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Watershed Protection and Management Using QGIS: Study Area of Borgoan Village, Sangli, Maharashtra. A review

Ms. Sharayu Shankar Pujari¹, Mr. S M Bhosale²
Department of Technology, Shivaji University, Kolhapur

Abstract: Watershed management or protection implies the proper use of all land and water resources of a watershed for an optimum production with minimum hazard to natural resources. Delineated watersheds are required for HSPF modeling and for BASINS watershed characterization reports, so we can characterize and investigate what is going on in one portion of the study area versus another. Delineation is part of the process known as watershed segmentation, i.e., dividing the watershed into discrete land and channel Segments to analyze watershed behavior. Boundary of a watershed consists of the line drawn across the contours joining the highest elevations surrounding the basin. A common task in hydrology is to delineate a watershed from a topographic map. Use of GIS (Geographic Information System) popular and has facilitated much of the work of hydrologists. The use of DEMs (Digital Elevation Models) in particular has made watershed delineation a smooth procedure. With help of QGIS delineation and mapping of micro watershed at Kaneri is done. This has given watershed boundary for the particular stream. The results obtained from watershed delineation and rainfall runoff model have wider application for watershed management

Keywords: QGIS, DEM model, Watershed Delineation, Catchment area, Rainfall Runoff Model, HSPF Modelling.

I. INTRODUCTION

Water is limited vital natural resources, which is indispensable for the expanse of all-living matter, plant, animal, and man. Potable water which was once thought to be an infinite, is in fact a fast depleting scarce commodity and at the present rate of consumption by mankind it would not last longer and become as dearer as fossil-fuels today. Sangli district has hot semi-arid climate and is having drastic variations in the rainfall patterns. This year it was the hottest summer and the drought condition was very severe. The water level could have dipped below 300 meters in Sangli district according to Sangli Zilla Parishad, more than 80% farm ponds and all dug wells in the talukas have dried up since March. Even the Atpadi Lake in Sangli district has dried up. Borgoan is a village in Sangli district facing the above problems and hence watershed management can prove a permanent solution to the scarcity of water. Watershed management or protection implies the proper use of all land and water resources of a watershed for an optimum production with minimum hazard to natural resources. Geographic Information Systems (GIS) technology has played critical roles in all aspects of watershed management, from assessing watershed conditions through modeling impacts of human activities on water quality and to visualizing impacts of alternative management scenarios. QGIS is the best GIS tool in the free and open-source software (FOSS) community. QGIS provides watershed delineation using the DEM model and SRTM data which can give factors for calculation of rainfall runoff model and delineate a boundary for a catchment area. The maps created in the QGIS software are very useful and proper planning designing and implementation of protection of watershed can be done.

II. LITERATURE REVIEW

A. S. Chandra Bose et al (2012) in this research study, an attempt is made to delineate the Kaddam watershed of Middle Godavari sub basin of Godavari River Basin into mini watersheds using GIS. They carried out the delineation using GIS and it was concluded that Kaddam watershed is well drained and the drainage is in a well-integrated pattern and the area is underlain by highly resistant permeable material with vegetative cover and lower relief. Present study demonstrated that GIS is found to be flexible and is relatively easy to apply on large areas enabling gathering of all data and information in a common data base for watershed delineation and stream network analysis.

F E Tombus et al. (2012) carried out study to determine and evaluate the soil loss in the west region of Corum with the help of commonly used Geographic Information Systems according to USLE model. The Universal Soil Loss Equation (USLE) method, used at calculating the soil loss at the work area or basin in a year at unit area per unit of time, is also a commonly used and efficient

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model for determining the precautions against soil erosion at areas under soil erosion threat using GIS technique.

I S Sitanggang and M H Ismail (2010), this research aims to achieve an estimate for watershed delineation from topographical map using standard Digital Elevation Model (DEM) in ArcGIS 9.1. A simple automatic delineation technique in computer vision application was carried out at Ayer Hiram forest Reserve, Selangor. Results showed that by using watershed function in ArcGIS 9.1 watershed delineation for the Ayer Hitam Forest Reserve can be determined. This exercise is mainly a case-study of simple applicability of GIS as a tool of watershed delineation.

Ishtiyag Ahmad and Dr. M. K. Verma (2013), studied that the soil erosion can be controlled effectively if it is predicted accurately under alternate management strategies and practices. The Universal Soil Loss Equation model has been accepted and used most widely all over the world to predict the soil erosion from a watershed. Assessment of soil erosion is expensive and intensively long exercise. Geographic Information System integrates the spatial analytical functionality for spatially distributed data. In the present paper the application of USLE model and GIS, for soil loss estimation has been presented for the Tandula reservoir catchment area on Tanudula River at Balod Tehsil of Durg district of Chhattisgarh State, India. The result obtained from USLE model has been compared with existing model, Nayak and Khoslas method, it is observed that USLE with GIS give better result as compared to other two methods.

Maya G. Unde and Namdev V. Telore (2012), studied role of watershed development programme in sustainable development. It indicates that watershed development programme is helpful for sustainable development of this drought prone region of Satara District. It is useful to increase agricultural production, to stop ecological degradation in rain fed and resource-poor areas.

Mudher N Abdulla (2011) carried out drainage analysis on a terrain model for Bekhma area. The Arc Hydro tools are used to derive several data sets that collectivity describe the drainage patterns of the catchments. Raster analysis is performed to generate data on flow direction, flow accumulation, stream definition, stream segmentation, and watershed delineation. These data are then used to develop a vector representation of catchments and drainage lines from selected points. The utility of Arc Hydro tools is used to develop attributes that can be useful in hydrologic modeling. The main data is the DEM with 1 arc second to get as much accurate results as could. Using this technique the author got very good results by comparing the Russian results introduced using the topo maps, with GIS technique while they used the collection of hard copy maps and they extracted the DTM from the contour lines and calculated the catchment area.

Sarita Gajbhiye (2015) this study concentrated on Kanhaiya nala watershed located in Satna district of Madhya Pradesh using remote sensing and GIS. The total area of watershed 19.53 km². Soil map, Land Use and slope map were generated in GIS Environment. GIS technique is a very reliable alternative or a dependable support system to our conventional way of surveying, investigation, planning, monitoring, modeling, data storing and decision making process.

Subhash Chavare (2011), gave the methodology to analyze the relief of the Kolhapur district using SRTM data and GIS techniques. The elevation model derived from Shuttle Radar Topography Mission (SRTM) data is used for the relief analysis. Relief visualization study is important for the analysis of slope of particular area. In this study the slope of Kolhapur district is steep in western side and gentle towards the eastern side and from the slope analysis we can identify the drainage pattern of the area and watershed boundaries.

Supakij Nontananandh and Burin Changnoi, (2012) carried out the coupling of a GIS and the USLE has been widely used and is a very effective approach for estimating the magnitude of soil loss and identifying spatial locations vulnerable to soil erosion.

Yongsheng Ma (2004) stated that unless the watersheds are not managed in an integrated sustainable manner, then not only the water resources but also other resources such as vegetation, fertile soil, fauna and flora get depleted. Rational management of upper and lower parts of a watershed is equally important for the sustenance of the environment. Therefore it is extremely important to use an integrated spatial approach for managing watersheds and river basins. The remote sensing and GIS for watershed management constitutes theoretical aspects of Geographic Information Systems (GIS) & Remote Sensing and their application for watershed management.

III. CONCLUTIONS

Above mentioned literature review summarized that GIS gives user friendly interface and flexibility in planning watershed protection and management.

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