7.1 Brief Summary of the Work:

Meghalaya is one of the seven States of North East India. It comprises the erstwhile United Khasi and Jaintia Hills, and was formerly a part of Assam. On January 21, 1972 Meghalaya was given the status of a full fledged State. The State is divided into five districts for administrative convenience.

Meghalaya plateau is geologically a part of the ancient Peninsular India being separated from the latter by a faulted alluvial plain of the Brahmaputra and Ganges rivers. The Plateau also encompasses physiographically, the Karbi Anglong and North Cachar Hills District of Assam (Chapter I).

The plateau lies sandwiched between the Brahmaputra Valley in the north and the Surma Valley in the south. The rugged plateau has variable elevations, even
then three physiographic units are easily identifiable, with consequent variations in physical environment, human habitation, ecological and economic considerations.

1. **The western section comprising the Garo Hills** has an average altitude of about 600 metres.

2. **The central section embracing the Khasi Hills** is a true plateau surface as revealed by its morphology, geology and physiography. This section can be further sub-divided into:

   (a) **The central upland consisting of the 'Ri-Khasi' areas** has an average height ranging between 1230-1961 m. This zone acts as the major watershed for the north and south flowing rivers.

   (b) **The northern slope or the 'Bhoi area'** has an average elevation of 170-180 m. Here the low undulating hills slope down gradually to the lower Brahmaputra Plain of Assam.

   (c) **The southern slopes or the war area** has rounded hills with steep slopes and shallow valleys.

3. **The eastern section of Meghalaya encompasses the Jaintia Hills.**

   The Shillong Plateau exhibits a complex geological structure. The basal complex is composed of
Pre-cambrian formations which is overlain by rocks of successive recent era to the tertiary period.

The entire north and north western part is covered by the gneissic rocks. The low hills with irregular outliers are found even beyond the Brahmaputra Valley. The central part of the plateau has gneissic rock covered by sub-metamorphic rocks with bands of quartzites overlying the schists. Various metamorphosed and sub-metamorphosed rocks are also found overlying the Pre-Cambrian basic rocks including the sedimentary deposits of Jurassic and younger periods. While the older rock yield minerals like sillimanite, corundum, clay etc. the younger one yields coal and limestone. The Quaternary and Recent deposits found in the peripheral regions of the plateau forms its fertile plain land.

Localised exposures of epidiorite masses are found under the Pre-Cambrian rocks which form resistant escarpments in and around the capital city of Shillong. These escarpments form ideal locations for cascades and waterfalls occurring around the city.

Growth and development of radial pattern of drainage is controlled by the fault plane, fault axis and NW-SE aligned joints in the granite and gneissic rocks. The Central east-west crestline forms a conspicuous
watershed for the north-south flowing rivers. The principal north flowing rivers like the Umkhri, Umtru and Umkhen have formed plain embayments on reaching the Brahmaputra Plain, with the result that the northern face of the plateau presents an irregularly rugged topography. Also it is to be noted that the upper courses of the above stated rivers have formed deep and narrow valleys due to active headward erosion.

Climatologically, the plateau falls under the Tropical Monsoon climate but because of its higher elevation, prolonged rainy season and interplay of variable winds, reduces the thermal extremes. The climate may be termed as sub-tropical monsoon hill climate (chapter II).

The climate of the Central Upland zone is bracing but the southern foothills and areas in the north and east have a warm and humid climate. The higher altitudes experience ground frost and dew in the winter months. The distribution of rainfall is chiefly governed by the alignment of hill ranges, whereas areas in the south receive heavy rainfall and those in the north have moderate amount due to rain-shadow effect. Winter rainfall is meagre but not absolutely dry.

The soils of the Meghalaya Plateau vary regionally with the variation of the underlying rocks,
relief, climate and vegetation. Usually the hill slopes have thin soil profiles. While the cooler central upland has in general sandy loam podzolic soil, the organic content of the soil tends to be high at higher altitudes where temperature is lower.

The upper parts of the southern slope contains sandy soil, whereas the lower parts has lateritic soil. The northern Khasi and Jaintia Hills as well as the interior regions of the Garo Hills have also lateritic soil. Fertile silty loam soil occurs only in the plain river valleys.

