Integration of Remote Sensing and GIS for Delineation of Watershed of Ramgarh Dam Catchment Area of Jaipur

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***Abstract*—A watershed is an area of land where all of the water that is under it or drains off of it goes into the same place. Watersheds, also known as basins or catchments, are physically delineated by the area upstream from a specified outlet point. Delineation is the creation of boundaries that represents the contributing area for a particular control point or outlet. This study has demonstrated that the recent advancements in remote sensing and GIS technologies provide powerful tool for mapping the watersheds. The Ramgarh dam served Jaipur city for 100 years, but fail due to illegal encroachment in catchment area of dam which causes the failure of dam. The main objective of this research is to find out basin of Ramgarh dam catchment area. In this study, available Digital Elevation Model (DEM) of pixel size of 90 m (zone 43) is used to delineate the catchment area of Ramgarh dam, Jaipur. Study shows that study area (SA) has 72 unique colours which shows the different drain area watersheds. The findings of this study highlight the need for a comprehensive assessment of human activities in dam area.**

Keywords: Remote Sensing, GIS, DEM, Ramgarh Dam, watershed

I. INTRODUCTION

The construction of Ramgarh dam was started on 30.12.1897 by the erstwhile ruler of Jaipur Maharaja Madho singh. It took around 6 years to complete its construction. It was inaugurated sometime in the year 1903 by the then Governor General of Rajputana, Mr. Crasthwest (as the info collected from Rajasthan high court civil writ petition no.11153/2011). The height of its walls was raised looking to inflow of water. In the year 1981 water level touched 64.5 feet which was the last height point of the aforesaid reservoir. It has catchment area of 2975 square miles having average rainfall of 19-22 inches. The dam was having irrigation area of 21.5 miles by canals apart from 139.5 miles by its tributaries. In the year 2003, the dam could not fetch sufficient water and the same story was repeated in the year 2004. It was in the year 2005 that water was not taken from the dam.

Delineation is part of the process known as watershed segmentation, i.e., dividing the watershed into discrete land and channel segments to analyze watershed behaviour. The delineation of watershed includes prepossessing steps using digital elevation data and results are discussed in this paper. The preprocessing involves removal of sinks using iterations process, generation of flow directions from each cell, calculation of flow accumulation by accumulating the weight of all cells that flow into each down slope cell and derivation of stream network using a threshold on the flow accumulation value. Automatic delineation of watershed is carried out by selecting an outflow point on the stream network. The size of watersheds generated is controlled by number cells that need to flow into cell to classify it as a stream. Watersheds of different sizes can be achieved by giving the different threshold value while building the stream network. The result generated can be used for effective watershed modeling and improved land use practices.

II. STUDY AREA

The study area is situated in latitude 26 59 59.41 N-27 14 04.66N and longitude 76 00 20.79E-76 08 02.18E.This study area is situated 50 km far from Jaipur city, this entire area is covered by Banganga river. The total study area is 103.8sq miles.

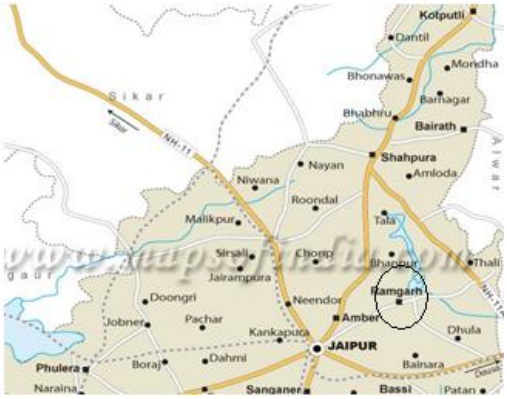

Fig1- Study area of Ramgarh Dam Marked by Circle

III. DATA USED

DEM taken from Shuttle Radar Topography Mission (SRTM) image ,which have a resolution of 90m which shows the elevation of ground surface. Landsat image of 2006 of 30m spatial resolution is used for sub set the area of interest. Survey of India(SOI) Toposheet no. 54 A/4 on scale 1:50000 is also used to demarcate the catchment area of Ramgarh dam. ERDAS Imagine 9.2 and Arc GIS 8 softwares of image processing are used for different processing such as Subset and watershed analysis.

