ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 05, pp.32088-32096, May, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

MORPHOMETRIC ANALYSIS OF RELIEF ON JAYANKONDAM BLOCK, ARIYALUR DISTRICT, TAMILNADU, INDIA

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ARTICLE INFO

Article History:
Received 10th February, 2016
Received in revised form
23rd March, 2016
Accepted 14th April, 2016
Published online 31st May, 2016

Key words:

Relief, Ruggedness, Roughness, Morphometric, Drainage, Jayankondan

ABSTRACT

Morphometric parameters likespatial distribution of relief (contour lines) and drainage basin (Stream area) was studied in Jayankondan block. The Jayankondan block lies between 10 54'N to 11 30'N latitude and 78 40' to 79 30' longitude with an area of 343.81 sq.km. It is bounded on the south by T, palur and Ariyalur block and on the north by on the western side by andimadam and sendurai blocks. The Jayankondam block consists of 32 panchayat villages. Morphometric studies involvesthe evaluation of measurement of various profiles such as (superimposed, composite and projected profile), height histogram, hypsometric curve, relative relief map, average slope map. Analysis of various drainage parameters namely ordering of the various streams and measurement of area of basin, perimeter of basin, length of drainage channels, drainage density (Dd), drainage frequency, bifurcation ratio (Rb), drainage texture (T), Roughness index and ruggedness was determined which are used to describe and compare the basins of different sizes. A major objective of morphometrics is to statistically determining the factors that affect relief features. No segment of the basin is gauged and only piecemeal information on the basin is available as no research has been carried in this direction.

Citation: Dayalan, N. 2016. "Morphometric analysis of relief on Jayankondam block, Ariyalur district, Tamilnadu, India", *International Journal of Current Research*, 8, (05), 32088-32096.

INTRODUCTION

Morphometric analysis are commonly performed on organisms which is useful in analyzing their fossil record, the impact of mutations on shape, developmental changes in form, covariance between ecological factors and shape, as well as for estimating quantitative-genetic parameters of shape. Morphometric studies are also used to quantify a trait of evolutionary significance, and by detecting changes in the shape, function or evolutionary relationships. A major objective of morphometric is to statistically analyzing the factors that affect shape. Morphometric parameters was also used to describe and compare basins of different sizes. Such parameters include profiles (superimposed profile, composite and projected profile), height frequency histograms, hypsometric curve, relative relief map (smith), average slop map (Wentworth), stream order, bifurcation ratio, drainage density, drainage texture, roughness index and ruggedness numbers. But the story is different as far as the Jayankondam relief is concerned. According to Wentworth (1930), Morphometry is the measurement of geometry of a drainage basin or of a part of it. Significant numerical values for the linear, areal and relief properties of the area concerned can be obtained from such measurements. According to Horton (1945) Geomorphologists and hydrologists often view streams as being part of drainage basins. A drainage basin is the topographic region from which a stream receives runoff, through flow, and groundwater flow. Drainage basins are divided from each other by topographic barriers called a watershed. A watershed represents all of the stream tributaries that flow to some location along the stream channel. The number, size, and shape of the drainage basins found in an area vary with the scale of examination. Drainage basins are arbitrarily defined based on the topographic information available on a map. The quality of this information decreases as map scale becomes smaller. According to smith (1950), the quantitative assessment as well as morphometric methods are applied and measurement from the topographical maps. According to Dean C. Adams, F. James Rohlf and Dennis E (1980) Slice explains the Geometric Morphometrics: Ten Years of Progress following the 'Revolution' multivariate analysis could be visualized as configurations of landmarks back in the original space of the organism rather than only as statistical scatterplots. The quantitative assessment as well as morphometric methods are applied which is used in the

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measurement from the topographical maps, which provide us with detailed information about the landform.

The Present Study and Its Major Objectives

The present study is analysing and evaluating the relief features by morphometric studies at Jayankondam block using different parameters.

Find out the significance of relief and their evolution of topology in Jayakondam block.

Study Area

Jayankondam block limit extends up to 343 sq. km. The population of Jayankondam is 33,945 peoples as per sex-ratio (1,031 females for every 1,000 males) which is much above the national average of 929.The physical background of the study area is a vast plain which istransversed by non-perennial streams. The volume of water in the rivers depends upon the occurrence of rainfall. The major rivers or drainage basins are Vellar River in the North and Colarden River in the South and it has no well-marked natural divisions. The climate of the study area is hot and dry. The rainfall of Jayankondam is steady compared to adjoining blocks, taluks and districts. The availability of Lignite at Jayankondam and nearby places is a bountiful gift of Mother Nature. Geologist considers the Fossils that are excavated as national assets (Figure 1).

MATERIALS AND METHODS

Morphometric Studies at Jayankondam block, the data have been collected from survey of India toposheet or topoplan No.58M/8 and 58M/7, scale 1:50,000 or 2 Centimetres represents 1km. The toposheet reduced 1:60000 scale, using various parameters, the spatial distribution of relief (contour lines) and drainage basin (Stream area) was determined. Morphometric studies involve evaluation of measurement of various profiles (superimposed, composite and projected profile), height histogram, hypsometric curve, relative relief map, average slope map. Analysis of various drainage parameters namely ordering of the various streams and measurement of area of basin, perimeter of basin, length of drainage channels, drainage density (Dd), drainage frequency, bifurcation ratio (Rb), drainage texture (T), Roughness index and ruggedness was determined.

RESULTS AND DISCUSSION

Profile

Serial Profile

A set of simple when arranged serially is known as serial profile. When closely spaced, they give visual impression about the characteristics of the landform.