On account of favourable soil and climatic conditions, the plateau has luxuriant vegetation cover in different altitudinal zones. The Central part has sub-tropical moist type of vegetation with pine as the principal species. While the upper part of the southern slope of the Khasi Hills has shrubby vegetation, its lower part has 'tropical evergreen type'. The northern foothills has moist deciduous type of vegetation with sal as the principal species.

The interior areas of the Garo Hills has 'sub-tropical wet type' of vegetation with evergreen trees but its border areas have 'moist deciduous type' of vegetation.
Meghalaya witnessed rapid growth of population during the decades 1901-81 (chapter 1). In 1981 its population was about 13.35 lakh persons, an increase of 292.28 per cent over 1901. Of course, the highest growth rates was recorded during 1961-71 and 1971-81 periods. The State's overall density was 59 persons per sq.km² in 1981 (Census) compared to 220 persons per km² at the national level. The indigenous population of Meghalaya is divided into three major tribal groups namely the Khasi, the Garo and the Jaintias. They still make up more than 75 per cent of the population of the State. The urban population density is higher than the rural areas. Shillong, Jowai and Tura are the three main urban centres. The region is characterised by dispersed and hamleted settlements obviously due to the dissected plateau. Settlements are found largely along gentle slopes and inter montane valleys. In fact, agriculture engages overwhelming majority of the population. In areas of jhuming, the settlements are of sedentary nature.

Road transport is the life-line of Meghalaya. The State has neither rail head, nor waterways. Recently, the capital city Shillong has developed a temporary air terminus. Plans have been drawn up by the State Government to connect the remote areas including border.
settlements either with the nearest highway or urban centre.

The complexities of human activities have been building up conflicting claims on land and in this battle of the claiments, a thorough probe into the geomorphological exposition may be considered to be the only means, by which the rationality of the claiments could be settled for perspective welfare of the society within a balanced ecological system. With this view in mind this exercise of evaluating the morphogenic history of the most populous north Khasi Hill region is undertaken. In this exercise, slope, relief, profile, drainage system are included.

The Northern Khasi Hills region exhibits subdued topography with sharp altitudinal variations. C.K. Wentworth's method of average slope determination has been applied for preparation of slope zone map for the region (Chapter 3). No doubt gentle slopes comprise over 40 per cent of the region followed by moderate slopes about 35 per cent. Very steep slope category occupies the least area (referred in table 3.1 of sub chapter 3.2). As the general frequency percentages do not clearly depict the slope category, region-wise frequency distribution has been prepared. The application of this method reveals that
nearly 91 per cent is shared by gentle slope in around Khyrim, Khydem and Mawrynkneng areas of the eastern boundary. Moderate slopes are found in Nongstoin, Marisaw and Nonghwaw (south of north Khasi Hills). Moderately steep slopes occur in the north and north eastern part of the study area (Jirang, Mylliem and Khyrim regions). On the other hand, the dominance of the steep slopes and very steep slopes is noticeable in around Kambrai and Mairang region of central north Khasi Hills. Maximum slope frequencies are found to occur in the gentle and moderate slope group.

A spatial analysis of average slope reveals that 97.6 per cent of the north Khasi Hills region lies between the slope group of 1°-5°. The highest slope area occupying 0.22 per cent of the study region occur in Kambrai, Mairang, Nongstoin and Shillong Peak areas. The slope group 1°-3° has the highest areal coverage (2352.5 km²) in 42.4 per cent of the total study area. Six main categories of slope have been thus identified ranging from 1°-7° at a regular intervals of 1° each. Each slope category is discussed briefly in chapter 3, wherein the cause and effect of the evolution of each category of slopes have been elaborately logically explained.
To make a comprehensive relief analysis of the region, few selected morphometric parameters associated to its relief characteristics have been chosen. The statistical indices have been applied for different elements of topography, proved to be useful in studying the erosion surfaces as well as the relief properties.

Altimetric frequency histogram and frequency curves are the two principal techniques that have been applied for computing the frequency of height occurrence above the M.S.L.

