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MORPHOMETRIC ANALYSIS OF MENDKARIVER: A TRIBUTARY OF SINA, AHMEDNAGAR, MAHARASHTRA

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ABSTRACT:

Drainage basin evolves as a result of interactions among the flow of matter and energy and resistance of the topographic surface. A drainage basin with all it's elements and attributes can be considered as an open system where there is continuous exchange of matter and energy with the surroundings. Mendka River which is selected for present study that is tributary of the Sina River. Morphometry of this river has calculated by using Arc GIS 9.1 software. Analyze steam ordering, length, bifurcation ratio, length ratio & other Linear & Areal Aspect such as DEM, Slope, Aspect, Drainage map etc. through this study analyze that there is no geological & structural control on river channel. Suggestion is to stop the human interference.

Key Words- *Areal Aspect, Bifurcation ratio, Length ratio, Linear Aspect, Morphometry.*

INTRODUCTION:

Morphometry is defined as the measurement of the shape. Morphometric studies in the field of hydrology were first initiated by Horton and Strahler in the 1940s and 1950s. Morphometric aspects of the river basin are useful in order to explain hydrological processes and the susceptibility for the erosion processes. The recognition of morphometric features along a region will achieve important perspectives; as such information permits an integrated overview of the diversfactor acting over the landform. The conventionally topographical maps are used for the morphometric and basin characteristics of the river basin. In such cases, it becomes difficult to examine all the morphometric and basin characteristics due to the vast area and rough terrain of earth surface. But now a day's morphometric analysis of the river basin is enhanced by the development

in the software and the advancement in the satellite data and it's availability in the public domain.

STUDY REGION:

Mendka River is of the tributary of the Sina Basin,Originate on Bagadi hill. She is flowing west to east direction near Ahmednagar district. It meets to Sina Near PargoanmaulaCoordinates of Mendka Basin is19°2'4"north to 18°59'41"north latitude&Longitude 74°34'27"east to 74°47'21" east.

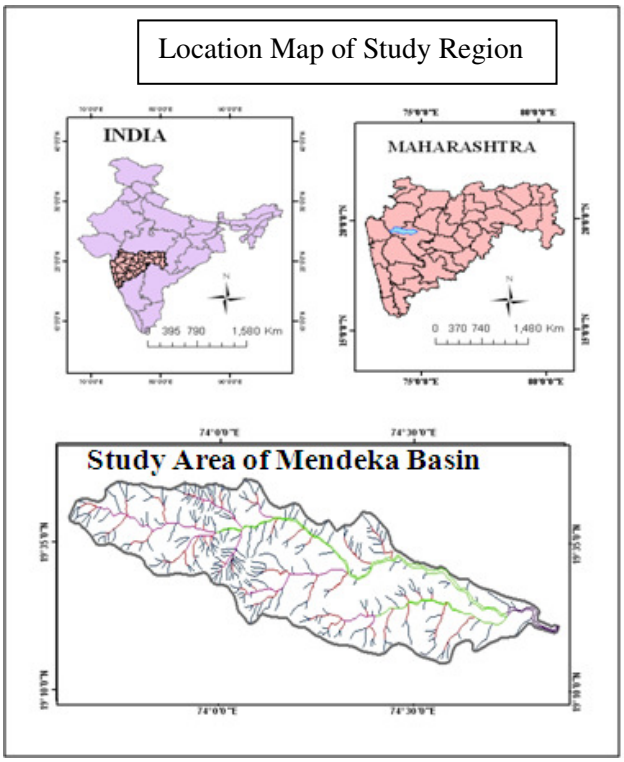

Fig-1 (Location Map)

AIMS & OBJECTIVES:

- To study the Morphometry of Mendka River basin.
- To Study the Drainage system of Mendka River
- To Study the Surface Characteristics of Mendka River Basin.

METHODOLOGY FOR TOPOSHEET DATA

Digitization of layer:

Geographical data in the toposheet is given in the form of the signs and symbols with attribute. This information is made usable for the analysis of the GIS software for that purpose various layers were which are important for the study of the area under investigation. For the entire study area

(Mendka Basin) contour, rivers with all the orders and all the spot height of the study area were digitized with the help of software Arc GIS 9.3.

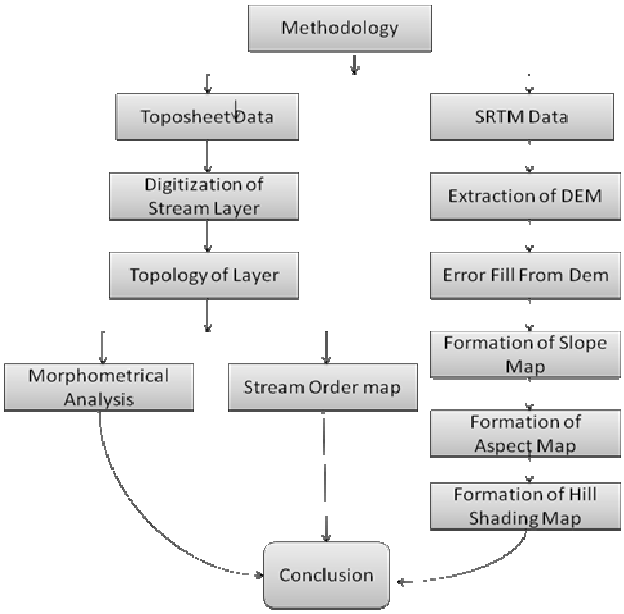

Fig-2 (Methodology chart)

Topology of the data:

After the digitization analyst can't use that data without error correction. For the correction of the error topology is needed. Topology was done for the digitized layer in using the same software.

Ordering of river:

For morphometric analysis of the river in the basin area it is necessary to give order for each and every tributary and main stream. Channel segments were ordered numerically from a stream's headwaters to a point somewhere down stream. Numerical ordering begins with the tributaries at the stream's headwaters being assigned the value 1. A stream segment that resulted from the joining of two 1st order segments was given an order of 2. Two 2nd order streams formed a 3rd order stream, and so on. In all the order went up to 5^{th}orders are in the area depicted in the toposheet.

MORPHOMETRICAL PARAMETER OF THE BASIN AREA:

In many studies, the characteristics of the basin morphometry have been used to predict or describe geomorphic processes such as prediction of the flood peaks, assessment of the sediment yield and estimation of erosion rate. The analysis of various stream parameters such as ordering of various stream, measurement of basin area and perimeter, length of drainage channels, drainage density, stream frequency, bifurcation ratio, texture ratio, basin relief etc are very useful indices which help us to understand the landforms operating at different scales (Verstappen, 1983; Kumar et.al.2000).

Fluvial morphology include the consideration linear aspect, aerial aspect and relief aspect of a fluvially originated drainage basin the topographical parameters includes basin area, basin length, basin width, relative relief, absolute relief etc. And the basin parameters are includes the drainage density, stream frequency and bifurcation ratio.

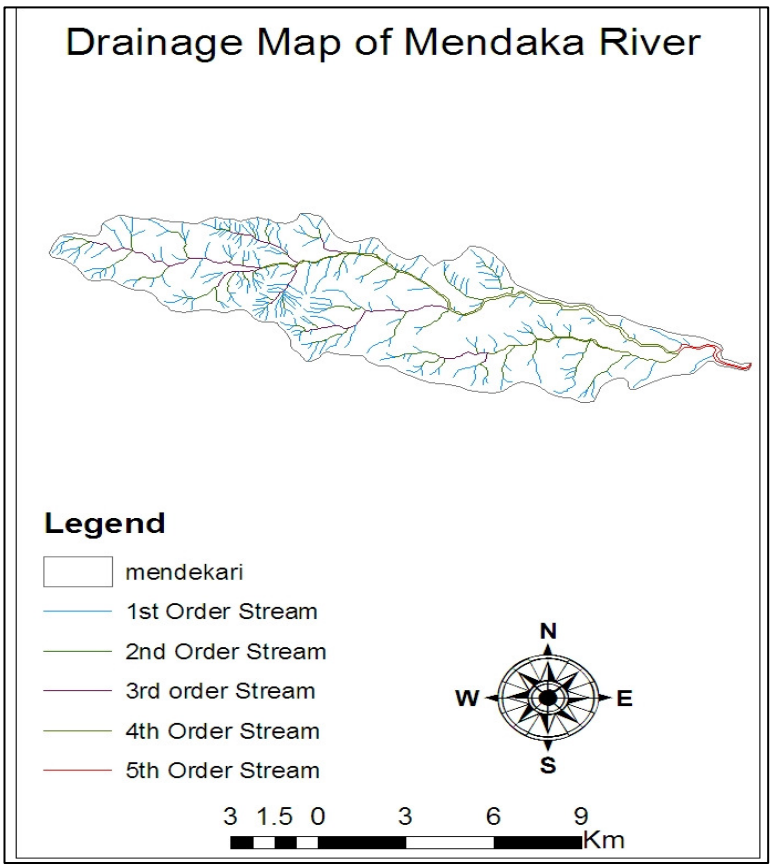

Fig-3 (Drainage Map)

Table -Drainage Basin and Network Morphometry

Parameters	Toposheet data
Linear Aspect	
Stream order	5
Total Stream Length	246.9313Km
Length of main stream	48 km
Stream Length Ratio	1.93
Bifurcation Ratio	4.605
Aerial Aspect	
Drainage Density	3.12 km/km^2
Stream Frequency	3.82km/ km^2
Slope	0.0035
Elongation Ratio	0.21
Circularity Ratio	0.16

