ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com
Journal DOI: 10.21474/IJAR01

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Cartosat Digital Elevation Model (DEM) to Drainage Extraction Techniques of Vrushabhavati basin of Karnataka, India Using Remote sensing and GIS Techniques.

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Manuscript Info

Manuscript History:

Received: 15 May 2016
Final Accepted: 13 June 2016
Published Online: July 2016

Key words:
Drainage, Basin, Remote Sensing, Digital Elevation Model.

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Abstract

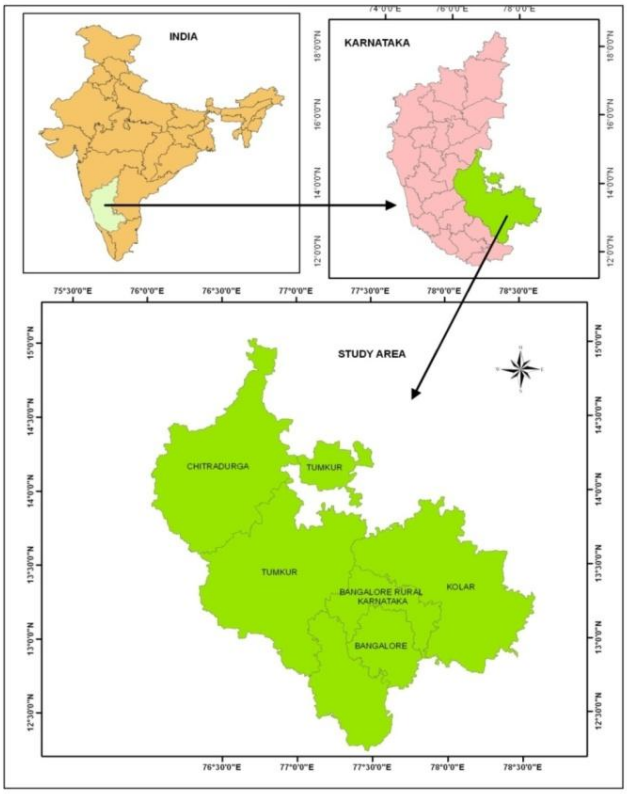
Digital Elevation Model (DEM) on of important concept for delineating the surfacial features like structures (Folds, Joints and Lineaments) and Drainages are also one of the surfacial features through software techniques and analysis using Arc-GIS 10.2.1 software and Erdas-14 Software delineating the drainages from Cartosat DEM The necessary base maps for morphometric analysis carried out through GIS Mapping using SOI Topographical Sheets of the area at scale 1:50,000. The required GIS maps are drainage map, surface water body map, drainage order map, drainage sub-watershed map. In the study area vrushabhavati area by Toposheet observed First order 762, Second Order 159, Third order 38, Fourth order 9 and Fifth order 3 and Deleneating the Drainage Pattern of using Cartosat DEM 710 First order, Second Order 131, Third Order 30, Fourth Order 7 and Fifth Order 2 this is the comparitivity between Toposheet and Digital Elevation Model Using Remote Sensing and Geographical Information system.

Introduction:-

The present study analyzes the significance of satellite images and digital elevation model (DEM) for the assessment of fluviological characteristics and the extraction of morphometric parameters for the Tista watershed of India and Bangladesh (Pramanik, 2016). A DEM is a raster representation of a continuous surface, usually referencing the surface of the earth. The accuracy of this data is determined primarily by the resolution (the distance between sample points). Other factors affecting accuracy are data type (integer or floating point) and the actual sampling of the surface when creating the original DEM.Stream networks can be delineated from a digital elevation model (DEM) using the output from the Flow Accumulation function. Flow accumulation in its simplest form is the number of upslope cells that flow into each cell. By applying a threshold value to the results of the Flow Accumulation functions using Map Algebra, a stream network can be delineated. Channel networks with arbitrary drainage density or resolution can be extracted from digital elevation data.) . Emerging of Remote Sensing (RS) and Geographic Information System (GIS) based on Digital Elevation Model (DEM) have been effectively utilized for delineating and selecting potential zone rainwater harvesting structure, in addition, play as vital role in plan and manage water resources (Jha & Peiffer 2006). In India, more than 90% of the rural and nearly 30% of the urban population depend on groundwater for meeting their drinking and domestic requirements (Reddy et al., 1996), In addition, quantitative morphometric parameters of the drainage basin also play a major role in evaluating the hydrological parameters, which in turn helps to understand the groundwater situation (Krishnamurthy & Srinivas 1995).

Location of the Study area:-

The study area is forest within the Dry Agro Climatic Region of Karnataka and spreads over in 3294 sqkm. It lies between 12°30'0" and 15°0'0" latitude and between 75°30'0" and 78°30'0" longitude and it encompasses seven districts viz., Bangalore Urban, Bangalore Rural,RamanagaraTumkur, Kolar,Chikkaballapura, Chitradurga. Total district area is 35214 sqkm and the forest area which is focus of the study is only 9%.



Map 1.1:- Location Map of the study area

Material and Methods:-

Hydrologic analysis of micro watersheds is essential for water resources planning at large scale. Space based input for decentralized planning at panchayat level use high resolution DEM. Drainage and slope play important role in planning and Digital Elevations Models (DEM) are widely being used for estimation of hydrologic parameters which are useful as input for hydrologic models. The estimates vary as per resolution and type of DEM.

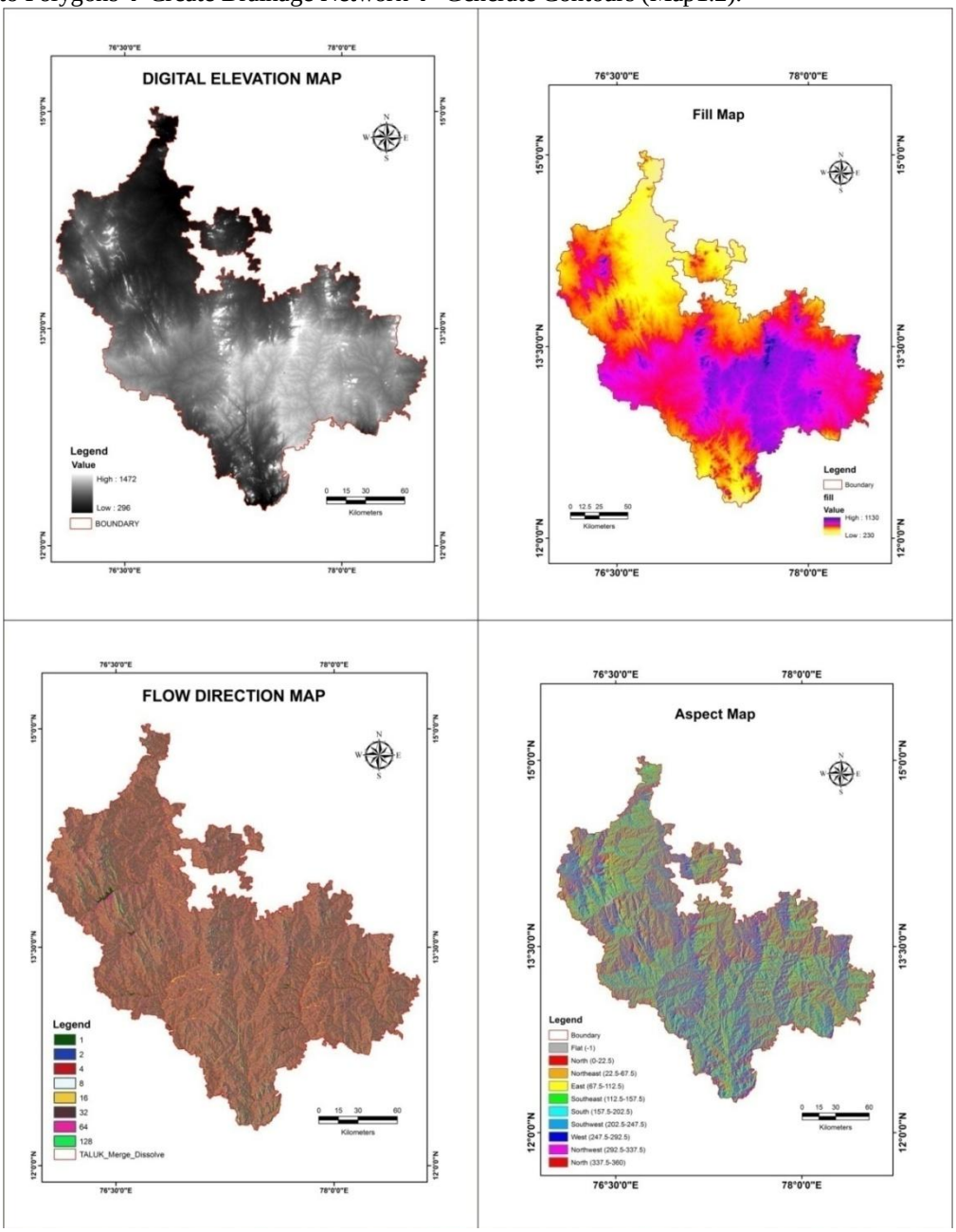
The evaluation of basin characteristics from the morphometric parameters helps in understanding the physical behaviour of the catchments with respect to floods. The advanced technologies, such as remote sensing and Geographic Information System (GIS), were used for extraction of drainage networks using Cartosat Digital Elevation Model (DEM) for the part of Vrushabhavati Basin. Delineation is part of the process known as watershed segmentation, i.e., dividing thewatershed into discrete land and channel segments to analyze watershed behavior. Drainage networks respond rapidly to structural changes (Shahzad et al., 2009). The automated generation of drainage networks from digital elevation models (DEMs) is a powerful analytical function in geographic information systems (GIS).