The altimetric frequency graph clearly depict the nature of relief at different height groups. In addition, it also reveals, the two main erosion surfaces one at 914.6 metres and the other at 1676.8 m, respectively. The abruptness of the frequency curve at a height of 152.4 m indicates a typical plateau character of the region.

Profile analysis has also been made to illustrate the morphological characteristics of the northern belt of the plateau section. The superimposed profiles drawn at regular intervals across the study region clearly depict both the higher plateau surface lying at a height of 600 m as well as the lower plateau area of about 300 m and also at 150 m. Besides the superimposed profiles
also project the erosional platform, the valley depth and the amplitude of relief.

Finally, the composite profiles explicitly outlines the relief configuration of the northern Khasi Hills. The region has three planation or erosional surfaces, two deep gorges and three summit levels.

Needless to say, that the consequent tertiary upliftment of the plateau associated with the change of base level has led to the initiation of the present geomorphic cycle that is solely responsible for the present physical layout of Central Meghalaya.

Besides, altimetric frequency and analysis of profiles, Smith's method of Relative Relief has also been applied to analyse the relief characteristics of the region. Five major categories of relative relief have been identified (Table 4.1 of sub-chapter 4.4) ranging from low to very high relative relief.

The present terrain of north Khasi Hills is the ultimate product of the drainage evolution. Naturally for a meaningful evaluation of terrain characteristics, morphometric analysis of the four major drainage system of the study area is attempted (chapter 5).
Drainage basin morphometry is potentially a most important approach to geomorphology since it affords quantitative information of fluvially evolved landforms, especially in a region like Central Meghalaya.

The four principal rivers of the north Khasi Hills such as the Kulsi, the Umtru, the Umiam and the Barapani, all draining similarly in a south north direction have developed their respective typical characteristics.

The rivers take their sources from the Central Upland region of the Shillong Plateau which forms a distinct water parting between the north and south flowing rivers of Meghalaya. These rivers after flowing over the plateau surface finally debouches themselves into the Brahmaputra plain of Assam.

The impact of regional structural framework is exhibited in the formation of rectangular and trellies pattern of drains in lower orders, whereas the higher orders drains are dominantly influenced by the climatic and associated factor for which the pattern is distinctly dendritic.

Both Horton and Strahler's laws have been applied for analysing the various aspects of the four basins of the study region.
The drainage network analysis reveals that among the four basins, the highest order i.e. the eighth order has been attained by the Kulsi, the Umtru and the Barapani river whereas the Umiam is confined to the seventh order (refer to table 5.1 of sub-chapter 5.1.1). Needless to say, that in their upper course the rivers generally have a large number of stream segments on account of steep slopes and the tableland topography, whereas in their lower course, the number of segments progressively reduces due to the presence of level lands and gentle slopes.

Geological structure such as the fault planes, fold axes and the conspicuous NW-SE joints have substantially controlled the overall drainage system of the northern Khasi Hills.

The application of Horton's Bifurcation ratio shows that the mean value of bifurcation ratio for all the four basins is around 4. This confirms the normal functioning of the drains. Inspite of this, the Rb values for all the basin do not appear to be uniform. The ratio tends to be comparatively lower in the higher order basins. However, the bifurcation ratio has proved the relevance of Giusti and Schneider's hypothesis.

The only exceptional basin is the river Umiam that has an increasing bifurcation value in the two
successive higher orders. This is because of the differential relief that has controlled the branching of the stream network.

On the other hand, the second hypothesis of Giusti and Schneider about constant bifurcation ratio may not be tenable for the four basins. Because it is not the basins that controls the network pattern but other associated factors are also equally responsible in branching of the stream segments. So, the bifurcation ratio (Rb) do not prove to be a very satisfactory index for a comparative study of drainage network.

Streams numbers of different orders of each basin are systematically arranged (Table 5.1 of sub-chapter 5.1.3) in order to test Horton's law of stream number. The law does not hold good in case of higher order streams, but the lower order streams conform almost to the line of best fit (figs. No. 5.1, 5.1.1, 5.1.2, 5.1.3).