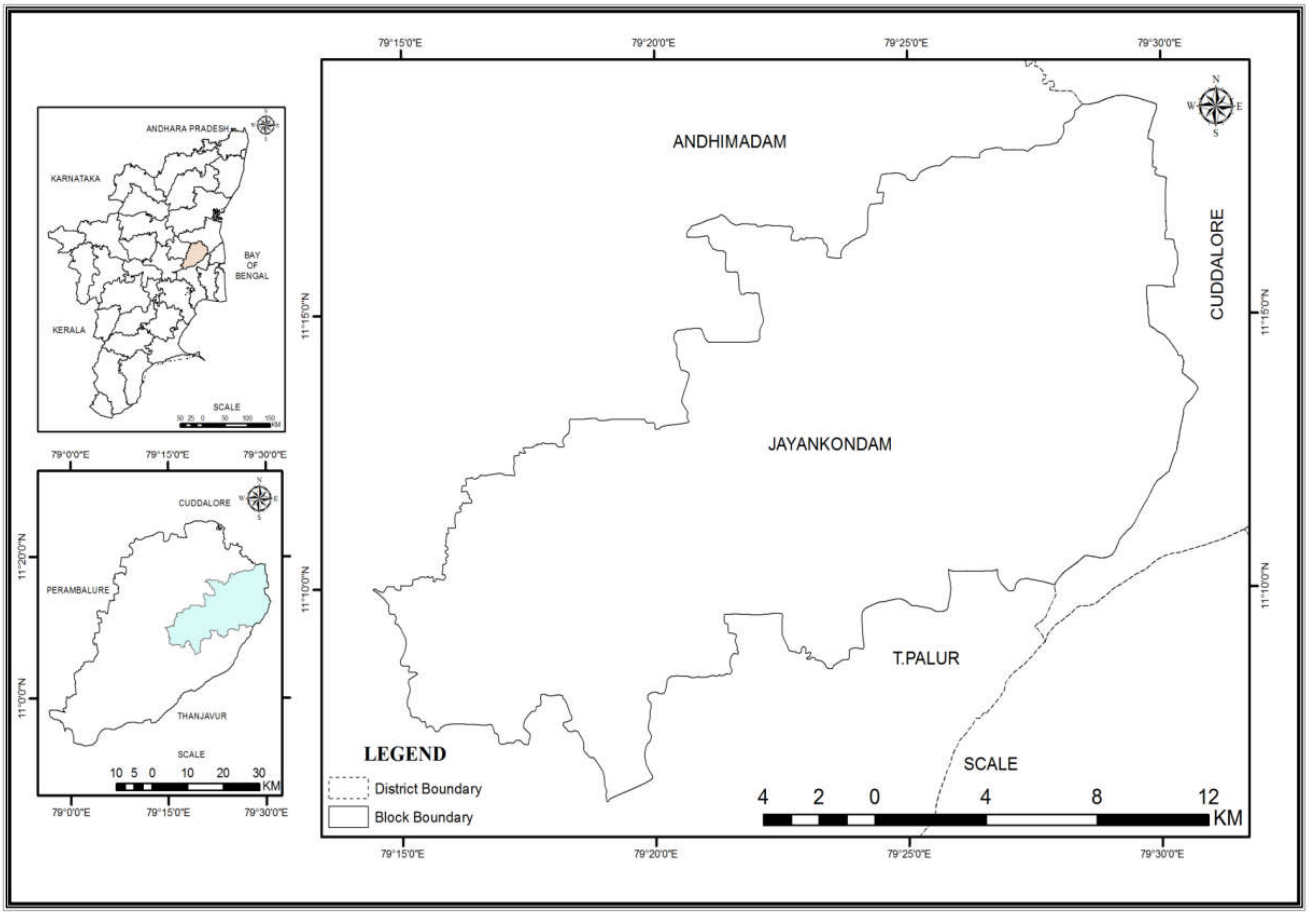

Figure 1. STUDY AREA

This Figure 2 represents the topographic profile of A1-B1, A2-B2, A3-B3, A4-B4, A5-B5, A6-B6, A7 -B7 from west to east. The slope gradually flows from west to east in which valley side is replaced by Colarden River.

The Superimposed Profile Plotting of a set of serial profiles covering an area on a single frame is known as superimposed profiles. Grouping of lines help in identifying plateau top, high level erosion remnants, the major break of slope and amount of lowering etc.

Projected Profile: A sketch of profile with a complete shape of the nearest one and peeping of the other profile behind the former one is known as projected profile gives a panoramic view.

Composite profile: Drawing of the upper most line from the diagram of superimposed and projected profile produces a composite profile. It is a line of greatest height across the strip. It illustrates the ruggedness of the skyline.

Figure 3 Superimposed, Projected, Composite profiles have been used to describe that this valley is developed into sub-tributary basin (Colarden River) of cauvery river because a part of Cauvery river flows towards the east which is formed as Colraden river.

Height frequency curve

The contour interval or spot height shown in the toposheet and maps are classed into groups and frequency from which frequency percentage or values are determined for each group. The height frequency group will indicate the most important erosional surface.

The distance between them also describes topographic landscape height was about 20-40mt. which is followed by 40-60mt. which is followed by 20-40mt. is seen at explain the contour topographic line. This height frequency curve has explained that moderate height containing contour line is seen at higher frequency with gentle slope.