Methodology:-

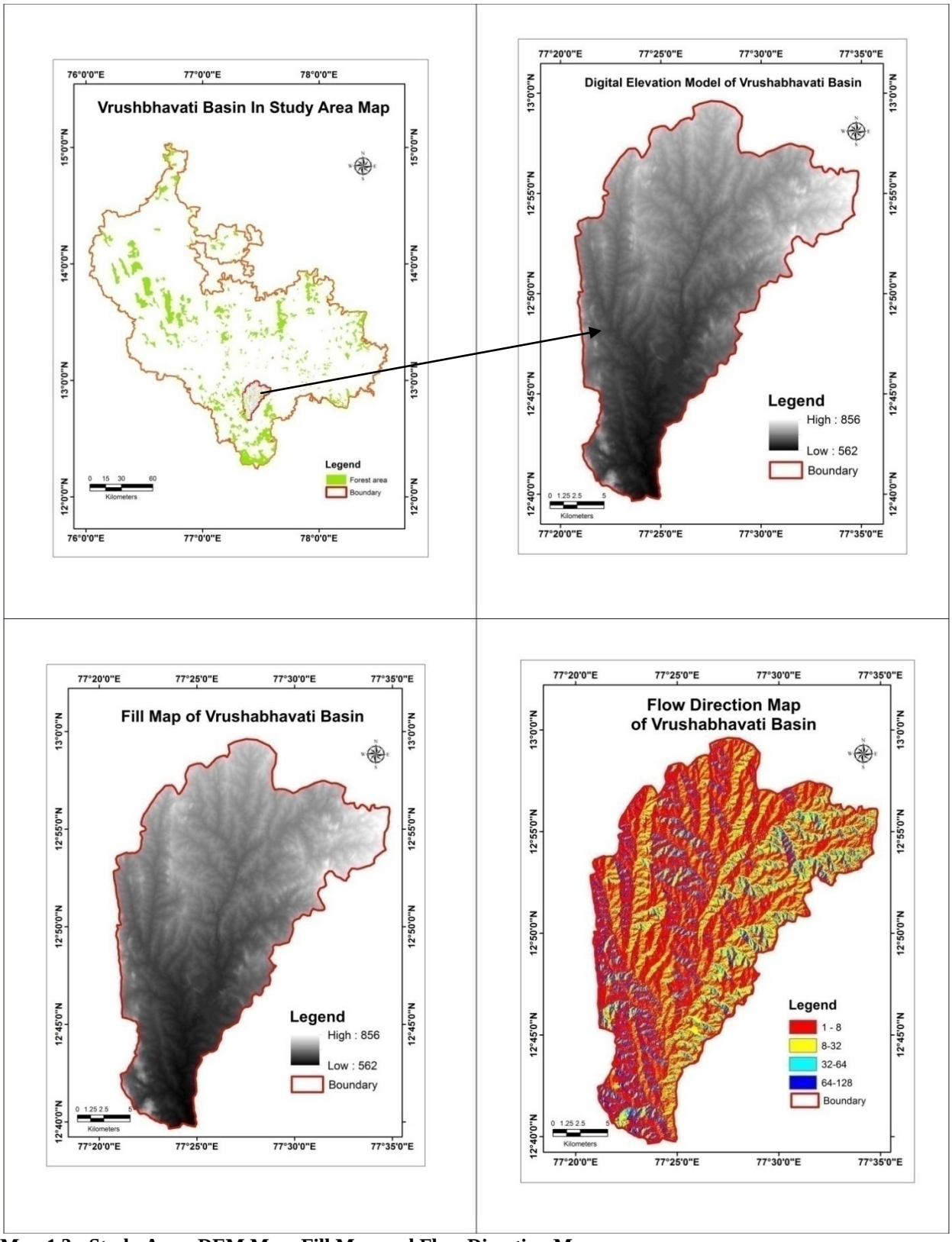
Estimate watershed and drainage delineation from topographical map using shuttle radar topographical mapper digital elevation model (SRTM - DEM) in ArcGIS 10. A simple automatic delineation was carried out at sindapalli uppodai sub basin of vaippar River basin; Tamilnadu, India. Results showed that by using watershed function in ArcGIS 10 for watershed delineation in the sindapalli uppodai sub basin can be determined. This work is mainly a case-study of simple applicability of GIS as a tool of watershed delineation and drainage extraction (Venkatesan, 2016). Spatial data base building: All the thematic maps are created using GIS software by adopting digitization of scanned maps, editing for errors, topology building, attributes assignment and projection (Sharma et al., 2012).

There are two methods to evaluate the basin asymmetry: the transverse topographic symmetry factor method (*T*) and the asymmetric factor method (AF). An asymmetric factor (AF) can be applied over a relative large catchment area (Keller & Pinter 2002).

