CHAPTER III

Morphometric Characteristics of Landforms

R. E Horton (1945) was the first to realize the need and importance of morphometric analysis of drainage networks in the study of basin geomorphology. He gave more attention on drainage basin morphometry on realizing that classical descriptive analysis cannot give a proper understanding of the geomorphic complexities of the drainage basin characteristics. Since the time of Horton, the geomorphologists have been engaged in applying advance statistical techniques in drainage basin study. However, Strahler (1952) had slightly modified some of the Hortonian techniques of morphometric analysis. Strahler (1969) defined the term as “the measurement of shape or geometry of any natural form – be it plant, animal or relief features” According to the dictionary of Geography authored by Jackie Smith (1984) the term morphometry is the precise and objective measurement of landforms. “For example, the drainage basin morphometry involves quantitative measurement for the investigation of geometric properties of rivers and their channels and the basin pattern and dynamics as well. Such a type of quantitative analysis helps one to make a comparative study of different components and variables of the basin concerned. By analyzing the morphometric properties one can interpret the result of processes which operated in the past and also which are acting today. As a whole, the study of morphometry can help to understand the morphology, morphogeny and morphochronology of a basin (Monkhouse and Wilkinson, 1973), if it is carried on keeping in mind the today’s spirit and purpose of studying drainage basin.

3.1 Relief Characteristics

The concept of ‘relief’ is used to denote and describe the altitude of landscape features above a certain fixed or relative reference level. There is no generally accepted definition of the term relief. The term “Range” is most commonly used to mean and measure altitude (Smith, 1935) of points or places. There are various ways to measure the altitudinal range of an area. Dury (1951) linked relief with the depth of dissection in an area, by which he meant the difference in altitude between stream line surface and the summit surface. The term relief indicates the difference in elevation or
the physical outline of the land surface or ocean floor (Smith, 1984). Relief acts as one of the best indicators of landform development and analysis of its pattern and processes.

Relief is the actual configuration of the earth’s surface. Relief acts as a strong basic factor for the morphometric development in a region be it basin or any other area. Relief may, however, be analysed by the considerations of absolute and relative relief, slope and dissection pattern. The major relief features of the study area may be of two types:

(a) Parts of the young fold mountains of tertiary origin in the north - This includes the bhabar zone. South of this zone is the Terai zone and south of the Terai lies the built up zone.

(b) The recent builtup alluvial plain - This zone is well settled characterized highly by cultural environment i.e. settlements, landuses, transport routes.

Differences of elevation in the Kaldiya basin is not well discernible, only except the northern parts, where the rivers leave behind hills and join the plains. The highest elevation is in the upper piedmont. A very minor relief difference separates the upper piedmont from the lower piedmont which makes undiscernable slope with the terrain below. The flood plain areas are covered by croplands and wetlands. The slightly elevated parts are croplands and the nearby depressions are wetlands.

### 3.1.1. Absolute Relief

Absolute Relief is the difference between original upland surface and the bottom of the graded valley or mean sea level. The absolute relief helps us to predict the nature of landform evolution and development vis-a-vis the structural control in the basin. The analysis of such a morphometry is based mainly on the pattern of contour distribution. The contours are closed in Bhutan foothill zone. On the other hand, they are sparse at their same interval of height in the built up plain and chronically flood affected plain. The study of absolute relief helps to interpret the erosional and depositional activities of landform in the basin.

The original upland surface in the Kaldiya has been buried under thick cover of sediments i.e. by gravels in the upper part and fine sediments in the lower catchments and valley floor down stream. There remains, of course considerable difference of height between the highlands and the plains. The relief ranges from
below 50 m in the south to above 135 m in the hill slope in the north. Table 3.1 shows the spatial pattern of absolute relief categories and areas under the relief groups.