The mean length of all the basins of the study region more or less confirms Horton's law of stream length. Only some deviations have been observed in the higher orders for both Umiam and Barapani basin. Perhaps the slope and the age of the basin have been the resultant factor for such departures in these two basins. Unlike
that of the mean length, the length ratio of the respective basins considerably varies within their different orders.

The total stream length of the different orders of the four basin is inversely related to their respective orders. In other words total stream length tends to decrease from the first order to the successive higher orders. This rule is applicable for all the basins except in case of Umiam where the highest order has a total length more than that of the preceding one.

It is observed that the mean stream length possess a direct relationship with the basin orders. This law is more tenable in case of the river Kulai and the Umtru.

The logarithmic analysis of the cumulative mean length for the four basin exhibits Horton's positive exponential function model. Nevertheless, in case of Barapani pronounced variations are observed consistently in the fifth, sixth and seventh orders.

In regard to the areal aspects of the drainage basins Strahler's method has been suitably applied for calculations of the basin areas.

Among the basins, Barapani has the highest areal
coverage i.e. (54.3 km²) and the least is occupied by the river Kulsi covering an area of (18.4 km²).

The application of the law of allometric growth reveals a linear relationship between cumulative mean length and the mean basin area of the drainage basins.

The network analysis of the drainage basins clearly exhibits that the different laws of drainage basins propounded by Horton and Strahler conform with the advanced stages of basin development rather than the transitional basins. Secondly, the laws seems to be more tenable in case of lower order basins than that of higher orders and finally, differential terrain characteristics are responsible for the deviations in the basin growth.

The computation of drainage density (Table 5.5) depicts a low drainage density value of four rivers, indicating a coarse texture. Moreover, like that of stream frequency the drainage density is found to be the highest in the Kulsi basin. Whereas in the Barapani basin, both stream frequency as well as the drainage density is the minimum (5.3.2 of Chapter 5).

An inverse relationship has been obtained between
drainage density and constancy of channel maintenance in each basins. A spatial analysis of the distributional pattern of the length of overland flow reveals that Barapani, being more advanced in the stage of basin development have comparatively higher value of Lg than the other three basins. This findings however, contradicts with the hypothesis of Coates. As such, a negative correlation is also observed between drainage density and the length of overland flow.

Horton's Form Factor, Miller's circularity Index and Schumm's Elongation Ratio has been applied (Chapter 5) for analysing the geometrical shape characteristics of the drainage basins. The application of these individual method clearly reveals that both Umiam and Barapani have achieved elongated shape whereas Kulsi and Umtru on the other hand have semi-circular shape. The analysis also exhibits that among the four basins, Kulsi is much more circular whereas Umiam has entirely maintained an elongated course. It has also been observed that Miller's circularity Index and Schumm's elongation ratio are not always inversely related to each other. This is specifically noticed in case of the above two mentioned river basins.

Schumm's method of relief ratio has been used for studying the relief aspects of the respective drainage
basins (Chapter 5). No doubt, the rivers Kulsi and Umtru possess the highest relief ratio in contrast to Umiam and Barapani rivers. In short, the network analysis of each of the individual basins clearly shows that the linear, areal and the relief aspects of the drainage basins are overwhelmingly controlled by geology, pedology, rainfall and vegetation. Any variation in one of these factors not only brings deviation in the different morphometric aspects but also upset the normal operation of the drainage system.

The very purpose of geomorphological investigation will fail if the complex linkages between man and his physical environment is not evaluated. Geomorphology of the study area has definite impact on the evolution of its ecological environment and thereby significantly influenced human activities and at the same time sculptured a distinct personality of the region.

The rugged topography, sub-tropical location, heavy annual rainfall, dominance of 'jhum' or shifting cultivation, all these together have a cumulative effect on the ecological and physical environment. For, usual 'jhum' cultivation and forest felling, soil erosion is a common problem. On an average of 41 tons per hectare of top soil are estimated to have washed down from 'jhum' areas.
according to a study conducted by the Indian Council of Agricultural Research in 1982. The consequence of the loss of such top soil has caused irrepairable damages to the eco-system.

