



Topographical Analysis of Kolhapur District with the Help of Remote Sensing and GIS

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Abstract:

Kolhapur city is trending to the west of Ichalkaranji city. The terrain analysis denotes the study area highly elevated to north – east and decrease towards north – west. That analysis is helpful to take some preventive measures like where to build artificial recharge structure to increase groundwater. The study of the structure is for the analysis slope, watershed delineation, and drainage pattern analysis and soil formation study. The rainfall runoff and soil erosion also analyzed from the slope analysis. The slope is more steep means runoff is more and the percolation rate of water is to low and its lead to soil erosion. GIS techniques are helpful to analyze the slope and aspect of that area and we can do the proper measurement for reducing the soil erosion problem.

Keywords: Terrain Analysis, Artificial Recharge Structure

1. INTRODUCTION

While considering geographic information system (GIS) to be software programs that manipulate spatial data, this definition is very restrictive. As the name implies, geographic information system are systems designed to input, store, edit, retrieve, analyze, and output geographic data and information (DeMers 2005). Like all systems (e.g., ecosystems, digestive systems, ventilation systems, etc.), the GIS is composed of an orchestrated set of parts that allow it to perform its many interrelated tasks. These parts include computer hardware & software, space & organizations within which these reside, personnel who use the system in a number of levels & capacities, data & information upon which the system operates, clients who obtain & use the products, vendor who supply the hardware & software, & other systems (financial, institutional, & legal) within which the GIS functions . While the software component of GIS is most often what we think of when we hear the term, its scope is far bigger & more comprehensive than that. Initially we will focus our discussion on the computer programs themselves-the technology component-and revisit the other components later in this book as appropriate. A representation of the world using points, lines, and polygons. Vector models are useful for storing data that has discrete boundaries, such as country borders, land parcels and streets.

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2. STUDY AREA

The Kolhapur district is extends between 15°43' to 17° 10' North latitude and 73° 40' to 74° 42' East longitude. The district occupies 7685 sq.km area. Physiographically it is situated in the Western Ghats region and characterized by the ridges and valleys. The physical setting of the Kolhapur district is divided into three main parts namely Eastern ranges, Central ranges and Southern ranges. Eastern and Central ranges have black soil formed from 'lava' and at some places it has large tracks of fertile land. The western ranges are mostly hilly and have red soil. The majority area in the west is under thick forest coverage.

STUDY AREA: KOLHAPUR

LONGITUDE: 73°40' E to 74° 42' E

LATITUDE: 15°43' N to 17° 10' N

AREA: 7685 km²

3. LITERATURE REVIEW

This chapter presents the review of studies conducted on the history and topographical analysis.

3.1. Mahadevaswamy.G concluded that, Quantitative analysis of drainage network found the dendritic to sub dendritic drainage pattern with Third order streams in all sub watersheds except Balurhundi and Nerle sub watershed. Stream frequency of all sub watersheds shows positive correlation with drainage density. The variation in values of bifurcation ratio among the sub watersheds is ascribed to the difference in topography and geometric development. Balurhundi sub watershed shows coarse drainage texture results in higher value of drainage density, stream order, elongation ratio and less length of overland flow. Except Balurhundi sub watershed, all the other sub watersheds showing fractured, resistance, permeable rocks and drainage network has not affected by tectonic disturbances.

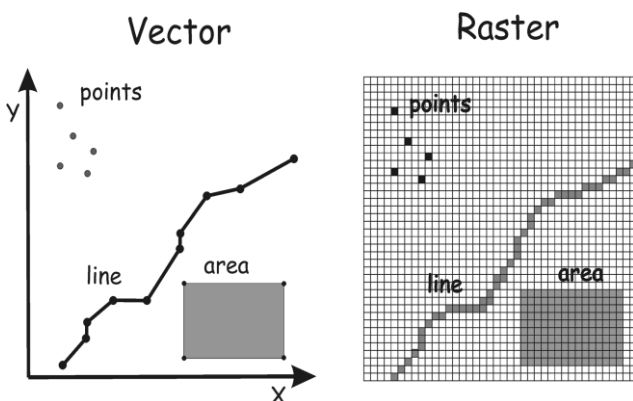


Figure.1.1. Vector and Raster Model

3.2 U. Kedareshwarudu concluded that, Analysis of watershed characteristics, land use pattern and land use changes has been taken up for the Upper Provenance of Karamana basin. Remote Sensing and GIS applications have proved very much useful in analyzing the basin characteristics. It is observed that Karamana basin is experiencing severe deforestation and environmental degradation. Deforestation may lead to other serious threats causing ecological imbalance like soil erosion, landslides, sediment pollution and is also lead to changes in hydrological and climatic regime. Socio-economic compulsions caused an impact in the land use changes and in turn environment degradation. The region needs monitor regularly with sustainable management schemes.

