3D MODEL CONCEPTION OF KOLLI HILL USING GEOSPATIAL TECHNOLOGIES

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ABSTRACT

An attempt has been made to apply the geological knowledge on the morphometric analysis from the Digital Elevation Model (DEM) creating by using spatial knowledge. Many geo-morphometric parameters such as DEM, Slope, and Aspects are related with elevation of the terrain. Digital elevation model is used to determine the features of drainage networks and slope of drainage network and to determine the characteristics of basins. The current analysis clearly indicates the relations between the various attributes of the morphometric aspects of the basin; it helps to understand their role in sculpturing the surface of the region geologically.

Key words: DEM Generation, Aspect, Slope, Flow direction, Flow Accumulation.

1. INTRODUCTION

A DEM is a representation of Earth surface with latitude, longitude and altitude, i.e. X; Y horizontal coordinates and height Z. DEMs play a significant tool for the extraction of three dimensional models (Swaraj and Anji Reddy, 2013). Digital Elevation Model is a quantitative representation of terrain and is consequential for geological and hydrological applications. DEM generation from

remotely sensed imagery is crucial for a variety of mapping applications such as ortho-photo generation, city modeling, object recognition, and creation of perspective views. Recently launched high-resolution imaging satellites (e.g., World view, 3, 2, SPOT-5, IKONOS, QUICKBIRD, ORBVIEW, and EOS-1) constitute an excellent source for efficient, economic, and accurate generation of DEM data for extended areas of Earth's surface (Shin et al., 2003).

Delineation of terrain parameters, such as slope, drainage network, watershed boundaries, etc. are very important for many geo-scientific studies. These parameters are often required in preparation of development and conservation design for natural resources, infrastructure development, town planning, etc. DEM

generated from stereo data has been validated using ground control points (GCPs). Evaluation of drainage pattern is carried out by morphometric analysis (Suganthi and Srinivasan, 2010).

2. STUDY AREA

The area chosen for the present study forms a major portion in the Namakkal District of the state of Tamil Nadu kolli hills (Fig. 1), except for a small pocket on the eastern part of the hill, which lies in Tiruchirappalli District. The study area is geographically situated between the north latitudes 11°11′N to 11°30′N and east longitudes 78°16′E to 78°29′E covering an area of 485 Sq. km. On the northern side, it is bounded by Salem District and in the eastern and the south eastern sides; it is bounded by Tiruchirappalli District.

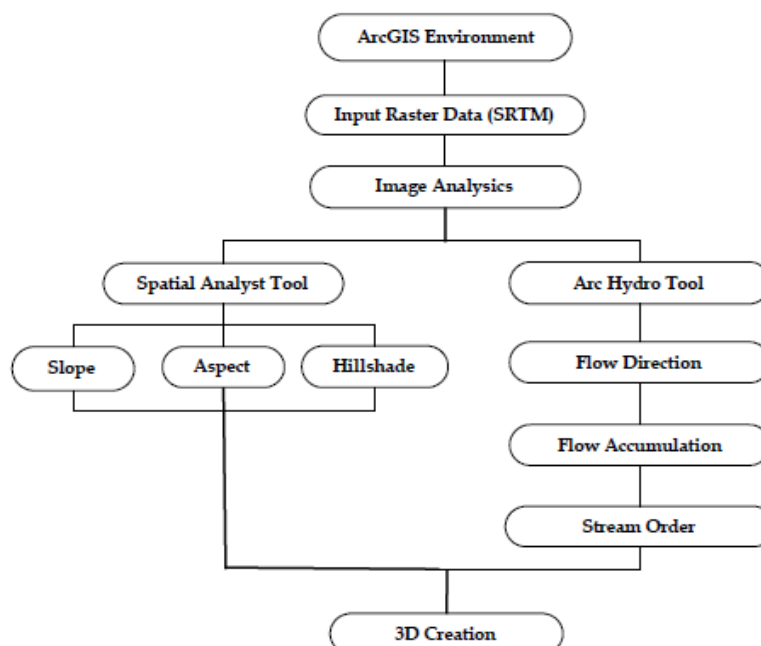**Fig.1. Location map of the study area.**

3. METHODOLOGY

Fig.2. Flowchart showing methodology.