The central highland of the Khasi Hills stands as an orographic barrier for the south-west monsoon winds. So the southern face of Khasi Hills receive more rainfall than the north facing slopes. It has been observed in recent years that there has been decrease in the total annual rainfall with a marginal increase of average annual temperature. The urban sprawl of Shillong and rapid felling of forests is one of the major cause for climatic charge in the recent years. With the decrease of rainfall and increase in temperature the population of mosquitoes, flies and pests have appeared over the plateau. Concurrently several species of weeds and unproductive plants have encroached the higher elevations from the lower ones.

The two significant earthquakes of 1897 and 1950 have caused major upheavalment of the landscape in recent years. Land faulting, fracturing and slides have imparted momentum to erosional problems and changes in river courses.

Turning to vegetation cover, it is observed that the northern face of Central Meghalaya has a dense canopy of vegetation cover, compared to the southern face. The
commercial exploitation of timber has resulted in rapid destruction of various species of trees. The manufacture of charcoal on one hand and to meet the requirements of wood-based industries on the other, has stimulated unsorted felling of trees, resulting progressive ecological disturbances. In fact, the Landsat images data obtained from the National Remote Sensing Agency reveals that there has been 8 per cent decrease of the forest area in Meghalaya as a whole between 1972-75 and 1980-82.

Another serious reason for the destruction of forests is the common practice of 'jhum' cultivation. It is estimated that approximately 20 per cent of the state's total population is engaged in 'jhum' cultivation, spread over an area of approximately 52,000 hectares. The ephemeral settlements in and around 'jhum' plots, following the 'jhum' cycle further accentuates ecological imbalances. The ecological disorder brought about in the forest eco-system has its ramifications on the animal population as well. For example, the loss of vegetal cover directly reduces the food supply for various animals. Forest fires - an accomplice of jhuming, are also greatly responsible for destruction of various species of flora and fauna.

Poaching of wild animals for food and recreation has made the wildlife population susceptible to extinction.
The ecological demolition is not confined to the land organisms only. Its effect is visibly seen in the aquatic eco-system as well. The pollution of the lake Umiam from the sewerage collected from the Shillong urban agglomeration has progressively endangered the existence of the biotic species.

An attempt is made to throw light on the human ecology on the background of physical layout of central Meghalaya. Clustered settlements are few and far between due to the physical configuration of the land, criss-crossed by hilly terrain associated with transverse and extended gullies. In general it is observed that average slope is a key factor in determining the growth and spatial layout of settlements. Large sized settlements are commonly found along the watershed zones.

Compact settlements are found along the gentle slopes of the hills and intermontane valleys suitable for agriculture, and along national highways which provide ease of accessibility to different villages and semi-urban centres. Dispersed settlements are mainly found along the western and north-western part of the study area, having deeply dissected topography with isolated hillocks. In general, nearby 82 per cent of the settlements are found in areas of about 3° slopes and the areas having slope above 6° are more or less secluded.
Due to the initiation of various development plans and programmes, there has been a marked shift of rural population from agricultural pursuits to other occupations in the urban and semi-urban centres. The 1971 census recorded only six urban centres but in the 1981 census six more towns were added. The growth of urban settlements and diversification of activities have promoted strong reaction not only in the settlement pattern, but also in primary activities of rural mass.

The urban population are mainly employed in the secondary and tertiary sector of the economy. In fact, the service sector engages a considerable number of persons. The creation of new administrative units have drawn people to the urban centres for employment purpose. The Nepali settlers are basically engaged in live-stock farming. Their concentration is well marked in the lower slopes of the north Khasi Hills. Wanton grazing of animals in the forests have accentuated soil erosion problem. Rapid growth of population has progressively caused encroachment upon the virgin lands for settlement purpose. Desperate attempts are made to overcome the adversity of slopes by adopting contour and terraced farming method.

By evaluating the terrain characteristics and ecological setting, plantation of tea, coffee, rubber and
cashewnuts are being envisaged especially in selected areas like Umsning. Jhuming is being discouraged primarily for restoration of eco-system through forest regeneration and adaptation of terrace cultivation.

The construction of roads to connect the interior areas with the nearby urban centres has necessitated cutting across the rocks on the gentle hill slopes. The areas composed of red laterite materials once disturbed are susceptible to frequent landslides and soil slips in the monsoon season. Frequent cutting of hill slopes to develop new roads or to realign the existing ones, has its impact on the physical landuse.