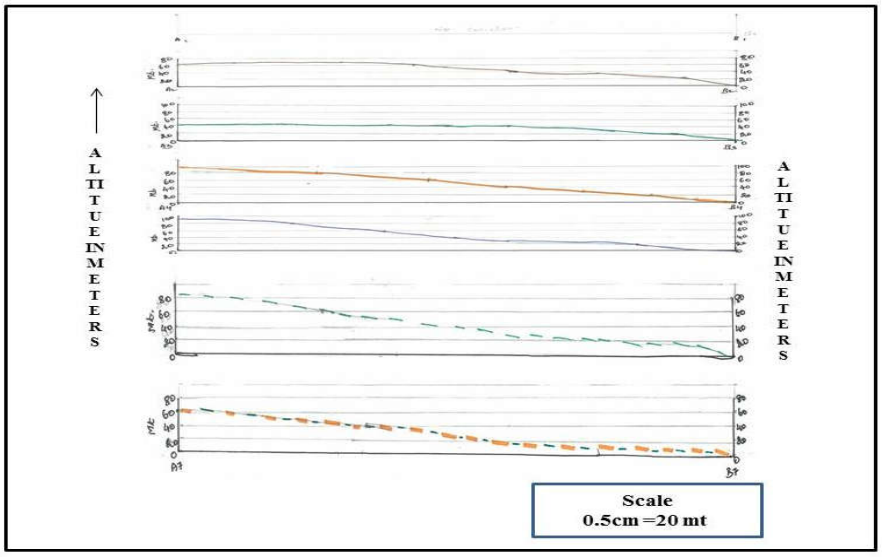

Figure 2. Serial Profile

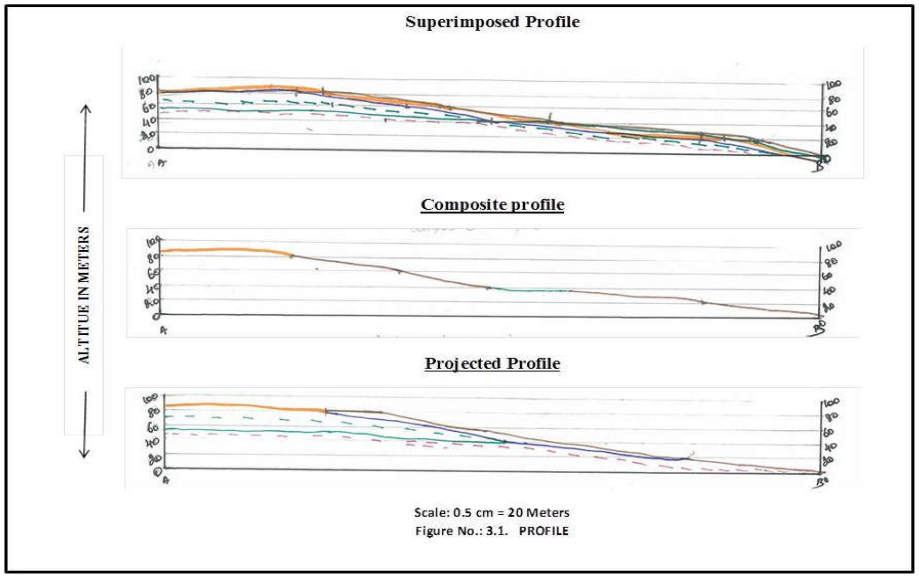

Figure 3.

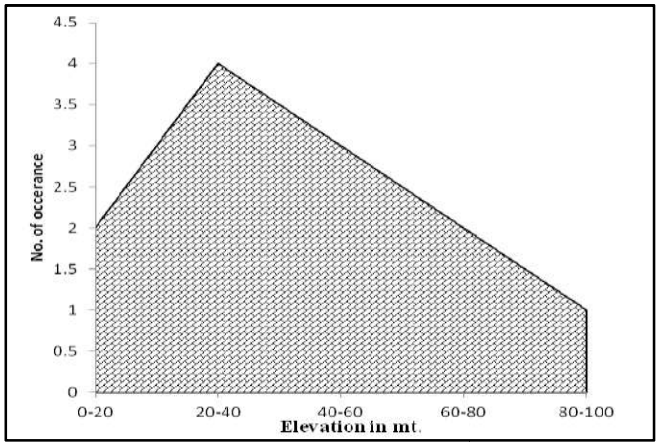

Figure 4. Height Frequency Curve

Hypsometric Curve

The areas which enclosed by each contour are plotted against height as proportion to total area and proportion of total height.

The formula

$$\frac{\text{Total Area- Area Any Particular Contour}}{\text{Total Area}}$$

Hypsometric integral curve is defined as the proportion lying below the curve to the total square graph. When it lies within 6.6-1, it indicates youthful stage. When the integral lies between 0.35-0.60 it indicates maturely dissected landform and less than 0.35 indicates equilibrium or old stage of dissection.

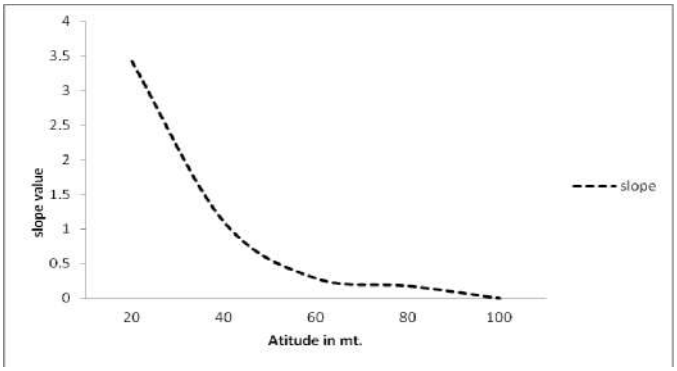

Figure 5. Hypsometric Curves

The Figure 5 describes the topographic slope of the region. In this study, topographic land of youthful stage is seen which is due to presence of Colarden River nearer to study area. This region has gentle slopeat average height with high landscape is seen. Step slope is seen which due to hard rock. The water flow in river is seen only during rainy season or while opening dam.

Relative Relief map

To start with, a topographical sheet is divided into squares of say 5 min. of longitude and latitude. Differences between the highest and the lowest points within each of the squares are marked and plotted on a small-scale base map. Isolines are then drawn by joining places of same difference to get a choropleth map showing relative relief.

