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Research Papers

Demarcation of Drainage Network for Watershed Management of Sangamner Tahsil Using Topographical and GIS Data: A Case Study of Sangamner Tahsil of Ahemadnagar District

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Abstract

Water is significant geographical resource, which need to micro level planning for the conservation. It is the fundamental need of all biotic community which is depending on the precipitation sources directly and River, lake, tank water sources circuitously. There is sensitive issue regarding water managements because of its need and availability. So the, variety of research techniques applied for the sustainable development of water resource. In most of region very less rainfall incidence, where need to conservation of water by the appropriate techniques for sustainable development. From the ancient time humans are using variety of techniques for preservation of water, which is now a day becomes a time consuming, resources wastage and less correctness. This traditional techniques replaced by advance GIS and RS techniques where obtain the precise accuracy, digital quality, fewer recourses.

In this epoch, the research approach is changing and using the modern approach for the precise effort and management. The traditional technique replaced by advance GIS and RS techniques which have high accuracy and quality. An attempt has been made here to perform the use of GIS and RS techniques for proper and applied base watershed management. The drainage network of Sangamner Tahsil is extracted from the topographical map of the region. This extracted whole drainage network superimposed on the DEM (Digital Elevation Model) model of Tahsil, which shows the real characteristic like flow direction, geometry, length, total covered area, density, and sinuosity of the drainage network.

Key word: Watershed Management, Geographical Information System, Remote sensing.

Introduction:

A watershed is an area of land and water bounded by a drainage divide within which the surface runoff collects and flows out of the watershed through a single outlet into a lager river or lake. Watershed is unit, where the water is collect from various directions in a particular main stream from the other sub streams. This watershed boundary needs to find out properly by various techniques which are utilized in irrigation and engineering field. This demarcation methods changing day by day and replace by advance technology in recent time. The GIS technique is one of them which demarcate the watershed from 3D nature in GIS software. The drainage network can extract by digitization and it can superimpose over the 3D data of regain. This superimposed data helps for spatial modeling and its high accuracy visualization.

Study Area:

Present study area is the part of Ahemadanagar district which is located in Maharashtra state of India. (Fig 1)The geographical extent of study area is 74o 03' 45.50"

E to 74o 24'22.50" E and 19 o 16' 52.50" to 19 o 43' 07.50" N The study area divided in two parts due to Pravara River called has northern and southern part. The northern part covered by hilly region as far as southern part known as plateau region. The central parts of region drained by river Pravara, and northern and southern parts strongly facing the drought full environment because of less rainfall. The average rainfall of Sangamner tahsil is 50-100 mm. study area under the rain shadow region of Maharashtra, that's why most of month it facing the drought the year.
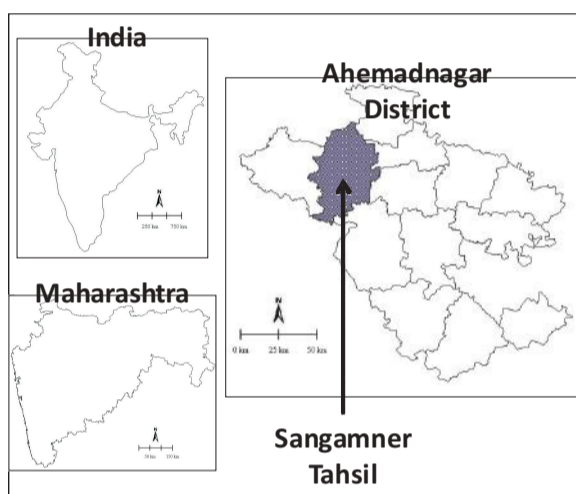

Figure 1: Location Map of Study Area

Objective of Study:

The different objectives of watershed management are discussed here, to modeling of watershed management using GIS techniques. To digitized the drainage network from Topomaps of Sangamner tahsil (Fig: 2). This digitized network is superimposed over the DEM (Digital Elevation Model) for watershed modeling. To prepare the various maps of slope(Fig:3), drainage network, location map and related characteristic. The stream networks are shown over the 3D nature of Sangamner Tahsil. After this preparation or mapping in GIS, suggest the guideline for control damaging runoff and degradation and conservation of soil and water in region. To protect, conserve and improve the land of watershed for more efficient and sustained production. To protects and enhance the water resource originating in the watershed, because of situation of tahsil especially in southern and northern part of tahsil.
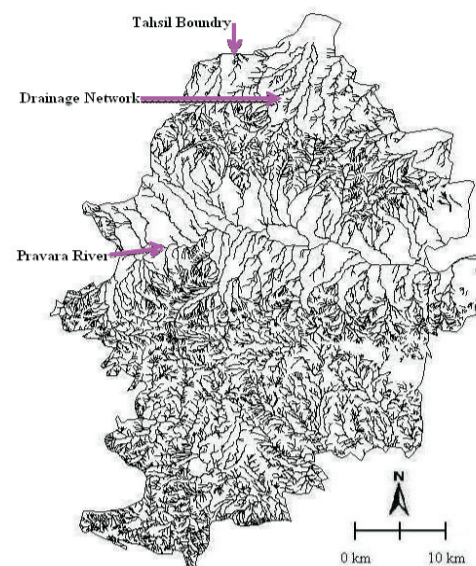