**Table 3.1. Kaldiya Basin: Areas under Absolute Relief Groups**

<table>
<thead>
<tr>
<th>Absolute Relief (in metres)</th>
<th>Area (km²)</th>
<th>Percentage of area to total basin area</th>
<th>Relief Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50</td>
<td>187.50</td>
<td>37.28</td>
<td>Low</td>
</tr>
<tr>
<td>50 -70</td>
<td>102.20</td>
<td>20.32</td>
<td>Moderate</td>
</tr>
<tr>
<td>70 – 90</td>
<td>68.25</td>
<td>13.57</td>
<td>Moderately high</td>
</tr>
<tr>
<td>90-110</td>
<td>57.23</td>
<td>11.38</td>
<td></td>
</tr>
<tr>
<td>110 – 130</td>
<td>45.58</td>
<td>9.06</td>
<td></td>
</tr>
<tr>
<td>&gt;130</td>
<td>42.27</td>
<td>8.40</td>
<td>High</td>
</tr>
</tbody>
</table>

Source: Based on the data computed from Topographical Sheet of RF 1: 63, 360

The absolute relief of the Kaldiya Basin may categorically be grouped into low (<50m), moderate (50-90m), moderately high (90-130m) and high (>130m)

The spatial pattern of low absolute relief (<50m) covers an area of about 37.28 percent equivalent to 187.50 km². Again, the moderate absolute relief group (50-90m) is estimated at 33.89 percent or 170.45 km² of the basin. The moderately high absolute relief covers a spatial extent of 20.44% of basin’s total area equivalent to 102.81 km². The spatial coverage of high absolute relief (>130m) goes to about 8.40 percent or 42.27 km².

The mean value of absolute relief of the basin is 71.97. Here, above the mean the absolute relief accounts for 28.84 per cent of the total area or 145.08 km², whereas below the mean there lies 71.17 per cent of the basin’s total area equivalent to 357.95 km². This may be substantiated by the standard deviation estimated at 4.21.

**3.1.2 Relative Relief**

The term ‘relative’ as used by geomorphologists differs from the concept from used by climatologists or statisticians. The concept of relative relief in morphometric analysis is facing certain problems. Smith (1935) observed ‘The difference in elevation between highest and lowest points within a limited area may be regarded as the local relief of that area. The expression ‘relative relief’ is here used to imply
regional comparison. Therefore, the relation between areas and the delineation of regions with similar relief become important objectives’. Thus, the maximum height difference in each grid square in the present study is its local relief and the isopleth on the basis of such values show the relation of each area to adjacent areas of lesser or greater relief. It then becomes relative relief. Thus, the local relief and the relative relief are practically the same both in expression and magnitude. The difference in elevation between the highest and lowest points in a grid in this case is the relative relief. The general definition of relative relief entangles the difference in the altitude between the highest and lowest points within a limited area.

The study of relative relief (Smith, 1932) finds its importance in understanding the topographic disposition of landform, degree of dissection and stage of evolution of landforms in a region. “For a general expression of local relief the difference in elevation between the highest and lowest points in a small area is sometimes used or a figure may be used that indicates the average or prevalent height of crests above the adjacent valley bottoms in the area” (Trewartha, 1957). Glock (1932) has defined it as the “amplitude of relief”. Raisz and Henry (1937) also attempted on relative relief analysis for New England region by adopting Smith’s method. Robinson (1948), Elliot (1953), Shipitsyn(1991) studied relative relief of different places at different points of time.

The relative relief of the study area has been calculated by using Smith’s method with certain modification of grid size. On the basis of this method a map of the basin with relative relief is prepared by taking 5.08cm (2 inch) square (approximately 3.22km square or 2 mile grid) grid network on the scale of 1:63,360.

There has been a great change in relative relief from north to south, as the basin is a transitional area between the Bhutan Himalaya and the Brahmaputra river. The relief change ranges between 30 m and 400 m. High relative relief is marked on the foot hill zone in the north. The recession of value is observed as one approaches to the active or chronically flood affected areas in the south through the built up plain. Table 3.2 and Fig 3.1 show the spatial pattern of relative relief categories and areas under the groups.

