency of 0.78 to 0.92, per cent deviation values of 4.43 to 19,30 and student's t-test indicate accurate simulation of sediment yield from Karso watershed. The sensitivity analysis of the model input parameters shows that sediment yield is very sensitive to interrill erodibility and effective hydraulic conductivity, whereas, runoff is sensitive to effective hydraulic conductivity only.

Based on the average annual sediment yield obtained from WEPP model, it is concluded that sub-watershed number-4 is most critical. This sub-watershed having the highest sediment yield was assigned the highest priority number of 1, the next highest value was assigned a priority number 2, and so on. In the order of priority the sub-watershed numbers 4, 3, 1, 5, 2, 6 and 7 are considered for evaluating the best management practices for further conservation of soil and water.

For reduction of sediment yield and boosting of economy, it is advisable to replace paddy crop in the upland portion of the watershed with cash crops like soybean. The existing tillage practice (country plow/ M.B. plow) can be replaced by the field cultivation system. Soil and water conservation structures like nala bund, check dam and percolation tank are recommended in the study watershed. Finally, the hillslopes and channel attributes can successfully be extracted and updated using Indian RS satellite data and GIS technique in a short time and cost effective manner. The WEPP model can also be successfully adopted for hydrological evaluation and prioritization of other small Indian hilly watersheds.

KEY WORDS: GIS, Hydrological Modeling, Prioritization, Remote Sensing, Watershed, WEPP model.