3.3 Sarita Gajbhiye concluded that, Quantitative analysis of drainage network found the dendritic to sub dendritic drainage pattern due to changes in slope and topography with six order streams in all sub-watersheds except sub watershed 1, 2 and 4. The variation in values of bifurcation ratio among the sub-watersheds is ascribed to the difference in topography and geometric development. Drainage density is very coarse to coarse texture. The development of stream segments is affected by slope and local relief (Strahler, 1964) the physiographic structure of the basin area produces high surface runoff values and low infiltration rates. The conventional methods of morphometric analysis are time consuming, tiresome and error prone, while use of GIS technique allows for more reliable and accurate estimation of similar parameters of watersheds. The morphometric analysis of different sub watersheds shows their relative characteristics with respect to hydrologic response of the watershed.

3.4 Syed Ahmad Ali, Nazia Khan concluded that, Remote sensing and GIS techniques are convenient tools for morphometric analysis. Detailed morphometric study of the Banas river basin represents dendritic to sub-dendritic drainage pattern with 5th order drainage. The larger number of first order streams indicate uniform lithology and gentle slope gradient. Banas river basin shows very fine drainage texture. The bifurcation ratio of the Banas river basin is 2.54 which indicate that the basin is normal and the control of drainage network is mainly pronounced by geomorphology. Lower value of bifurcation ratio indicates that the drainage basin is underlined by uniform materials and the streams are usually branched systematically. A plot of logarithm of number of stream vs. stream order shows deviation from straight line indicating regional upliftment. Banes river basin possess high drainage density which is indicative of less permeable material, sparse vegetative cover and moderate to high relief. Circularity and elongation ratio shows that the basin has elongated shaped.

4. OBJECTIVES

1. To study the topography of various section of a Kolhapur city by GIS and Remote Sensing system.
2. To help the client to understand the capabilities of GIS.
3. To identify background resources and data sources.
4. To study the stream order of Kolhapur district by GIS & Remote Sensing.

5. METHODOLOGY

For carrying out proposed work following methodology was adopted.

1. Software and Data used -

- a. ASTER DEM (USGS/NASA ASTER DEM data), available from
2. <http://www.gdem.aster.ersdac.or.jp>
 - a. Q - GIS 2.6.1 software. For study the terrain analysis of Kolhapur district we prepare
 - b. The study area with the help of QGIS software.
3. Collection of special data for Remote Sensing.
4. Trial analysis – Slope, Hill-shade, Contour, Aspect, relief Map, & Roughness index.
5. Create Digital Elevation Model of study area of Kolhapur district.
6. Compile all data for contour.

6. RESULT AND DISCUSSION

6.1 Introduction of QGIS:-

Geographic Information Systems (GIS) is a tool used to display, create, and analyze spatial information to help solve real world problems. It combines the graphics that make up a map with data tables of associated attributes. QGIS is a GIS platform that is available as a free web download. This tutorial guides you through the functionality of QGIS using fictitious data of the status of tree health on Brock University's campus. Your task is to identify trees in critical condition that must be removed from the roadsides on campus to prevent road blocks or accidents.

6.2 Digital Elevation Model:-

Digital Elevation Model When modern aerial photography and satellite remote sensing started to provide continues surface information by means of optical cameras, radar or laser beams, for example, and the derivation of terrain elevation was made possible by stereoscopy and interferometry, topography gained whole new meaning in spatial studies. Our ability to perceive and analyze the physical, biological, chemical and cultural character of the Earth's surface has, since, been greatly expanded. Today, the elevation in-formation is represented in computers as elevation data in a digital format. This for-mat is usually called digital elevation models (DEM). Thus a DEM is a computerized representation of the Earths relief. Different formats exists, among the most usual are triangulated irregular networks (TIN), regular grids, contour lines and scattered data points. A DEM is usually described either by a wire frame model or an image matrix in which the value of each pixel is associated with a specific topographic height. Digital elevation models are in combination with other spatial data, an important database for topography-related analyses or 3D video animations (e.g. fly-troughs). Different geo referenced 3D products can be derived and complemented by a coordinate system and presented in a 2D-map projection or as a 3D perspective view.

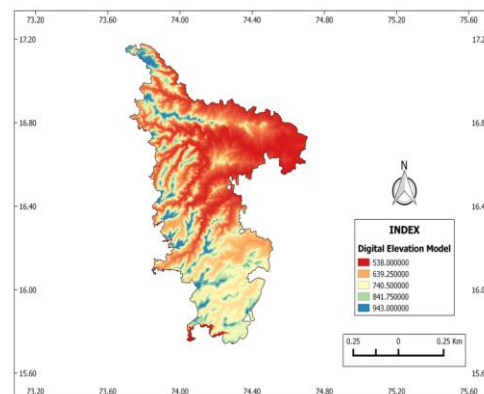


Figure.6.2 Digital Elevation Model

6.3 Slope Map:-

Slope identifies the steepest downhill slope for a location on a surface. Slope is calculated for each triangle in Tin's and for each cell in raster's. For a TIN, this is the maximum rate of change in elevation across each triangle. For raster's, it is the maximum rate of change in elevation over each cell and its eight neighbors. The Slope command takes an input surface raster and calculates an output raster containing the slope at each cell. Lower the slope value, the flatter the terrain; the higher the slope value, the steeper the terrain. The output slope raster can be calculated as percent slope or degree of slope.