The relative relief of the Kaldiya Basin may categorically be grouped into low (<10m), moderate (10-30m), high (30-50m) and very high (>50m).
The spatial pattern of relative relief of the basin indicates that about 302 km², equivalent to 60.03 percent of the total basin area accounts for low relative relief. While moderate and high relative relief groups cover about 25.79% or 129.75 km² and 10.73% or 54 km² respectively. Spatial coverage of very high relative relief is represented by 3.50% of the area equivalent to 17.65 Km².

**Table 3.2 Kaldiya Basin : Areas under Relative Relief Groups**

<table>
<thead>
<tr>
<th>Relative Relief (in metre)</th>
<th>Total Area (km²)</th>
<th>percentage of area to total basin area</th>
<th>Relief Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>302.00</td>
<td>60.03</td>
<td>Low</td>
</tr>
<tr>
<td>10 – 20</td>
<td>107.75</td>
<td>21.42</td>
<td>Moderate</td>
</tr>
<tr>
<td>20 – 30</td>
<td>22.00</td>
<td>4.37</td>
<td>High</td>
</tr>
<tr>
<td>30 – 40</td>
<td>31.00</td>
<td>6.16</td>
<td></td>
</tr>
<tr>
<td>40 – 50</td>
<td>23.00</td>
<td>4.52</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>17.25</td>
<td>3.50</td>
<td>Very High</td>
</tr>
<tr>
<td>Total</td>
<td>503.00</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Source: Based on data computed from Topographical sheet of R.F. 1: 63, 360

The mean value of relative relief of the basin is 13.40 m. Here, above the mean the relative relief accounts for 18.55 per cent of the total area or 93.25 km², whereas below the mean there lies 81.45 per cent of the basin’s total area equivalent to 409.75 Km². Such a pattern indicates skewed distribution of the relief in the basin. This may be substantiated by the Standard deviation estimated at 2.60 m.

**3.1.3 Slope Pattern**

An analysis of slopes is very important for a better understanding of the processes of landform evolution. Very rarely we do find areas on the earth’s surface that are absolutely level. All landform consist of slopes. Geomorphology is concerned with landform and so, an understanding of the processes which control slopes must be an important element of study.

Some slopes such as actively eroding sea cliffs or the free faces of the high valley sides may consist of bare rock. A slope may be formed by a covering of weathered rocks resting on bed rock. Another type of slope consists of bed rock
forming the basal slope covered by weathered rock, often including a surface layer of soil.

**Development of Slope**

Slopes are developed by the different processes which are acting upon different forms of land. There are three important factors which influence the development of slopes as noted below:

(a) The earth surface has relief and hence slope exists. A variety of endogenetic forces and processes have raised parts of earth’s crust to considerable elevation above the sea level. The initial slopes caused by such movement will depend on the rapidity of the uplift and the material which is being raised. Many of the older theories of slope development envisage different periods of uplift giving rise to slope.

(b) Both the weathering and transport of materials on slopes are affected by climate.

(c) The activity of the stream at the base of the slope is important. The stream removes the material conveyed to it from the surrounding slopes. It sometimes moves around the bottom of the valley and undercuts its banks. Thus, the slipping of materials on slopes and the removal of bank materials are parts of a continuous drainage basin dynamics.

(d) Man has had a considerable influence on slope development through landuse and some other activities.

The study of slopes in the Kaldiya basin will bring to light the nature and characteristics of development of slope profiles. The impact of man in this basin may be noticed in the modification of slope profiles.

The angle of slope is a fact of geomorphic and economic significance. The nature of lithology, process of erosion, nature of tectonic movement, climate of the region and the time factor play an important role in determining slopes of straight, concave or convex nature. Debris accumulation are common features at the base of the steep slope.

The relationship between slopes and the flowing water is significant. A steep gradient allows a greater speed of flow. This in turn helps the stream to scour its course deeply. A zigzag course seldom occurs on such steep gradients except when it
is produced by excessive overloading or due to physical obstructions in the stream. The steep slopes provide the velocity required for the transportation of all the load supplied to the streams from above. The areas without vegetation cover suffer from serious erosion. However, on the slope zones the erosional changes are continuous.