Central Meghalaya has abundant reserve of coal and water resources for power generation. So far, only the Umtru, Umiam and Kopili hydro-electric projects have been completed. The damming of rivers has submerged valuable agricultural lands, human settlements and forest areas. This has its ill effects on the ecological assets. The open cast mining of coal practiced in Khasi Hills has damaged valuable land resources making them totally useless either for forest regeneration, settlements or agricultural purpose. Similar ill effects are also commonly observed in limestone quarries. The construction of overhead electricity transmission and
telephone lines by dutting down trees in remote and inaccessible areas has resulted in loss of considerable forest cover.

The industrial milieu of Meghalaya is dotted with innumerable small scale and few medium scale industries. Among them, the saw mills and plywood factory at Burnihat and the Cement factory at Cherrapunji are worth mentioning. The era of planned development initiated under the Five Year Plans has generated employment opportunities for the local populace, but at the cost of impairing the environment. In all such developmental activities, the vital aspect of resource conservation and ecological management has been ignored. Depletion of floral wealth, atmospheric pollution caused by vehicular and factory exhausts has caused abnormal heat conservation in the atmosphere with resultant thermal change.

The development of road communication has also helped to diversify settlements vis-a-vis decentralised growth of settlements thereby exerting significant effect on land management aspects. The diversification of economic activities has stimulated considerably the land and environmental management scenario irrespective of the geomorphological setting at the local level.
The occupational pattern has mainly controlled the environmental management of the region. Escalation of settlements, abrupt spurt in population density, unscientific management of land has been directly responsible for creation of water scarcity in the study area. Intensive use of road side lands for raising cash and horticultural crops, has promoted depletion of valuable lands and at the same time stimulated diversification of economic activities. This is a common scene along the main communication lines, the urban and sub-urban areas.

It is quite apparent that morphological changes in its physical make up has a direct impact on ecological setting in the study area. The intensity of ecological mismanagement has gone to such an extent that the future habitability of the region will be adversely affected if a scientific and judicious land-use and water resource planning is not undertaken in the study area. The geomorphological evolution is therefore considered to be the primary approach in assessment and resolution of chronic degradation that has occurred in the northern Khasi Hills.

7.2 Conclusion:

The above summary substantiate that the present landscape of the study region expresses itself in various
surface forms ranging from granite gneissic domes to peaks, hills-plateaus, spurs and scarps projecting above the general surface and have been highly dissected and variegated by prolonged stream actions.

However, it may also be pointed out that the physical configuration of Central Meghalaya in general and the area under study in particular is a denouement of the combined function of different phases of tectonic uplift, the process and magnitude of erosion in consonance with the resistivity of geological formations.

A detailed morphometric analysis of average slope, relative relief and drainage characteristics of the northern belt of the Khasi Hills has revealed two distinct but vital issues of terrain evolution and development.

Firstly, the characteristics of the terrains have developed in spatial as well as in regional dimensions.

Secondly, it confirms the impact of the pedestal structure on the landscape evolution.

Further, it has been observed, that the present morphology of the area with respect to drainage, slope and relief bear close relationship with the regional and local faults which are numerous in the region. A series of rapids, variations in the depth of the bed rock, deflections
in the river courses present meaningful evidences of faults that took place during the post tertiary period.

1. A spatial analysis of the average slope of northern Khasi Hills shows a variable distribution of slope throughout the entire area.

2. The aforesaid analysis has provided a lever to categorise the entire region into six major slope groups, such as level (0°-1°), gentle (1°-3°), moderate (3°-4°), moderately steep (4°-5°), steep (5°-6°) and finally very steep (6°-7°) slopes.

3. Gentle slope is found to have the largest areal coverage, whereas very steep slope of above 6° occupy the least area in an isolated patches. This indicates the existence of a sizeable area for settlement and other activities in the study region.