The map no.:6 shows that western and the eastern region has low or little relative relief topography and this study areahas no relative relief change in broad level except in few places. It is due to presence of gentle slope topography and drainage pattern.

Average Slope Map

According to this method firstly the contour map of the area is covered with an east-west, north-south gird, then contour crossings are counted and then tabulated for determining the average number of contour crossing per mile. The procedure was repeated using an oblique grid over the same area and the average number of contour crossings per mile determined. He then applied the following formula to determine the tangent of the average angle of slope of the land surface.

The average angle of slope (tanÕ)

$$\frac{\text{Average no. of contour crossing per mile (A)} \times \text{contour interval (I)}}{3361\text{(constant)}}$$

The map no.: 3.2 determines the slope in degree. In that, the north, northeast, east, southwest and central parts of the Jayankondam block consists slope which flows in direction from north east to southern part of study area. It is due to presence of Colarden River aside to this region, the slope is towards east.

Stream Ordering

Horton formulated a system of ordering to arrange the streams of a drainage basin in a hierarchical order. According to this scheme a stream without any tributary is a first order stream. Two first orders join to form a second order; two second order joins form a third order and so on. He then extended the highest value of order towards the head. Shreve observed that any addition of a new stream to the main channel will enhance is energy and therefore amalgamation of any number of streams will increase the order.

The Figure 8 explain the drainage basin in the study area, mostly first order small streams channel was seen followed by second order which is followed by third order and fourth order streamline. The streamline is based rock hardness and topographical structure of the study area.

Stream Frequency

It is defined as number of streams per unit order of a drainage basin on percentage. It is independent of the drainage density for the same basin.

The Figure 9 explains the stream frequency in percentage at study area, mostly first order (small streams channel) captured high per cent was seen followed by second order which is followed by third order and fourth order per cent at streamline.

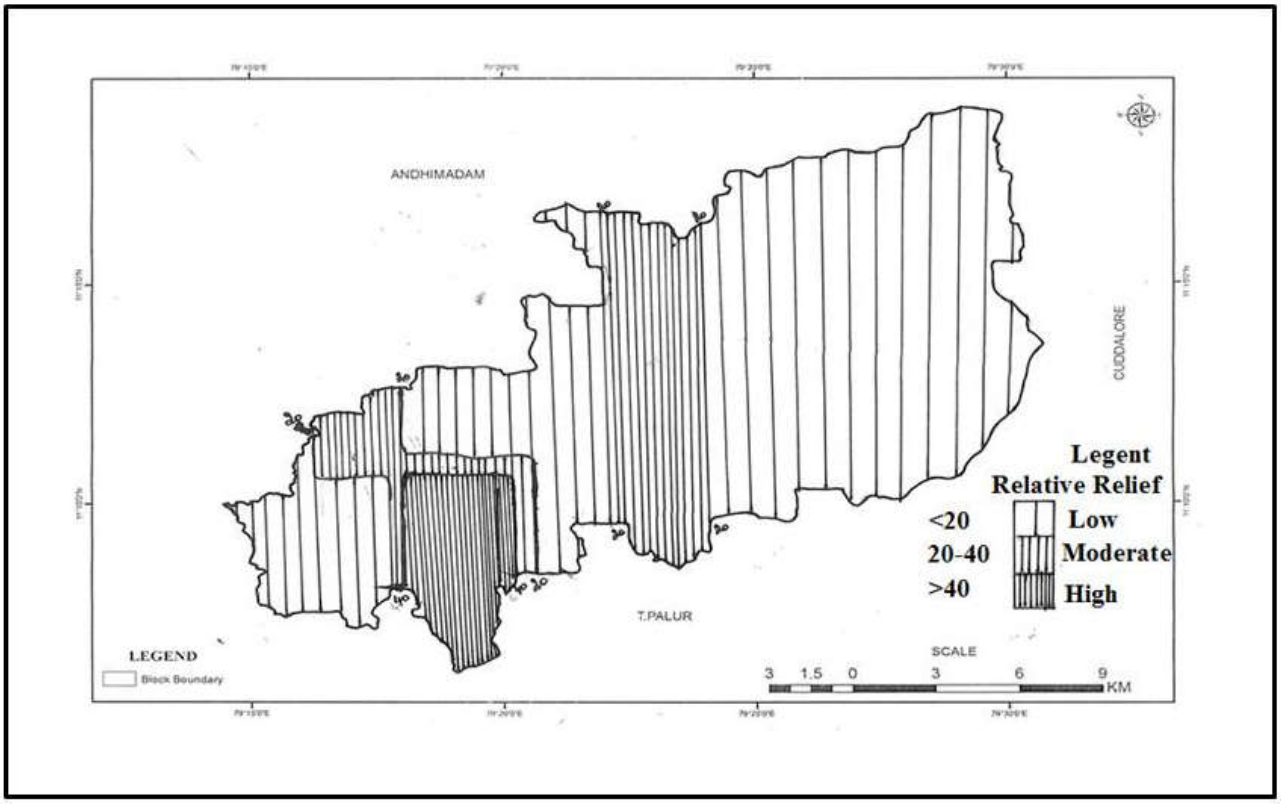

Figure 6. Relative Relief Map

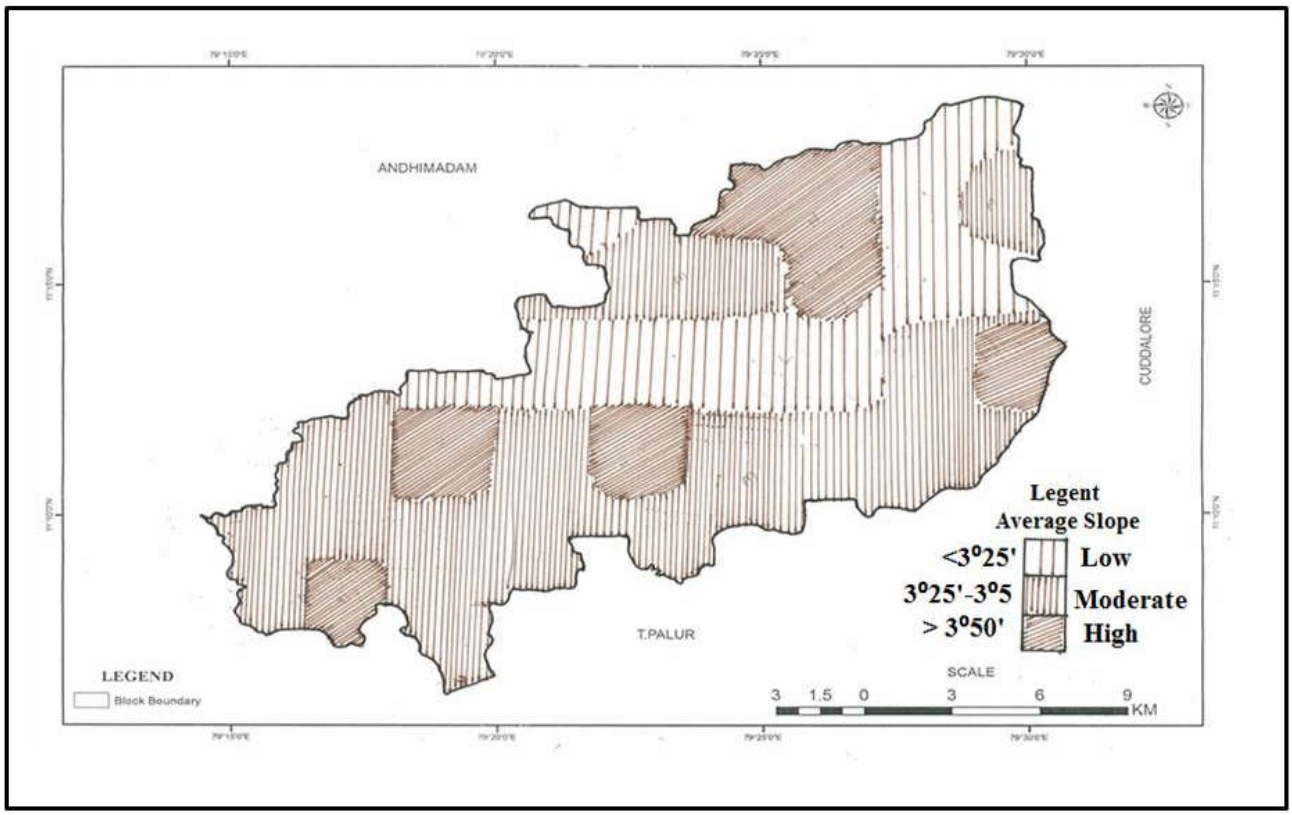

Figure 7. Average Slope Map

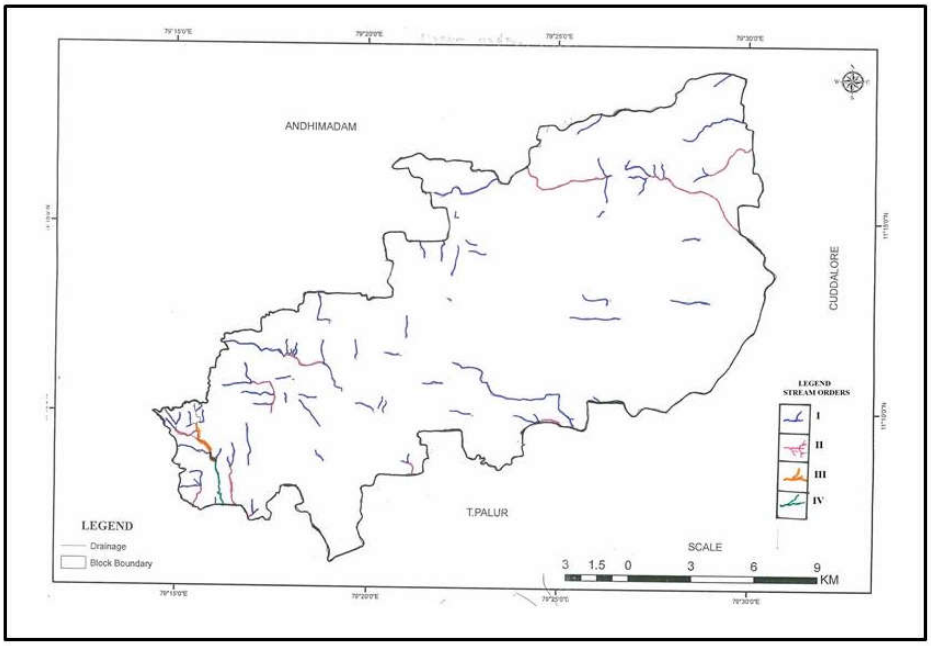

Figure 8. Stream Order

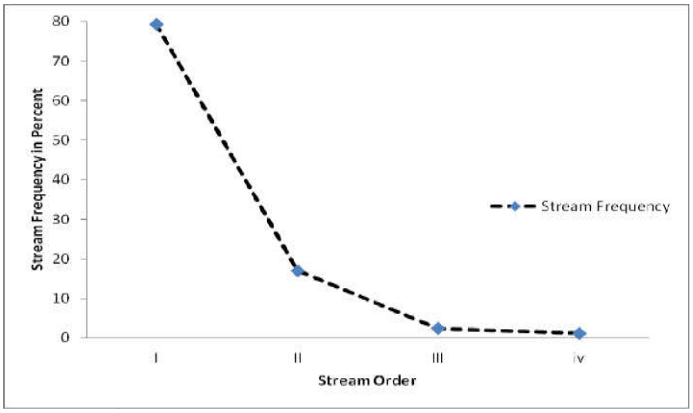

Figure 9. Stream Frequency

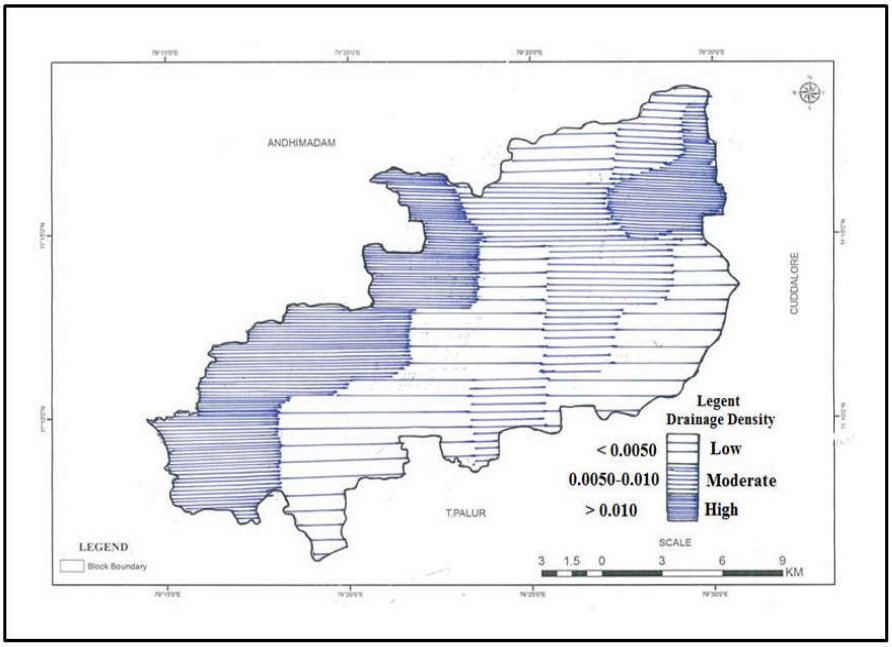

Figure 10. Drainage Density

Bifurcation Ratio

It is defined as the ratio of the number of stream segments of any order to the number stream segments of the next higher order. It gives the idea about the rate of bifurcation towards the water divide.

Table 1. Bifurcation Ratio Index

S. No.	Stream Order	Number of Segments	Bifurcation Ratio
1	I	65	4.6
2	II	14	7
3	III	2	2
4	IV	1	

The Table 1 this method also describes the water utilization is describes each area and their level to be understood. First bifurcation ratio value is not greater than second bifurcation value, the second to third order, the third order to fourth order greater than study area so, drainage basin is satisfactory in the study area.

Drainage Density

According to Horton as the total length of stream channels per unit area represents a very important to geo morphometric parameter. It is independent of order and varies inversely with the size of the basin.

The Figure 10 represents density level at western region is high, which is due to nature of topography which is based on rock hardness. A slight variation in density is seen in this study area. From this drainage of a stream measured. The variation is seen at 0.0050 densities. This region the density flow from western to eastern part reaches Colarden River slope which is located at study area.

Drainage Frequency