Figure 2: Drainage Network Flow Direction

Watershed Management and GIS:

The methods of watershed management have been changing due to development in technology and knowledge. The planning of any watershed management depends upon size, drainage density, and regional situation. Normally, the watershed is classified on the basis of size, drainage, shape and land use pattern. It can be explain, i.e. Macro watershed (> 50,000 Hector), Sub-watershed (10,000 to 50,000 Hector), Milli-watershed (1000 to10000 Hector), Micro watershed (100 to 1000 Hector), Mini watershed (1-100 Hector). The size is determinant factor of watershed management successes.

The GIS has capabilities to perform the application in watershed management sector with greater accuracy and digital spatial modeling. Watershed management can design by layer generation (DEM, Drainage Network, and Regional boundary), this layer needs to superimpose, after that all management can be perform by visualization and modeling of watershed management (Fig: 4). This advance sources and its various operation in GIS packages provide the high accuracy oriented mapping which will really support for Decision Support System.
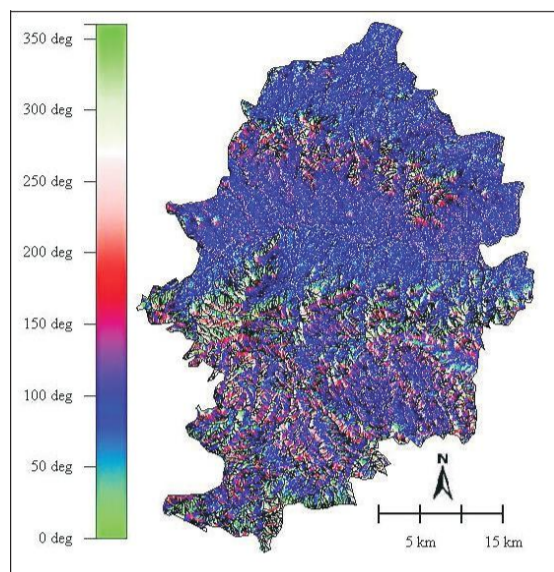
Figure 3: Slope map of Sangamner (Slope-deg)

Methodology:

For present research work adopted the following methodology:

1)   Selection of study area- Sangamner Thasil of Ahemadanagar district.

2)   Data base collection- Toposheets, and tahsil basic information.

3)   Software used- Georefransing and digitization of Drainage network.

4)   Software operation- Layer overlay, Superimposing of network on 3D.

5)   Demarcation of watershed and its analysis for watershed management planning.

Drainage Network Characteristic:

Watershed is defined as a geohydrological unit draining to a common point by a system of drains. The central part of tahsil flow the main river Pravara from west to east direction. The sub river like as Mhalungi, Adhala etc, is meeting to main Pravara River. From the Baleshwar hilly range (located at southern part of tahsil) most of streams flow toward the northern part and meet to Prvara River from right bank. The high drainage density noted in this region in southern part due to hilly region. The entire drainage network not submerges in river due to undulating nature of Sangamner tahsil
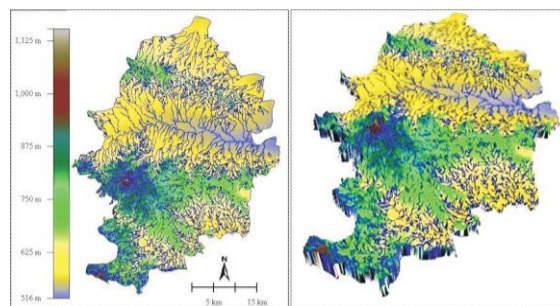

Figure 4: Drainage Network Superimposed over
Digital Elevation Model of Sangamner Tahsil

Conclusion:

GIS improves calculations for watershed characteristics, flow statistics, debris flow probability, and facilitates the watershed delineation by using Digital Elevation Models (DEMs). It provides a consistent method for watershed analysis using DEMs and standardized datasets such as land cover, soil properties, gauging station locations, and climate variables. Various software provide GIS Spatial analyst for hydrologic analysis such as calculating flow across an elevation surface, which provides the basis for creating stream networks and watersheds; calculating flow path length; and assigning stream orders (Fig : 4).

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