IV. METHODOLOGGY

The method flow diagram of research has shown in Fig 2. These processes start with data procurement and then image pre-processing and post-processing operations on Landsat satellite data and DEM. The classified data are then analyzed using GIS tool to delineate the watershed.

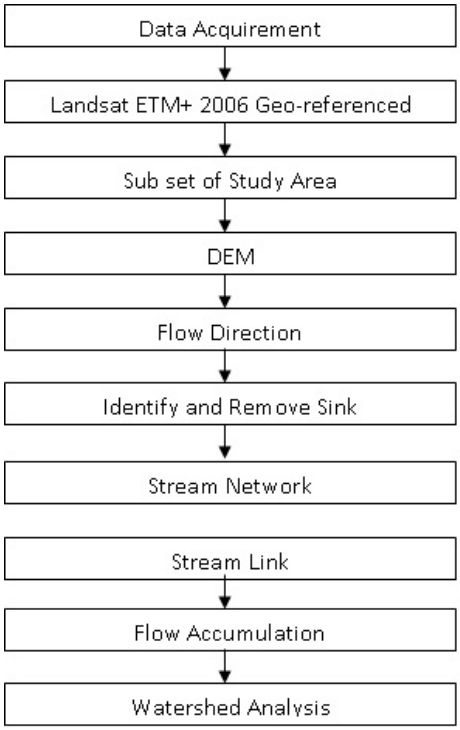

Fig 2- Method Flow Diagram of Research

V. RESULT AND DISCUSSION

A watershed is constructed by the DEM image. The DEM is used to calculate flow direction. A flow accumulation raster records upstream cells which will contribute drainage to each cell. Then sinks are identified. Sink is surrounded by higher cell. It can artificially terminate streams by trapping flow. Filling sinks is an iterative process. Sink cell values are changed to equal neighboring elevation cell values. Lowest value is used. Flow accumulation grid is used to identify drainage courses by which we have created a drainage network. A stream network is derived from a flow accumulation raster, each section of the stream raster line is assigned a unique value and is associated with a flow direction. It is the number assigns to the stream link. Watersheds delineate a drainage area. In our watershed 72 unique colour is present which shows the different drain area watershed.

Fig.3-Dem image of study area.

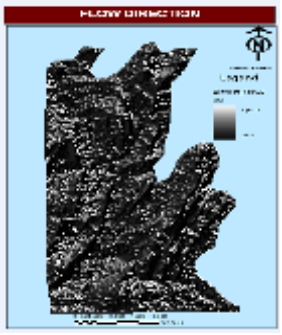

Fig.4- Flow direction image.

Fig.5-Flow accumulation.

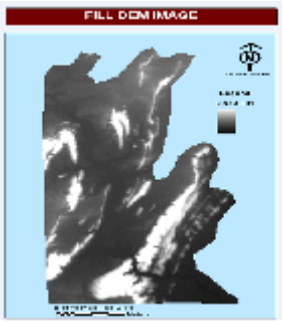

Fig.6-Fill dem image.

Fig.7-Fill dem flow direction.

Fig.8-Fill dem flow accumulationimage.

Fig.9-Sink flow image

Fig.10-stream network.

Fig.11-Stream shape image.

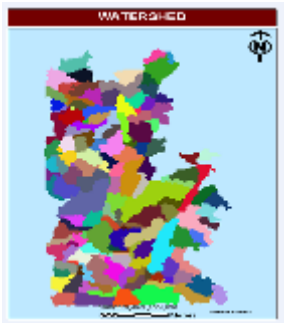

Fig.12-Watershed.

VI. CONCLUSIONS

This study has demonstrated that the recent advancements in remote sensing and GIS technologies provide powerful tool for mapping and delineation of watershed. This research carried out in a part of dam area using these modern technologies in conjunction with field observation showed there is decrease in the area of watershed in dam area due to change in land use. In our watershed 72 unique colour is present which shows the different drain area watershed.

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