Abstract — Hydrology plays a vital role in protection and management of water and other environment resources associated with the occurrence and distribution of water above and below the land surface. Runoff is the most prominent process that needs a precise study for solving the quantity and quality problems of water resources. These problems are identified in watersheds dominated by a monsoon climate in which heavy rains cause floods and severe erosion of the top soil layer, resulting in loss of soil resources and pollution of water bodies used for various purposes. Forecasting hydrologic variables accomplished in two ways, the first approach deals with the use of various tools such as GIS to obtain map sets of watersheds at the macro level and the second approach is to use physical models, which require forecasted weather data i.e. temperature and precipitation in order to predict future values of the hydrologic variable such as stream flow & sediment yield in a particular watershed domain. In this paper, various parameters have been developed and discussed in relation to the watershed modeling using QGIS 2.2.2.

Keywords— Runoff, Watershed, hydrologic variables, soil erosion, model, QGIS

Corresponding Author: MR. ABHISHEK P. SINH

Co Author: MR. D. G. REGULWAR

Access Online On:

www.ijpret.com

How to Cite This Article:

Abhishek P. Sinh, IJPRET, 2015; Volume 3 (8): 287-295
INTRODUCTION

topology, soil type, texture, existing land use land cover, water resources and drainage pattern as obtained from field measurement. In recent year, a number of conceptual watershed models have been developed in the GIS framework. Geographical Information System tool (GIS) has wide range of application and comes with GRASS interface and user support. Numerous studies on watershed water and soil resources management have been done using the GIS modeling. In context with the Water Resources Engineering, GIS was developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds with varying soils, land use, and management conditions over long periods of time. The GIS modeling is a computer based and computationally efficient tool; it uses available inputs viz. vector or/and raster and allows users to study long-term impacts. Thus, GIS is a continuous time model (i.e. a long-term yield model). The ability to incorporate spatial data, manage it, analyze it and answer spatial questions is the distinctive characteristic of GIS.

The Study Area:

A study area watershed GV-42 is located in Khuldabad taluka. The study area falls in the eastern part of Aurangabad district as shown in fig 1. The watershed lies between 19°5′69″N latitude and 75°25′49″E longitude. The area covers under geological survey of India toposheet no. NE 43-3/ SERIES U503/ EDITION I-AMS. The scale of toposheet 1: 250,000 i.e. one inch measured on the map represents the 250,000 inch on the ground surface. The toposheet of selected area is collected from the Survey of India topographic sheet. The watershed area is found to be 960.60 km². The average annual rainfall in the area varies from 500 mm to 950 mm. The study area has varied land covers & uses namely water bodies, waste land, habitations, paddy fields, deciduous forest, plantations, marshy land etc. The soils in study area have mixed texture like clay, clay-loam, sandy clay loam, and gravelly loam, sandy loam etc. as per data obtained from the LU/LC and soil maps.

Fig.1
MATERIALS AND METHODS:

Watershed modeling in GIS can be done through either ARC GIS or QGIS. In the present paper, watershed modeling is carried out in Quantum GIS 2.2.2 (i.e. QGIS 2.2.2) within the GRASS environment. The Digital Elevation Model (DEM) for the Maharashtra State is procured from BHUWAN-2D and Aurangabad District DEM is extracted through the QGIS as shown in fig 2.

From the DEM the Reduced Level of any required location can be obtained. Watershed delineation is performed in GRASS interface taking the input from the QGIS environment as shown in the fig.3 and the extracted Map of Macro-Watersheds of Aurangabad District is shown in fig 4.
DEM is also useful in contour plotting and for the delineation of macro-watersheds as obtained in fig 5.

When the rain occurs within the watershed, the rain water is bi-furcated through the ridges of the hills and forms a large nos. of macro streams (1st order) in each macro-watershed. These macro streams combines together and develops a higher order streams with a high runoff and forms a watershed catchment. In QGIS 2.2.2 it is possible to obtain all the streams orders within the sub-watershed along with its flow directions as shown in the fig 6 and 7.
Macro-watersheds are digitized with respect to the ridge boundaries to obtain a watershed as shown in the fig 8.
QGIS provides a unique feature of Google earth plugin; this enables the user to directly place the area over the globe for obtaining various spatial informations such as elevation, lat/long, extent etc. such a google earth integration is processed for the study area as shown in fig 9.

As the raster files are very heavy and it’s not possible to perform all the analysis smoothly, hence they are converted into vector files as represented in fig 10. Vector data is characterized by the use of sequential points or vertices to define a linear segment and polygon.

The Aurangabad district of Maharashtra is highly characterized by various physiographical and topographical features. The study area is rich in its physiographic features. In QGIS mapping,
the area is mapped into four major categories such as Ghats, Upper and lower plateau region, where certain portion of upper plateau bears metamorphic origin of land features. A detailed map for the physiographic regions in the study area is prepared and then rasterised as shown in fig 11.

![Map of Physiographic Region](image1)

**Fig.11**

The annual rainfall in the area varies from 350 mm in the rain shadow areas to 1000 mm in Ghats. About 80 per cent of monsoonic rain is received during June to October. The study area shows humid to per humid climatic type to the west of the ghats, semiarid type in central and southern part, and sub humid type in the eastern part of the plateau region. Based on soil climatic variations, the area is divided into four rainfall classes starting from rain shadow region (rainfall between 350 to 550) and heavy rainfall region (rainfall between 750 to 1000) shown in the fig12.

![Map of Rainfall](image2)

**Fig.12**
Soil erosion is one of the most serious environmental problems as it removes the top layer which is rich in nutrients and thus leads to loss of fertile soil. Soil erosion within watersheds results in increase of level of sedimentation in the streams and reservoirs and thus reducing their storage capacity and life span as well. In present study area, it has varied land covers & uses namely water bodies, waste land, habitations, paddy fields, forest cover, plantations, etc. The soils in area have mixed texture like clay, sandy clay loam, and gravelly loam. Such geological features are favorable for the soil erosion accompanied with heavy rainfall of 600 mm to 1000 mm as discussed earlier. Considering the soil cover and its nature soil erosion map is developed in QGIS as given in the following fig13.

![Erosion Map](image)

**Fig. 13**

**DISCUSSION:**

The GV-42 watershed in Khuldabad taluka is very important to Aurangabad District as it supplies about 38% of the total annual freshwater need to the taluka and contains appreciable fertile agricultural lands covering about 57% of the entire watershed. Excessive erosion means reducing not only water capacity of the Khuldabad taluka, but also productivity of agricultural lands in the study area. This study aimed at understanding the various digitized features such as DEM, watershed delineation, contour maps rainfall and physiographical features and soil erosion risk in the watershed by using QGIS 2.2.2 modeling method with GRASS interface in a GIS framework. The study provided a reliable prediction of soil erosion prone zone within the watershed.
REFERENCE:


