Integrated Watershed Management of River by Using Geoinformatics: A Review Paper

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Abstract: *Watershed planning greatly depends on examination of drainage basins using Geoinformatics. The most effective way to determine how different aspects relate to one another in the watershed is through morphometric analysis. There is no set standard classification or meaning for every parameter, even though this field of study has been covered in a large number of technical papers. Evaluating the values of each morphometric parameter is incredibly perplexing. With sufficient background information, this paper discusses the significance of the values of the different morphometric parameters.Each classification is thoroughly examined, along with the spectrum of possible values and any intimations.In addition to categorization and its outcomes, we are concerned with the caliber of given data, including preparing the data as well as scope and degree of detail of mapping.*

I. INTRODUCTION

All land areas that collect precipitation and release water into streams, lakes, or other bodies of water are considered to be part of the drainage area or watershed, which refers to a region drained by a river system. A comprehensive method of controlling erosion in the catchment area and safeguarding and enhancing the quality of the water is known as "Watershed management."Comprehensive watershed River basin management is necessary to recognize and evaluate seasonal variations in the features of drainage basins, comprehend the potential of groundwater, and handle problems pertaining to the control of soil erosion brought on by flash floods during high flows.

II. METHODOLOGY AND ANALYSIS

I. Data Used:

Topographical map; 1: 50000 scale Toposheets from the Survey of India (SOI); 30 m spatial resolution DEM from ASTER, 90m resolution from Shutter Radar Topography Mission (SRTM); and RS data such as 1RS – P6 (Resource SAT – 1), 1 RS – 1D. All research papers used LISS 111, LISS ID PAN, 1 RS – P6 (Resource SAT – 1), and LISS 1V as raw input data.

II. Stream Length Ratio (R_I)

It refers to the relationship between the overall length of a stream segment at one order and the subsequent minimum order ofa section of a stream.Their completely formed geomorphic stage is suggested by the Stream Length Ratio increasing from minimum to maximum range. RI is not categorized as a result.

Bifurcation Ratio (R_b).

It is the number of stream segments in an order divided by the totalstreams in theorder.Dimensionlessness is an attribute of R_b. There are basically following classes for Rb values: lesser and greater. Lesser class denotes the absence of influence of geologic conditions on the drainage pattern. Structures, whereas the high class indicates that geologic structures regulate the drainage pattern. There is even no statement regarding the range of values for R_b categorizations which differ amongst the investigators. It is possible to classify less than five as low and more than five as high based on certain papers.

III. Drainage Density (D_d).

The overallstream lengths in every category (km) per drainage area (km^2) is termed as the drainage density. The drainage density value ranges are typically expressed in km/km^2, however one study used m/km^2. Nonetheless, it is evident from a few definitions of D classes that there are primary categories: lesser or coarser and higher or finer class. Regretfully, neither of the two primary drainage density classes has any value ranges.

IV. Texture Ratio (D_t)

A river basin's overall stream segments, regardless of levels, up to the edge of catchment is termed as the texture ratio. The unit of drainage texture is expressed as km^{-1}. Thecategorization of texture ratio is identical to that of drainage density classification. When classifying drainage textures, values within a given range are typically not applied to each class; instead, comparisons between the studied watersheds lead to more relative classification. Soil erosion is more likely to occur in a watershed with extremely fineor the greatest drainage texture value (>8).

V. Stream Frequency (F_s)

Stream frequency, denoted as Fs, is defined as the aggregate count of channel segments across all stream orders within a given area (km^2).The overall segments of channelhas no dimensions. There are 2 classes of stream frequency as high and low, which vary depending on the watersheds under study in a given research area. The value ranges and classifications are not mentioned. Stream frequency's relative value ranges can indicate different things for low and high classes. For example, low stream frequency corresponds to low relief, while low stream frequency corresponds to high relief. The application of the relative value ranges was the cause. If the interpreter is well-versed in the morphology,we can use relative value ranges.; otherwise, outcome will be incorrect.

VI. ElongationRatio (R_e).

The elongation ratio (Re) is determined by dividing the diameter of a circle with an equivalent area as the catchment by the maximum length of the catchment. Re is dimensionless. The two classes of elongation ratio values are typically the minimum value, indicates an extended drainage, and the maximum value, which denotes a circular drainage. Some papers use multiple classifications.

VII. Circularity Ratio (R_c)

The circularity ratio is the proportion of a watershed's area to the section of a circle whose circumference matches the watershed's perimeter.Moreover, ithas no unit. The presence of structural disturbances is correlated with the circularity ratio (R_c) value. It makes us think of the implications of theR_b, which indicated that themaximumrecommended value that the watershed was under strong structural control, and a minimum value suggested thatno structural obstacle there. Like R_b, a low R_c indicates no structural obstacle, whereas a maximum $R_c$indicates a pronounced structural influence layer on the catchment area.

VIII. Form factor (R_f)

It represents the ratio of the watershed's area to the square of its length. The watershed form is always impacted by the flood hydrograph. It has a few distinct value, the range values are <0.78 elongated and >0.78 circular. For R_f classification, there are additional range values as well, such as circular and (0 or low value)elongated. A watershed that is elongated exhibits lower peak flows for an extended duration compared to a circular watershed, where peak flows are higher but for a shorter period.

IX. Relief Ratio (R_h)

The relief ratio (R_h) is the variance in altitude between the peak and lesser altitudewithin a catchment. Nobody brought up the relief ratio's value range. Researchers classified it according to the relative ratio values in their study. In general, aexcessive slope and excessive relief are indicated by a high relief ratio value, while a low relief ratio indicates low relief. While there exists a distinction, it revolves around the proportion of the stream's dimensions to the overall size of the watershed. It can refer to the overall length or quantity of streams.

X. Overland flow (L_g or AOLF)

The overland flow length refers to the distance traveled by water across the terrain before it converges into specific channels of stream.With Dd (drainage density) expressed in km/km^2, Lg = 1/(Dd X 2). Average over land flow (AOLF),there is another term mentioned that is employed to depict the length of overland flow. To calculate L_g, Dd's input must be expressed in km/km^2. Three categories exist for Lg: low value (less than 0.2), moderate value (between 0.2 and 0.3), and high value (greater than 0.3). On the other hand, aexcessive value of L_g indicates long flow paths, gentle slopes, increased infiltration, and decreased runoff.

III. CONCLUSION

1. Watershed development planning and monitoring can be effectively facilitated by the use of sensing. Keep in mind that RS data cannot be used to gather information on certain parameters, such as rainfall.

2. The best outcomes are produced by carefully combining traditional techniques with remote sensing data collected from the field.
3. Better integration of data and information, database modification and updating, creation of development plans, and tracking the results of developmental actions are all made possible by GIS databases.
4. Database updates and modifications, plans for development, and evaluation of the results of development initiatives to develop the watershed, people must take part in activities related to its development.

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