It is defined as number of streams per unit area of a drainage basin. It is useful for the study of texture of drainage. It is independent of the drainage density for the same basin.

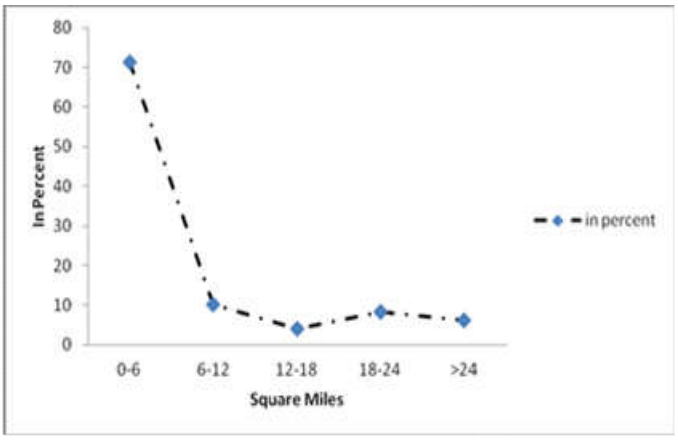

Figure 11. Drainage Frequencies in Percentage

The Figure 11 explain the drainage frequency in percentage at study area, mostly 0 to 6 sq miles (small streams channel) captured high per cent was seen followed by 12 to 18 sq. miles, which is followed by 12 to 18 sq. miles, 18 to 24 sq. miles and above 24 sq. miles order per cent at streamline captured. It is due to relief and drainage basin.

Drainage Texture

It is defined as the product of drainage density and drainage frequency. The scale of drainage texture is as follow below 4.0 coarse grains,4.0-10.0 intermediate grains, 10.0 - 15.0 fine grains and above 15.0 ultra-fine and bad land topography.

The map no.: 3.5 determines the drainage texture from the study area is few regions up land found coarse grains and intermediate grains. Other vast area covered at soft rock formation such as easily eroded in fluvial process. It is due to formation of gentle slope.

Roughness Index

Relief roughness, or smoothness, inspections are performed to monitor the pavement condition in order to evaluate the ride quality of new and rehabilitated pavements. Roughness is closely related to terrain, water dynamics and drainage basin development. A pavement profile represents the vertical elevations of the pavement surface as a function of longitudinal distance. The roughness index formula:

$$N \times \frac{\frac{M}{4}}{4} \times 10$$

N= total no. intersection of contour lines with to sets of perpendicular girds, set at 45 to each other. 4 and 10 are constant.