4. Regionwise frequency distribution of slope exemplifies that there are over 91 per cent of the gentle slope around Khyrim, Khydem and Mawrynkneng in the eastern boundary of the plateau. Moderate slope occurs in the southern part, and moderately steep slopes are found in the north and north-eastern part of the hill region. The steep and very steep slopes are dominant in and around Rambrai and Mairang region in central part of the north Khasi Hills.
5. The different slope ingredients and their spatial variation has exerted great influence on the human ecology of the area. So also, the impact of man in this hilly terrain is clearly noticed in the modification of slope profiles. The practice of jhum cultivation has also contributed substantially towards this end. Therefore, the study of slope in the northern Khasi Hills region not only depicts the mode and development of terrain characteristics but also indicates a basis for perspective physical planning.

6. The altimetric frequency analysis has established the variability of altitude in relation to the respective areas.

7. In addition, the frequency graph as well as the frequency curves have also revealed two distinct erosional surfaces, one at 914.6 m and the other at 1676.8 m above the M.S.L.

8. By and large, the steepness of the frequency curve at a height of 152.4 m indicates an original plateau topography of the study region.

The results of the altimetric analysis and the profile analysis are found to be conformal which confirm synomity of the two distinct erosional surfaces. At the same time these are represented by scarps.
1. The superimposed profiles have shown two different plateau surfaces. The higher one lying over 600 m height and the lower one at the height of 300 m and below.

2. The profiles have not only outlined the relief configuration of the northern Khasi Hills but have also established the fact that the central portion of the Khasi Hills represents the true character of a typical plateau landscape, in other words this area is a true representative of the 'Shillong Plateau'.

Relative relief analysis is essentially done to picture out the nature of the local terrain and their consequent landform characteristics. The northern Khasi Hills has its typical form unlike the rest of the Khasi Hills.

1. From the study of relative relief, five significant categories of relief configurations have been distinguished in the study area. They are low, moderate, moderately high, high and very high.

2. The study has highlighted that low relative relief shares the highest percentage of land, having a total areal coverage of 4070.1 km². The entire eastern margin of the study area along the broad Umiam Valley
is predominantly covered by low relief. Moderate relief occupies 25.7 per cent of the total area and is distinctly apparent in the east; in the scarp region of the higher plateau surface, in the central part and in the extreme north eastern boundary of the region. Shillong and its neighbourhood also have moderate relative relief. The dissected eastern edge of the plateau is the only conspicuous area having moderately high relative relief. Both high as well as very high relative relief are exclusively confined in ridges of exposed resistant rocks.

Admittedly, the findings of the study therefore clearly indicates that the eastern as well as the extreme northern boundary of the study area are in their senile stage of geomorphic development. A critical analysis of the morphometric properties of the four drainage basins of the study area substantiates the fact:

1. That the upper reaches of each of the basin show a close link with the natural laws of drainage network in respect to stream number, stream length and allometric growth. This establishes that in the lower orders homogeneity of the surface character is maintained, whereas in the higher orders heterogeneity is the rule.
2. Strahler's law of basin area is found to be exclusively tenable in case of the Kulsi river, whereas Umtru, Umiam and Barapani depicts pronounced departure from the law.

3. The analysis also reveals that bifurcation ratio, drainage density, drainage pattern as well as the basin shape of each of the four rivers of Central Meghalaya are specifically controlled by relief and structure.

4. Another important finding of the drainage network analysis is that the various laws of fluvial morphometry corroborate with the advanced stages of basin development rather than youthful or transitional basins.

5. The standard average value of bifurcation ratio around 4 has not only substantiated the characteristics of natural stream system but has also established the dissected nature of the terrain.

6. The study of overland flow (Lg) reveals that among the four basins, Barapani is in its mature stage of basin development, whereas, Kulsi, Umtru and Umiam are between youth and maturity, better be termed as perspective maturity.

7. A negative correlation is also found between drainage
density and length of overland flow in each of the basins which indicates a coarser texture, uncommon in such an old subdued topography.

8. Relief ratio has been found to be maximum in case of the Kulsi and Umtru river. This substantiates the fact that the central part of the Khasi Hills where these two rivers traverses is a zone of contrasting relief features. Here the surface configuration is much more irregular and dissected in contrast to that of the Barapani basin of the eastern extremity of the study region. However, the foregoing drainage analysis, explicitly suggest that the present configuration of the northern belt of the Khasi Hill Region is the temporal end product of the evolution of drainage system.