4. RESULTS AND DISCUSSION

4.1. Spatial Analyst

4.1.1. Slope

Slope is analyzed from the SRTM image. This is classified based on pixel values. The study area is extracted (cropped image) from the identified slope with its dark black to white which indicates the slope of the study area from low to high. The same SRTM image was classified into three zones as high, medium and low is given (Fig.3).
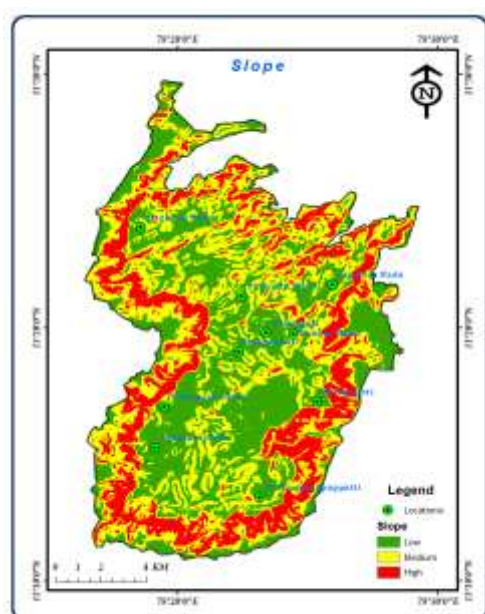

Fig.3. Slope map of the study area.

4.1.2. Aspect

Investigation of an aspect helps to identify the slopping directions and easy us to view the steep areas. In kolli hills, aspect based on the slope has been classified as below. It says that most of the steep slopping towards almost west, northwest, south and south east (Fig. 4).

4.1.3. Hillshade

Graphical display, hillshade can greatly enhance the relief of a surface. In the study, it has been focused on the later and this image has been used as a 3D image. The hillshade map are shown in Fig.5. The sun angle of the map shows from NE direction. The height of the terrain, as in the map, shows black tone for valleys and white tone for the elevated portion. The higher elevation was noticed as 181, and the lowest was 0. The field

difference related to the elevation of the hill varies from 300 to 1200 above elevation.

4.2. Arc Hydro Analysis

4.2.1. Flow Direction and Flow Accumulation

Drainage networks are made from the flow accumulation model. A lower limit value is determined considering the precision and size of the study on this model, and according to the highest cell value obtained from the flow accumulation model. All cells above this lower limit value are defined as a part of drainage network. When defining these drainage networks, all cells except for cells with zero values represent a part of the drainage network. By considering the water flow directions and flow accumulation model in the drainage network, main stream and side-branches are created. Water flow direction in the flow accumulation model is from cell with lower values to those with higher values. Drainage network map of the study area was drawn on this flow accumulation model (Fig. 6). This map shows existent stream paths and possible drainage network paths.
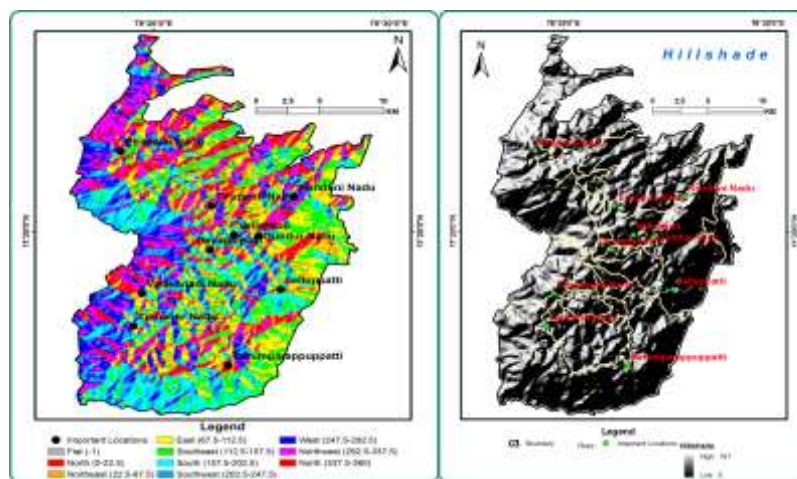
Fig.4. Aspect map.

Fig. 5. Hil

3D MODEL CONCEPTION OF KOLLI HILL USING GEOSPATIAL TECHNOLOGIES

P a g e | **395**   Gurugnanam. B,   Kalaivanan. K, Bairavi. S, and Vinoth. M

4.2.3. Stream Order

If the streams are idealized as single lines containing no lakes, islands, nor junctions of more than two streams at the same point, the resulting diagram is known in the geomorphic literature as a dendritic stream network. The sources are the points farthest upstream in a stream network, and the outlet is the point farthest downstream. The point at which two streams join is called a junction. An exterior link is a segment of stream network between a source and the first junction downstream. An interior link is a segment of stream network between first two successive junctions or between the outlet and the first junction upstream (Fig. 7).

The following table shows the stream order found in the study are calculated based on the Strahler (1952) method.

Stream order	Length (m)
I st Order	60698.32
II nd Order	17720.34
III rd Order	6978.52
IV th Order	1575.19
V th Order	2056.65

4.3. Digital Elevation Model

Geographic Information systems (GIS) used to delineate the watersheds, stream-networks and drainage order. Digital elevation models (DEM) are efficient and effective methods used to determine the features of drainage networks like size, length, and slope of drainage network and to determine the characteristics of basin and sub-basin.