M= distance in miles between grit lines

The roughness index of this area depends upon the nature of topography, relief and drainage basin. Low roughness or smoothness area is more susceptible to erosion which results in gentle slope. While comparing this with other sites, the topography nature of this has smooth surface. The roughness is seen from north to northeast region. The eastern region of this study area has Colarden River which is the reason for low roughness and smoothness topography.

Ruggedness

It is defined as the product of relative relief and drainage density. It is combined expression of relief, texture and slope steepness, although a precise index is yet to be worked out.

Figure no.:3.7 represent the ruggedness index of the relief. The map indicates the strong relief and hard rock topography found in eastern part of study area. The strangeness depends upon the nature of topographic and drainage basin. Ruggedness at different sites of this area is low, no extent variations is seen.

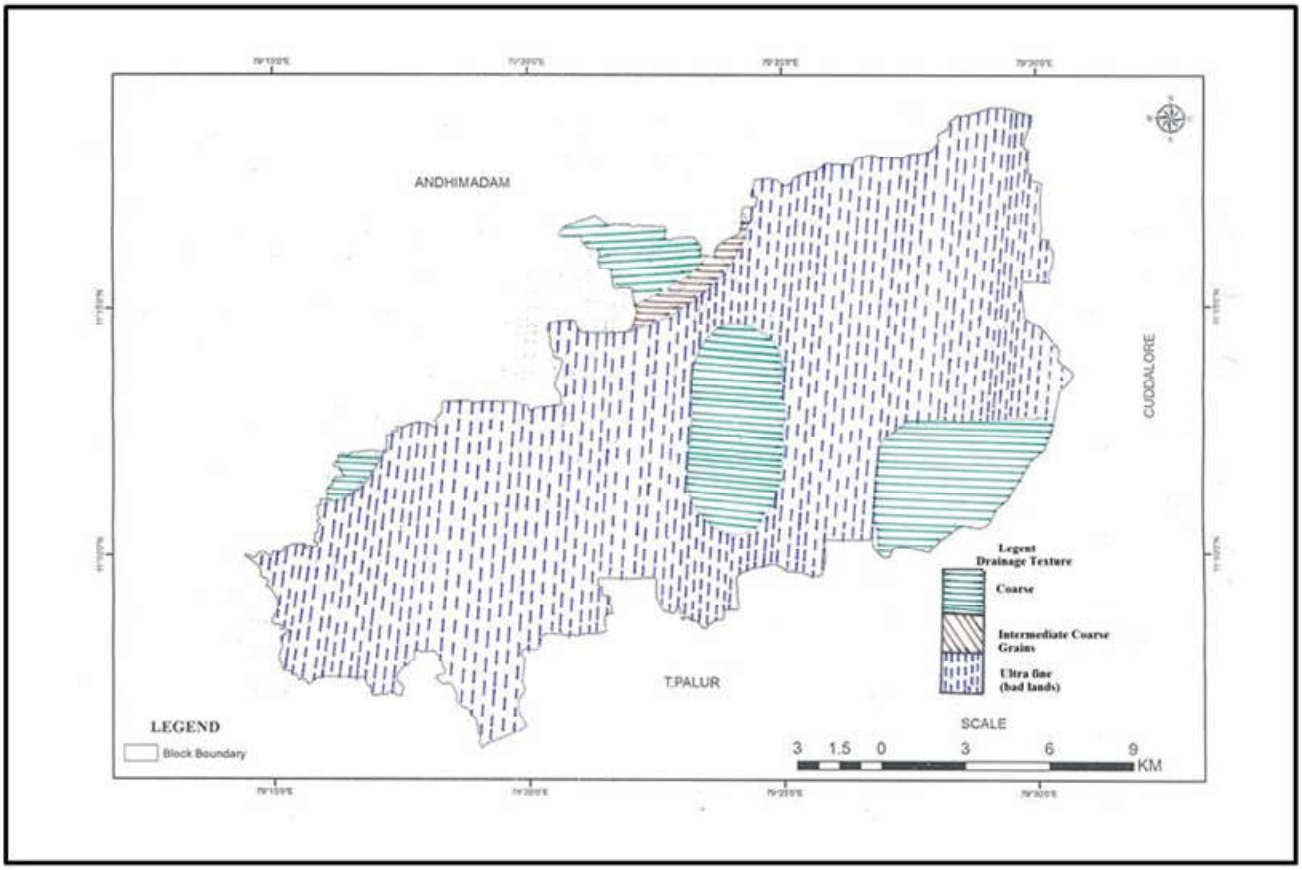