The overall geomorphological study of the region, therefore, reveals that average slope, relative relief, profiles and frequency of drainage, as also the tectonics of the area in response to the lithology have produced terrain of variable dimensions and differential elevations.

Further, it has been established that physical framework of the region has a direct bearing on the ecological landscape - both natural as well as cultural. The geomorphic control can very well be understood in the
region like Central Meghalaya. The role of various physiographic formations, soil characteristics and water source along with the other natural secondary controls like drainage, climate etc. are responsible for the evolution of definite type, character and direction of growth. The underlying geological formation and the surface configuration control the geomorphic processes and their varied impacts are reflected upon the human activities. The incongruous hilly terrain has influenced the type, growth and output of human endeavour to a great extent. Inspite of having a sound ecological set-up, the natural endowment of the Khasi Hills has been greatly undermined. Primarily this is done to solve immediate problems of settlements and employment. Indiscriminate encroachment even on the steep slopes of higher altitudes are not spared where jhum cultivation has damaged the natural ecosystem permanently.

Despite the fact, that agriculture is the main stay of the people of Khasi Hills, it is still a food deficit area. This is essentially because of lack of proper knowledge in identification of useful land and scientific management. Further, search for mineral exploits, forest resources and industrial development are in the main responsible for the use of the best culturable land of the area. Along with this, the
population explosion has caused enormous strain on the environmental make up resulting in rapid environmental degradation.

The evolution and the continuum changes are so radical and speedy that stage transformation has become evident. The entire development must be a co-ordinated approach for the preservation of the natural endowment including the scenic beauty for which the capital city (Shillong) was once famous as the 'Queen of the Hills of India' and 'the Scottand of the East'.

The findings, therefore, suggest that unless a concomitant adjustment is made, so far the use of the terrain is concerned for the benefit of human society, the consequences might lead to a hazardous situation in no distant future. The adjustments need a rational approach towards the perspectives of geomorphological endproducts.

A scientific and judicious land and water resources planning and management of Central Meghalaya is therefore, the need of the hour. Geomorphological appraisal shall be the only needs to provide the guidelines for assessment and utilization of its resources. This is inevitable in order to prepare an effective blue-print for the economic development of the area on the
backgrounds of a balanced eco-system.

The assessment shall profusely guide to evolve means and measures for soil erosion, land depletion and balanced economy.

7.3 Suggestions:

1. There must be an apposite classification of land according to the geomorphological characteristics, unlike the plain land. At the same time investigation in the soil properties especially in selective landforms should be undertaken for soil conservation, afforestation, canal construction, mining and agricultural activities.

2. For a sound environmental management, the rate of soil erosion, land depletion and the environmental degradation have to be assessed which invariably depends upon geomorphological characteristics of the terrain.

3. Any solution meant for the transformation of the 'jhum' fields to permanent agricultural land should (a) have an acceptability from the native habitancy (b) full protection against deforestation as well as soil erosion, (c) optimum use of existing land resources — through scientific management.
The only way of utilising the existing and perspective agricultural land without creating any problem of degradation is to promote terrace methods in a phased manner.

'Jhum' cultivation is a way of life, and there are cogent reasons behind the customs and practices of the Khasi tribes. The climate, the terrain, their food habit, their need all depend on 'jhum' cultivation. So any attempt for radical transformation of the poor and stagnant peasantry into a complex scientific one will be resisted as is experienced elsewhere. Tribals, all over the world are tradition bound people and therefore it is hard to persuade them to eschew their age old practices. It would, however, be desirable to start at least one experimental and demonstration farm in each village. Through practical demonstration and training the attitude and aptitude might change and the probability of acceptance would be faster.

Lastly, any future plan for new settlements, agriculture, industry or mining should be carefully formulated on the basis of the present geomorphological structure and the history of evolution for sustained socio-economic growth.
If pragmatic views are taken for rational evolution and use, the country will be protected from wastage and misuse which in course of time shall be effective instrument in conservation of the beneficial environment.