The slopes have great influence on landuse. The four slope categories may further be scrutinized and useful information may be gathered on the basis of slope sub-units for micro-regional studies. A knowledge of slope gradients is indispensible for the construction of metalled roads and rail tracks. In fact, slopes play an important role in determining how far and how fast development can proceed. The intimate acquaintance with slopes and awareness of their importance can however, be acquired through persistent field observation.

The average slope depicts precise information about morphological characteristics in terms of nature, dimension and magnitude along with rise or fall of areas in certain direction. It helps in the scientific interpretation of angular inclination (Trewartha, 1957) of earth's deformities which are caused by erosional or depositional activities. As expressed by H. S. Sharma (1981), the “slope is the loss or gain in altitude per unit horizontal distance in a direction”. Strahler (1956) worked on slopes by using quantitative techniques. Studies were also made by Pandey (1968) and Rai (1971).

Several methods have been suggested by Raisz and Henry, Smith, Wentworth and others to determine the average angle of slope. In the present study we have used the technique adopted by C. K. Wentworth (1930) for finding average slope.

It is a general and random method and hence is simple. For the purpose of the Kaldiya basin having no such high relief differences, the technique of “Average slope Determination” is used. As such grids of 5.08cm (or 2 inch) square are constructed and average slope value of each grid is determined. The formula for average slope as devised by Wentworth method is used in the study. *

A general overview of areal distribution of slopes indicates that in the terai and bhabar zones there exist comparatively high average slopes. The average slope

\[
\theta = \arctan \left( \frac{N \times 4}{3361} \right),
\]

where \(\theta\) is the average slope, \(N\) is the average number of crossing per mile and \(I\) is the contour interval in feet and 3361 is the Wentworth constant. However, the original formula of Wentworth modified to

\[
\theta = \arctan \left( \frac{N \times I}{3361.37} \right)
\]

is used, where \(N\) is the number of contour crossing per Km and \(I\) is the contour interval in metre and \(\theta\) is the average slope in degree.
reduces continually towards south on the built-up plain and chronically flood-affected areas. The angle of inclination of the basin as a whole ranges from less than $2^0$ to more than $10^0$. Table 3.3 and Fig. 3.2 show the spatial pattern of average slopes and their areas of operation.

**Table 3.3 Kaldiya Basin: Areas under Average Slope Groups**

<table>
<thead>
<tr>
<th>Average Slope (in degree)</th>
<th>Total area (in km$^2$)</th>
<th>Percentage of area to the basin’s total area</th>
<th>Category of slopes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;2^0$</td>
<td>172.24</td>
<td>34.24</td>
<td>Low</td>
</tr>
<tr>
<td>$2^0 - 4^0$</td>
<td>180.90</td>
<td>35.96</td>
<td>Moderate</td>
</tr>
<tr>
<td>$4^0 - 6^0$</td>
<td>34.02</td>
<td>6.76</td>
<td></td>
</tr>
<tr>
<td>$6^0 - 8^0$</td>
<td>32.63</td>
<td>6.48</td>
<td></td>
</tr>
<tr>
<td>$8^0 - 10^0$</td>
<td>51.20</td>
<td>10.19</td>
<td>Moderately high</td>
</tr>
<tr>
<td>$&gt;10^0$</td>
<td>32.03</td>
<td>6.37</td>
<td>High</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>503.02</strong></td>
<td><strong>100.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculated by the researcher from the Topographical sheets of 1: 63, 360

The slopes of the basin are grouped into four categories, viz low ($<2^0 - 4^0$), moderate ($4^0 - 8^0$), moderately high ($8^0 - 10^0$) and high ($>10^0$). The spatial pattern of slopes of the basin is such that 70.20 percent or 353.14 Km$^2$ of the basin area falls under the category of low average slope, while the moderate group of slope consists of about 13.24 percent or 66.65 Km$^2$ of the basin area. A percentage of 10.19 equivalent to 51.25 Km$^2$ goes to moderately high slope category. Only 6.37 percent or 32.03 Km$^2$ of the total coverage of the basin is marked by high average slope.