LINEAR ASPECT:

Computation of the linear aspects such as stream order,stream number for various orders, bifurcation ratio, streamlengths for various stream orders and length ratio are described below. All these parameters are shown in table 3.1).

a) Stream Number (Nu):

It is obvious that the total number of streams graduallydecreases as the stream order increases. Using Arc GIS, the number of streams of each order and the totalnumbers of streams were computed.

b) Stream Order:

The variation in order and sizeof the tributary basins are largely due to physiographicand structural conditions of the region. Application ofthis ordering procedure through GIS shows that thedrainage network of the study area is getting the 5th order of the stream.

c) Stream length (Lu):

Length of the stream is different for the different order of the stream. Total stream length of for all the orders of the streams indicated by toposheet data is 246.9313Km.

d) Length ratio (RL):

The length ratio (RL) is defined as the ratio of meanstream length (Lu) of segment of order (u), to mean streamsegment length (Lu-1) of the next lower

order u-1.leangth ratio for the toposheet data is 1.93The RL has an important relationship with the surface flow discharge and erosionalstage of the basin(Sreedevi et al. 2005).

e) Bifurcation Ratio (Rb):

The term 'bifurcation ratio' (Rb) was introduced byHorton (1932) to express the ratio of the number of streamsof any given order to the number in the next lower order.According to Strahler (1964), the ratio of number of streamsof a given order (Nu) to the number of segments of the higherorder (Nu+1) is termed as the Rb. Bifurcation ratio calculated for the toposheet data is 4.19 Bifurcation ratio of the Mendka River is between 3 to 5 and it indicates geological and structural control in the basin of study area (Sreedevi et al. 2005).

AERIAL ASPECT:

a) *Drainage Density (Dd)*

The relationship between various environmentalvariables and Dd has been analysed and the mainfindings are reported below.Several studies indicate the influence of climate ondrainage density.

Dd is generally inversely related to hydraulicconductivity of the underlying soil. For steep slopes, aninverse correlation has been modeled by Montgomery and Dietrich (1992). Generally, Dd increases with decreasinginfiltration capacity of the underlying rocks and/ordecreasing transmissivity of the soil.Horton (1945) definedDd as the total length of channels(Lu) in a catchment divided by the area (A) of the catchment. Drainage density is 3.12km/km^{2}for study area.Dd is high for this study it's indicatethat their decreasing infiltration capacity of Mendka River.

b) Stream Frequency (Fs)

The stream frequency (Fs) of a basin may be defined as the number of streams per unit area (Horton, 1945).Stream frequency shows the texture of thedrainage network.2.59km/ km^2 stream frequencyisindicated by the toposheet area which indicates that at least 2 streams are in the 1km^2. Once again the value is less in case of SRTM data, ie, 3.82 km/Km^2.

METHODOLOGY FOR SRTM DATA:

Extraction of DEM from SRTM data:

DEM is extracted from the SRTM data of (SRTM _51_09) which was downloaded from the glcf website.DEM was generated from SRTM data and are given in Fig 5.

This data was extracted from area shape file. For that spatial analysis tool option was used and extracted DEM by mask.

Fill error from raw SRTM data:

This extracted part of the SRTM data is raw it is contained some error, and analyst should fill these error. After extraction Arc Hydro extension will be used. In this process sinks and peaks errors are removed.

Flow direction model:

Flow direction was calculated for each pixel using the fill DEM. flow direction relates to the direction in which water will flow out of the pixel to one of the 8 surrounding pixels. This concept is referred to the eight direction (8D) Pour point model (Ozdemir and Brid, 2008). The direction of flow is determined by finding the direction of steepest descent from each cell this is calculated as:

Change in z value /distance*100

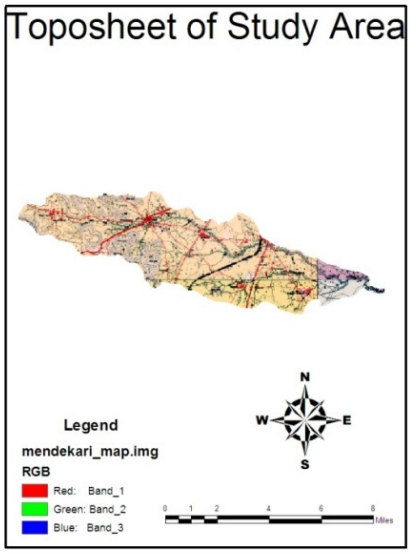

Fig-4 (Study Area Map)