Figure 12. Drainage Texture

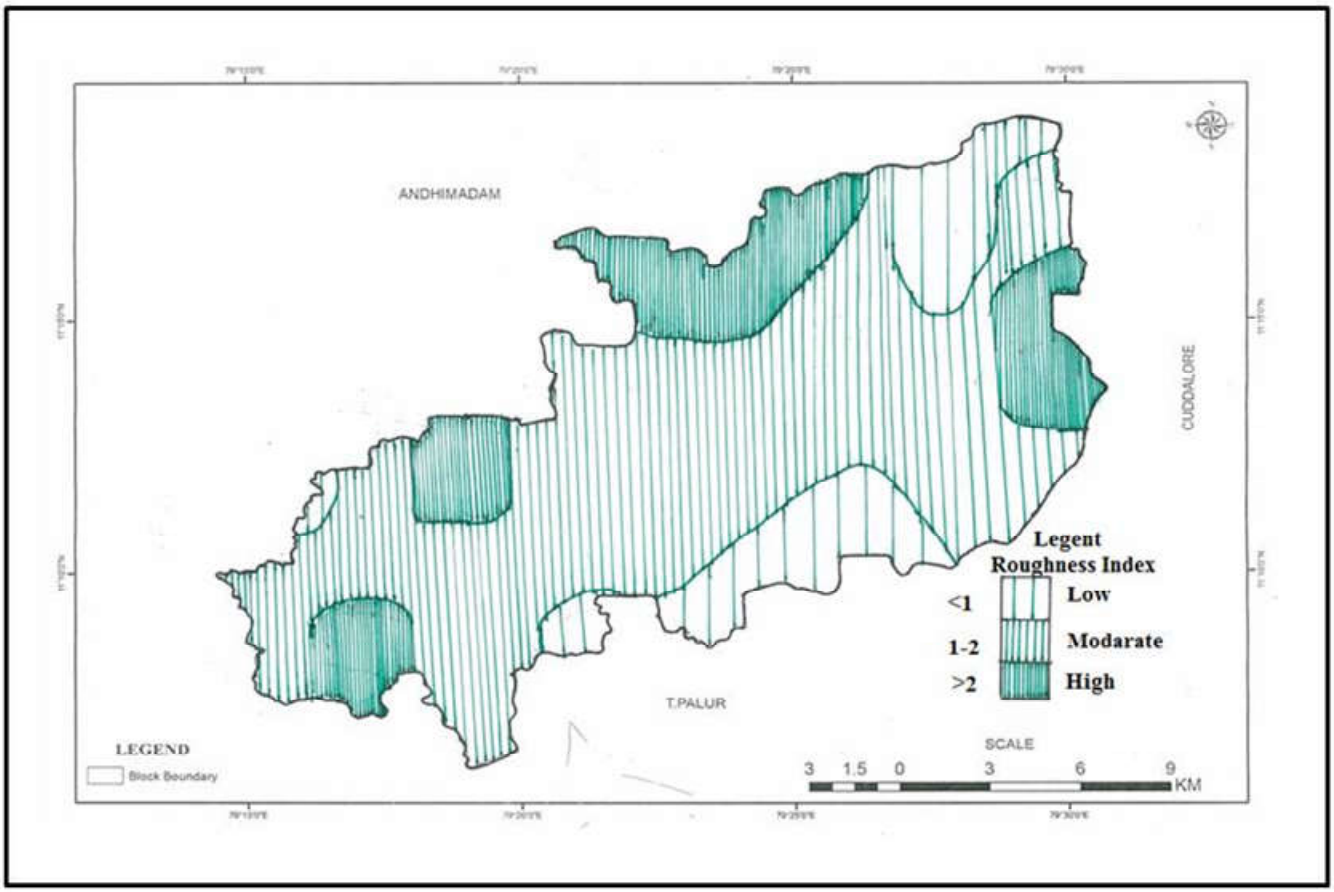

Figure 13. Roughness Index

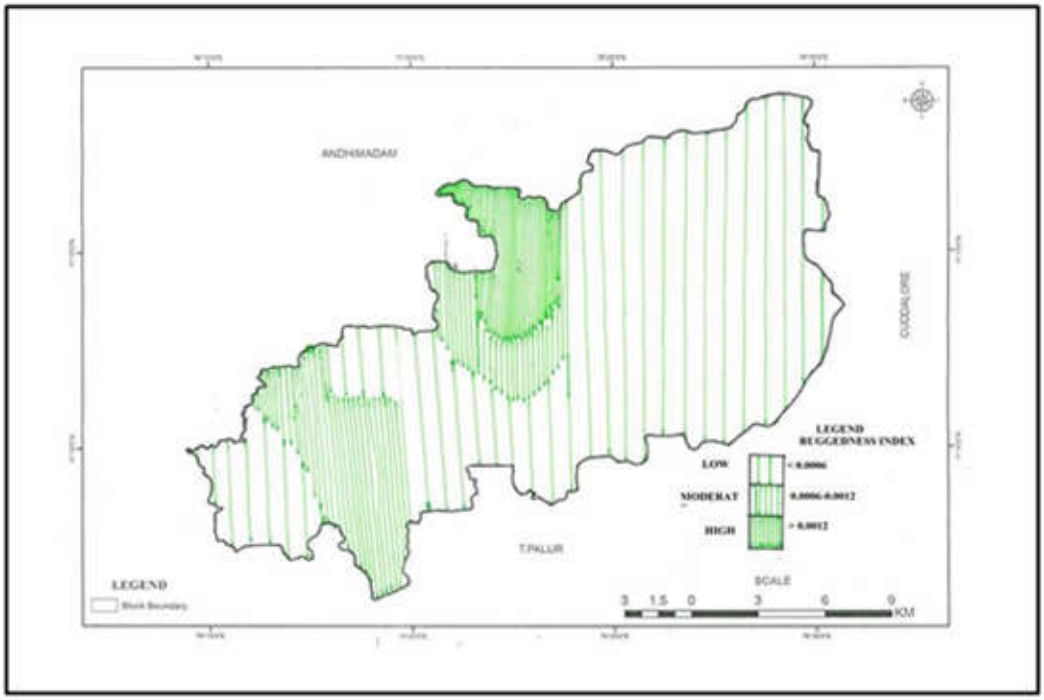

Figure 13. Roughness Index

Conclusion

It is concluded that, by using different parameter relief formation is the significant one for relief study of the topographical lands. The Jayankondam block relief is seen from the west to east which is due to presence of Colarden River and on the other hand, topographical structure character is discussed where greater amount of water is scattered in different direction as small streams, slightly varied relative relief, average slope, very fine topographical texture type of rocks or poor land topology, rock bed with moderate smoothness, week topology. So, this is the reason for the formation of slope towards the eastern region. These are such features which form the gentle slope relief and topology at study area. The morphometric analysis is important study and it serves as the backbone of the relief study.

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