The mean value of the calculated slopes falls at 6.20 degrees. On the other hand, the standard deviation stands at 6.78. The area estimated below the mean is about 76.96 percent or 387.16 km$^2$ and that above the mean is about 23.04 percent equivalent to 115.91 km$^2$. The mean falls in the moderate group of slope. The frequencies of slopes as revealed in table 3.3 are not symmetrical, they are skewed in nature and have deviations from the normality. This can be substantiated by the S. D. score of 7.4 estimated from the table.
3.1.4 Profile Characteristics

The drawing of a profile based on a contour map may be of great assistance in visualizing the relief and analyzing the characteristics of landforms (Monkhouse and Wilkenson, 1913). The drawing of profiles has also been found useful in analyzing the landform characteristics of the present study area. The profiles are drawn in north-south and east-west directions in order to have a spatially significant three dimensional view of overall relief characteristics of the basin area.

The relief profile of a region represents the variation of surficial altitude and the magnitude of the summit levels, etc. within the region. The significance of the profiles lies on “The profile or cross-section, with its reconstruction of the vertical qualities of the relief, forms a useful complement to the plan pattern emphasized, by the contours on a map”. (Dickinson, 1969). The objective of drawing a profile is to show with precision, the form of the land (Miller, 1953), Chorley (1958) stated that drawing of profiles not only helps in depicting the present form of land but also leads to draw an evidence of geomorphological history. Thus a construction and analysis of profiles have been necessary in the arena of geomorphological investigation.

For convenient and effective analysis of the relief characteristics of the Kaldiya basin, longitudinal and horizontal profiles are taken into consideration. For depicting the relief almost parallel to the Kaldiya river or in tranverse direction to the mighty Brahmaputra. A North South longitudinal profile along line AB is drawn and a East West horizontal profile along line CD across the Kaldiya basin is also drawn to visualized the undulating pattern of the relief disposition of the basin (Fig 3.3).

It is apparent from the Fig. 3.4 that there is no major knick points in the profile. The lateral erosion is predominant in the gentle slope between 200 and 300 meters. The vertical erosion is more above the height of 300 meters. A minute analysis of the longitudinal profile indicates the existence of three distinct sections of the basin viz. the northern section, the middle section and southern section. The northern section shows steep landform at an altitude of 300 meters. The altitude then tends to decrease towards south.

An analysis based on the horizontal profile (Fig. 3.5) shows that while there is perceptible undulation of relief pattern along foothill areas, there is little or no undulation along the low lying area.
KALDIYA RIVER BASIN IN ASSAM
CROSS SECTION ALONG LINE AB AND CD

Fig. 3.3
Fig. 3.4
Source: Data calculated from the topographical sheet by the researcher

Fig. 3.5
Source: Data calculated from the topographical sheet by the researcher
3.1.5 Dissection Pattern

Dissection Index is now one of the probabilistic models for morphometric analysis of the stage of development of not only cyclic landscape of Davisian concept but also of the landscape built-up under water flow conditions or in the big river valleys in the geological past (Barman, 1986). The present study is an attempt to find out intensity, spatial pattern and the probable cause of dissection and its effect on the landform of the aforesaid basin. It is assumed that even the low heterogeneity of the existing landscape of the basin has much effect on the dissection pattern of the landscape. It is also assumed that the dissection is more in the vicinity of rivers and it is less away from them especially in the regions of local depression.

The dissection index which expresses the dimension of erosion has its relationship in terms of the real area with the projected area between sets of contours (Dubey, 1986). Dissection and its pattern recognition have a far reaching impact on the investigation of geomorphic behaviour of an area. Dissection index is generally used as a morphometric determinant of the stages of terrain evolution where the values 0.1, 0.1 to 0.3 and above 0.3 are generally related to penultimate equilibrium, and inequilibrium stages respectively (Pandey, 1983) referred by Dubey (1986). Dissection index is expressed in terms of ratio between the maximum relative relief (RR) and maximum absolute relief (AR) as stated by Dovi Nir (1957). Miller (1949) also worked on dissection.