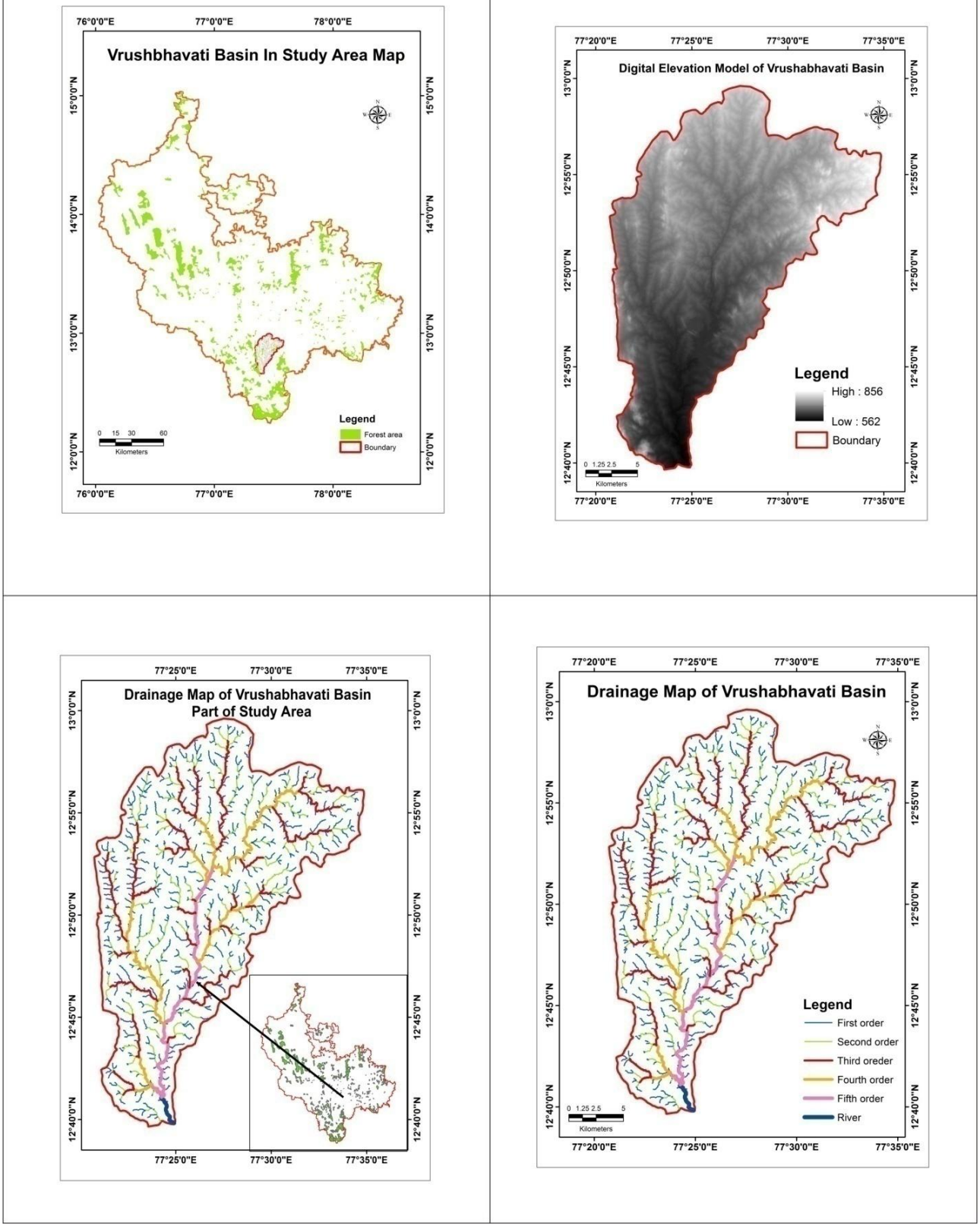
1. ArcGIS 10.1 Desktop→ArcToolbox→ Spatial Analyst Tools → Hydrology→Data: DEM data obtained from CARTOSAT
2. Setup Working Environment→Create Depressionless DEM - Fill Sinks→Create Flow Direction→ Create Flow Accumulation→Create Pour Points→ Snap Pour Points→Delineate Watersheds→Convert Watershed Raster to Polygons→Create Drainage Network→ Generate Contours (Map1.2).