Moreover, the DEM has many significant values like slope, direction, flow length and good visual effects for the

common people too. Elevation information of each contour was defined in geographic information system and according to these values; three-dimensional modeling of the

field was gained at 10 mts elevated is

given in Fig 5.

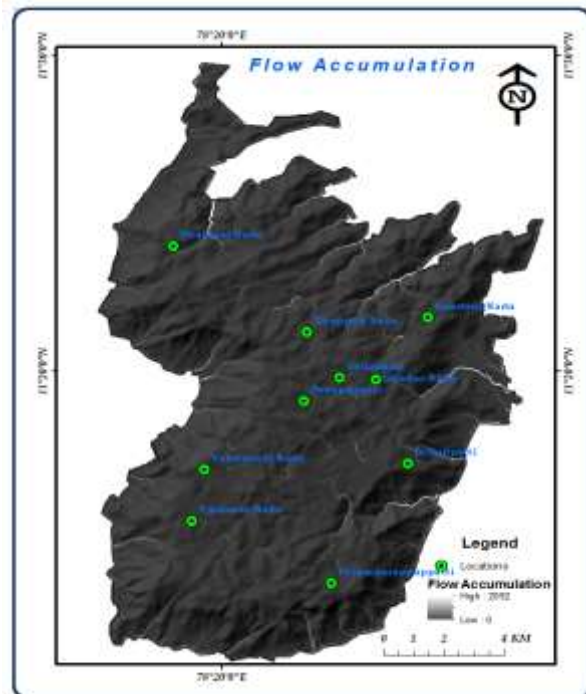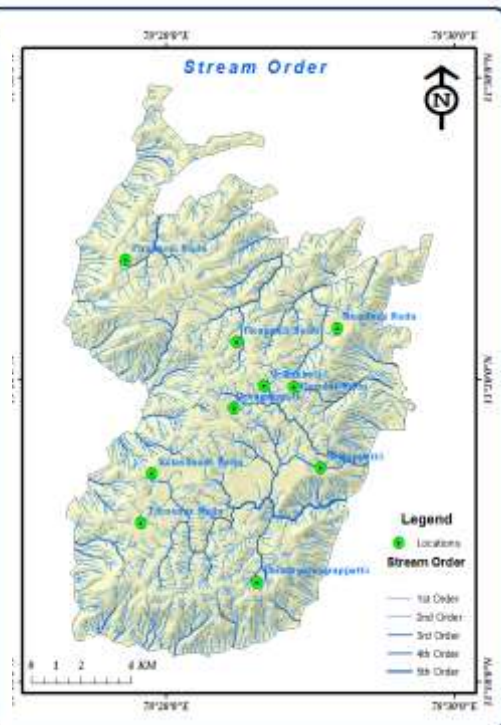**Fig. 6. Flow Accumulation map.**

Fig. 7. Stream Order map.

Typical applications of DEM for water systems include: (1) Watershed storm water management; (2) Floodplain mapping and flood hazard management; (3) Hydrologic and

Documenting field work; (5) Planning, assessment of the feasibility and impact of system expansion; (6) Estimating storm water runoff from

hydraulic modeling of combined and storm sewer systems, including estimating surface elevation and slope from digital elevation model data (DEM); (4)

the physical characteristics of the watershed, e.g., land use, soil, surface imperviousness and slope (Shamsi, 2002 and Longley, 1999).
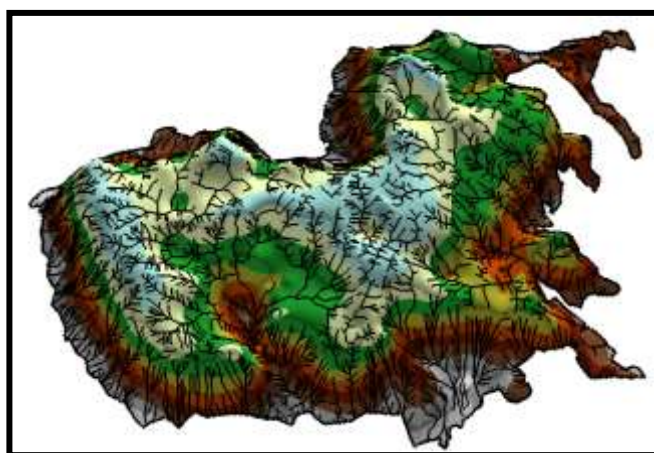
Fig. 8. Digital Elevation Model of the study area.

5. CONCLUSION

Three dimensional studies are carried through various techniques. Gathering information is the main for competence. Here, DEM creates a broad understanding of the elevated feature easily. This helps to produce the valuable resource information systems. The preceding analysis clearly indicates the relations between the various attributes related to the morphometric aspects of this basin. It further helps to understand their role in sculpturing the surface of the region.

6. ACKNOWLEDGEMENT

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