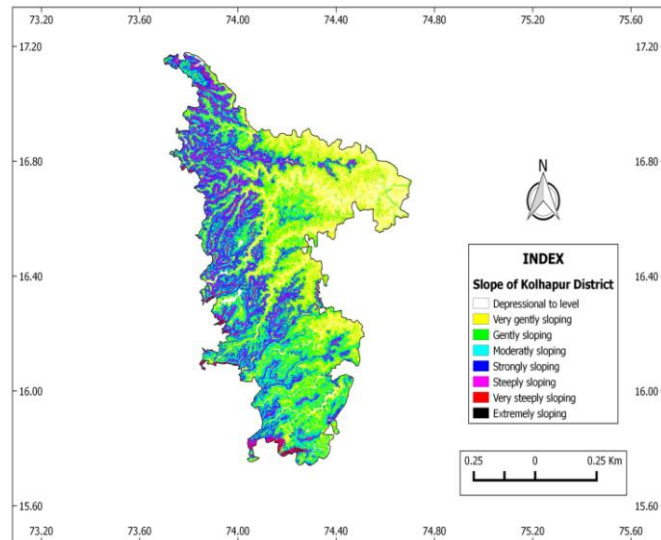


Figure.6.3 Slope of Kolhapur District Map

6.4 Aspect Map:-

Aspect is the direction that a slope faces. It identifies the steepest downslope direction at a location on a surface. It can be thought of as slope direction or the compass direction a hill faces. Aspect is calculated for each triangle in TINs and for each cell in rasters.

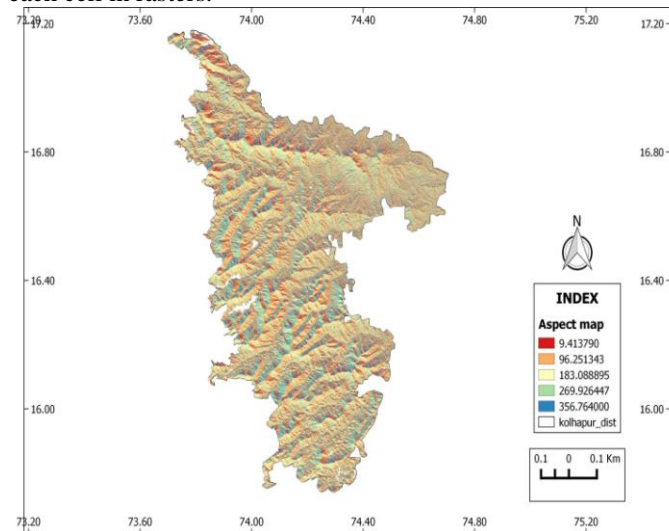


Figure.6.4. Aspect of Kolhapur District Map

6.5 Contour map:-

Contours are lines that connect points of equal value (such as elevation, temperature, precipitation, pollution, or atmospheric pressure). The distribution of the lines shows how values change across a surface. Where there is little change in a value, the lines are spaced farther apart. Where the values rise or fall rapidly, the lines are closer together.

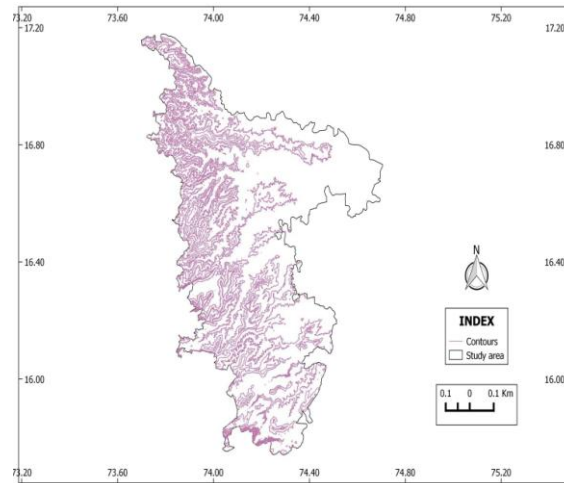


Figure.6.5 Contour of Kolhapur District Map

7. CONCLUSION:-

Remote Sensing and GIS are the advanced tools for surveying. With the help of Remote Sensing and GIS we studied the topography of Kolhapur district. With the help of Digital Elevation Model, Contour map, Slope map, Hill-shade map, Roughness Index map, Relief map.

We made the following concessions:

1. According to a Hill-shade map it is observed that North – West area shows hills and South –West area also shows hilly region. And towards East side it goes on decreasing.
2. According to a Contour map it is observed that North–West as well as South-West areas show close contour lines showing steep slope. Also East area shows contour lines far apart indicating flat surface.
3. According to a Slope map it is observed that North –West as well as South–West areas shows very gentle slope. East area shows plain surface.

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