Map1.2:- Dem, Fill, Flow Direction and Aspect Map of Study Area



Map 1.3: Study Area, DEM Map, Fill Map and Flow Direction Map



Map 1.4: Drainage Map of Vrushabhavati Basin

Results:-

Table 1:- Vrushabhavati Drainage Analysis by Toposheets and DEM (Drainage analysis)

By Toposheets			**By Cartosat DEM**	
Stream Orders	**Numbers**		**Stream Orders**	**Numbers**
First Order	762		First Order	710
Second Order	159		Second Order	131
Third Order	38		Third Order	30
Fourth Order	9		Fourth Order	7
Fifth Order	3		Fifth Order	2

In comparisons between the watersheds derived from the digital elevation data using the toolbox algorithms and watersheds manually delineated from topographic maps, agreement was very close (Jenson & Domingue, 1988). The study of the catchment characteristics with respect to floods using the advanced techniques of GIS reveal the best method for extraction of drainage networks and deri- vation of morphometric parameters from Cartosat DEM, and it reduces the efforts of digitization. The morphometric parameters derived from the Cartosat DEM helps in understanding the hydrological behaviour the South-East Dry agroclimatioc regions of Karnataka.

In the study area vrushabhavati area by Toposheet observed First order 762, Second Order 159, Third order 38, Fourth order 9 and Fifth order 3 and Deleneating the Drainage Pattern of using Cartosat DEM 710 First order, Second Order 131, Third Order 30, Fourth Order 7 and Fifth Order 2 this is the comparitivity between Toposheet and Digital Elevation Model Using Remote Sensing and Geographical Information system (Map 1.4).

Acknowledgement:-

Authors are thankful to the Central Ground Water Board (CGWB) Bangalore and Karnataka State Natural Disaster Management (KSNMDC) for producing the geophysical data for the study area. Author acknowledges the financial assistance under Rajiv Gandhi National Fellowship (RGNF) 2011-2015.

References:-

1. Azor, A., Keller, E. A., & Yeats, R. S. (2002). Geomorphic indicators of active fold growth: South Mountain–Oak Ridge anticline, Ventura basin, southern California. *Geological Society of America Bulletin*, *114*(6), 745-753.
2. Jenson, S. K., & Domingue, J. O. (1988). Extracting topographic structure from digital elevation data for geographic information system analysis.*Photogrammetric engineering and remote sensing*, *54*(11), 1593-1600.
3. Jha, M. K., & Peiffer, S. (2006). *Applications of remote sensing and GIS technologies in groundwater hydrology: past, present and future* (p. 201). Bayreuth: BayCEER.
4. Krishnamurthy, J., & Srinivas, G. (1995). Role of geological and geomorphological factors in ground water exploration: a study using IRS LISS data. *International Journal of Remote Sensing*, *16*(14), 2595-2618.
5. Machiwal, D., Mishra, A., Jha, M. K., Sharma, A., & Sisodia, S. S. (2012). Modeling short-term spatial and temporal variability of groundwater level using geostatistics and GIS. *Natural resources research*, *21*(1), 117-136.
6. Pius, A., Jerome, C., & Sharma, N. (2012). Evaluation of groundwater quality in and around Peenya industrial area of Bangalore, South India using GIS techniques. *Environmental monitoring and assessment*, *184*(7), 4067-4077.
7. Pramanik, M. K. (2016). Morphometric Characteristics and Water Resource Management of Tista River Basin Using Remote Sensing and GIS Techniques. *Journal of Hydrogeology & Hydrologic Engineering*.
8. Sayl, K. N., Muhammad, N. S., Yaseen, Z. M., & El-shafie, A. (2016). Estimation the Physical Variables of Rainwater Harvesting System Using Integrated GIS-Based Remote Sensing Approach. *Water Resources Management*, *30*(9), 3299-3313.
9. Shahzad, F., Mahmood, S. A., & Gloaguen, R. (2009). Drainage network and lineament analysis: an approach for Potwar Plateau (northern Pakistan).*Journal of Mountain Science*, *6*(1), 14-24.
10. Venkatesan, V. (2016). Extraction of Drainage Pattern and Watershed from SRTM Data Using GIS Tools: A Case Study. *Journal of Remote Sensing & GIS*, *7*(1), 1-9.