In the present work, Dovi Nir’s (1957) method is applied on the 5.08cm (or 2 inches) square grid of a map of the Kaldiya Basin with the scale of RF 1:63, 360. It is observed that the dissection values vary from below 0.10 to above 0.30. The trend of the values of dissection index in the basin tends to decrease from the Bhutan foothills to the Brahmaputra floodplain (Fig 3.6).

The Table 3.4 shows the spatial distribution of dissection categories and areas under them.

The distribution of dissection indices is grouped into four categories, viz very low (<0.10), low (0.10- 0.20), moderate (.0.20- 0.30) and moderately high (>0.30)
Fig: 3.6
Table: 3.4 Kaldiya Basin: Areas under Dissection Index Groups

<table>
<thead>
<tr>
<th>Dissection Index group</th>
<th>Total area (Km$^2$)</th>
<th>Percentage of area to total basin area</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.10</td>
<td>302.56</td>
<td>60.12</td>
<td>Very low</td>
</tr>
<tr>
<td>0.10- 0.20</td>
<td>24.70</td>
<td>4.91</td>
<td>Low</td>
</tr>
<tr>
<td>0.20- 0.30</td>
<td>102.24</td>
<td>20.33</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt;0.30</td>
<td>73.57</td>
<td>14.64</td>
<td>Moderately high</td>
</tr>
<tr>
<td>Total</td>
<td>503.07</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Source: Based on data data calculated from Topographical sheets

The spatial distribution shows that the very low category of dissection in the Kaldiya basin covers about 60.12 % of the basin’s total area or 302.57 km$^2$. The low dissection covering 4.91% of the basin’s area and the moderate dissection having 20.33 % of the basin’s area have combinedly dominate on 25.24% of the basin’s total area equivalent to 126.94 km$^2$. The high category of dissection represents about 14.64% or 73.57 Km$^2$ of the Kaldiya basin.

The mean value of dissection indices is 0.14 and the standard deviation stands at 0.01. The mean value falls in the low category of dissection. There is as much as 34.97 per cent of the total area above the mean while below the mean there lie 65.03 per cent of the basin’s total area.

It can be derived from the statistical distribution that there is perceptible variation in the dissection indices of the basin. This is because of differential pattern of erosive power of the fluvial agent, viz. the Kaldiya River and its tributaries.

### 3.1.6 Hypsometric Characteristics

Langbein and others (1947) derived an important dimensionless function called hypsometric analysis to show the relation of horizontal cross- sectional drainage basin area to elevation and applied it to large watersheds. Strahler (1952), Schunn (1956) and Coates (1958) have applied it to small watersheds to show the distribution of mass from the top to the base. To find the hypsometric integral, a hypsometric curve is constructed by reducing the real heights of the contours to a
dimensionless ratio between 0 and 1. To do so, the difference between the highest point on the watershed and local base level is found out.

According to Strahler (1952), the hypsometric integral above 60 per cent, and those between 60 per cent and 35 per cent, and below 35 per cent are indicative of youthful, mature or equilibrium and old stages respectively.

Since, the hypsometric integral is 15 per cent in the aforesaid basin, it indicates that the basin is in the old stage as per the cycle of erosion. But here there is no symptom of cycle of erosion as the basin is mainly built-up from the bottom of the foredeep (Krishnan, 1984) by the deposits of carried down by water.