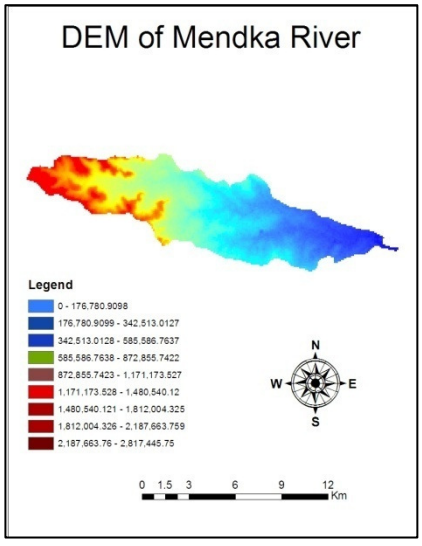

Fig-5 (DEM Map)

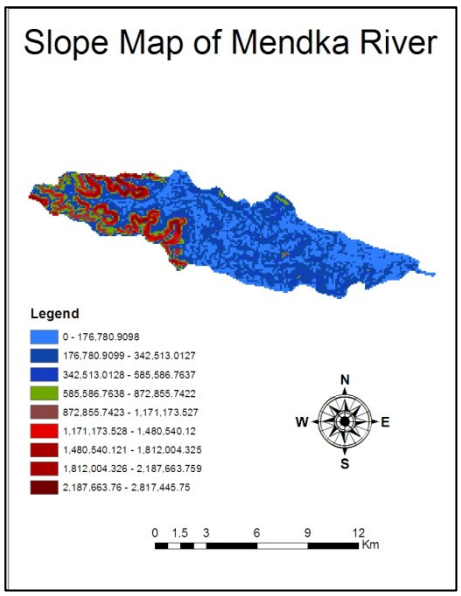

Fig-6 (Slope Map)

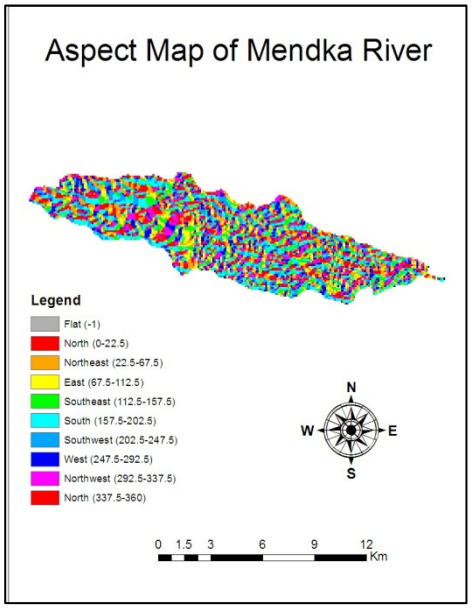

Fig-7 (Aspect Map)

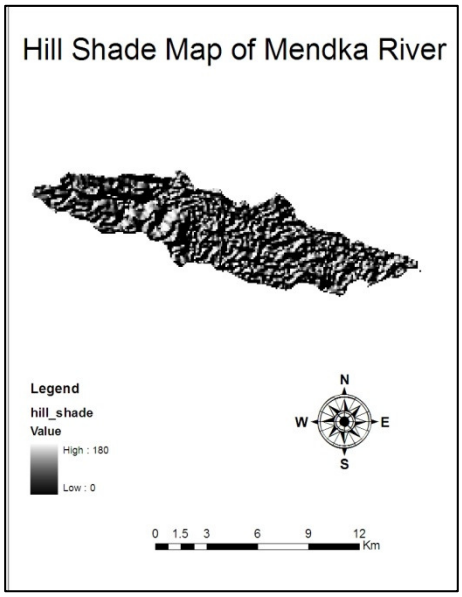

Fig-8 (Hill Shade Map)

FINDINGS:

1. Stream ordering, stream length, total stream length, main stream length length ratio and bifurcation ratios were calculated.

2. Mendka River has showing 5th order stream with tree Shaped drainage pattern.

3. Bifurcation ratio is 4.19 Value between the 3 to 5 indicate there is geological and structural control and all the streams flow with geological control, but simply follows the existing slope direction

4. Total Length of the all the streams is the 247 km. Length ratio is lesser for the Study region. It is it is give the information about the surface flow discharge and the Deposited sediment at the bed & bank. And it s Happen because of Drainage discharge is very less.

5. Slope map & Aspect map of Study region has shows direction of flowing water is change with human interferences.

CONCLUSION:

ThisRiver is a victim of a human interference. Water Scarcity is main problem of the area & secondly sand extraction, because of that river bed has totally change due to it's problem water discharge has not flow by proper channel.Recommendation is that should be totally stop the human interference.

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