The fig 3.7 shows the hypsometric curve for the Kaldiya basin. The two dimensionless variables relative area \((a/A)\) and relative height \((h/H)\) have been plotted along X- axis and Y- axis respectively (Table 3.5). Relative area is the ratio of horizontal cross sectional area ‘\(a\)’ to basin area ‘\(A\)’ and relative height is the ratio of height of given contour ‘\(h\)’ to total basin height ‘\(H\)’. The shape of the hypsometric curve of the basin is closely fitted with the monadnock phase even though it is doubtful. The curve shows that the proportion of area remaining at higher elevation is very less and the same at lower elevation is more. The basin is thus approaching apparently towards the monadnock phase and the lower course of the river is traversing through an almost flat plain. A measure called hypsometric integral (HI) is generally applied to assess the geomorphic status of a basin. The hypsometric integral which is the numerical description of the landscape represents the amount of material above base level to be removed. For the Kaldiya basin the hypsometric integral is calculated at 0.15, which indicates that only 15% of the mass of the basin above base still remains to be removed. Moreover, as per the norm suggested by Strahler (1952) on the basis of HI values, the basin can be said approaching the old stage (Monadnock stage) as the HI value is well less than 35%.

Topographically the Kaldiya basin with an area of 503 km\(^2\) has its absolute relief differences within 400m to about 30m. Table 3.5 reveals that the hypsometric pattern is such that as height increases, the area under certain height interval decreases abruptly. It is seen that 24.78 percent of the basin is covered by the height ranging between below 304.88m and 91.46m of elevation (from m.s.l.). A percentage of 48.97
KALDIYA RIVER BASIN IN ASSAM

HYPSOMETRIC CURVE

Fig: 3.7
of the basin’s total area lies within the height of 91.46m and 60.97m and a share of 26.25 percent goes to the altitudinal level of below 45m.

### Table 3.5: Kaldiya Basin- Hypsometric Curve

<table>
<thead>
<tr>
<th>Area (km(^2)) (a)</th>
<th>Percentage of Area</th>
<th>Cumulative Percentage of Area</th>
<th>Cumulative area (km(^2))</th>
<th>Relative Area a/A</th>
<th>Contour (in meter)</th>
<th>Relative Height h/H</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.27</td>
<td>4.63</td>
<td>4.63</td>
<td>23.27</td>
<td>0.05</td>
<td>&gt;304.88</td>
<td>1.00</td>
</tr>
<tr>
<td>12.52</td>
<td>2.49</td>
<td>7.12</td>
<td>35.79</td>
<td>0.07</td>
<td>304.88-152.44</td>
<td>0.41</td>
</tr>
<tr>
<td>38.26</td>
<td>7.61</td>
<td>14.73</td>
<td>74.05</td>
<td>0.15</td>
<td>152.44-121.95</td>
<td>0.29</td>
</tr>
<tr>
<td>18.27</td>
<td>3.63</td>
<td>18.36</td>
<td>92.32</td>
<td>0.18</td>
<td>121.95-106.71</td>
<td>0.23</td>
</tr>
<tr>
<td>32.35</td>
<td>6.43</td>
<td>24.78</td>
<td>124.67</td>
<td>0.25</td>
<td>106.71-91.46</td>
<td>0.18</td>
</tr>
<tr>
<td>40.03</td>
<td>7.96</td>
<td>32.75</td>
<td>164.70</td>
<td>0.33</td>
<td>91.46-76.22</td>
<td>0.12</td>
</tr>
<tr>
<td>206.32</td>
<td>41.01</td>
<td>73.36</td>
<td>371.02</td>
<td>0.74</td>
<td>76.22-60.97</td>
<td>0.06</td>
</tr>
<tr>
<td>132.05</td>
<td>26.25</td>
<td>100.00</td>
<td>503.00</td>
<td>1.00</td>
<td>&lt;45</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Estimated by the researcher from the data collected from topographical sheets.

Here

\[
a = \text{Area within a particular set of contour. } A = \text{Total area, } h = \text{Height of a particular contour, } H = \text{Maximum height of the contour.}
\]

Hypsometric integral as calculated from the curve is 15 per cent. Such a low integral value indicates that the basin is almost a level one caused mainly by the continuous fluvial deposits and planation of the river Kaldiya and its tributaries.
References


