

### Abstract of the Thesis

#### **Title: A STUDY ON THE GEOMORPHIC CHARACTERISTICS OF THE RAYENG BASIN IN DARJEELING HIMALAYA, WEST BENGAL**

The mountain stream Rayeng is a right bank tributary of Tista River. The elevation of the basin ranges between 180m to 2400m. The basin has extremely uneven topography with very steep to moderate slope. High gradient of the relief of the basin encourages the streams to carry large pebbles of crystalline rocks swiftly. The streams are mainly engaged in vigorous vertical erosion and headward erosion which encourage valley deepening and stream lengthening. Consequently steep walled narrow and deep channels are produced. The basin is characterized by many spurs, cliffs, rocky slopes and narrow river valleys. The basin is formed different rocks of different formations and geological ages. Because of various geological formations the morphological features in the basin area vary in magnitude and dimension. This basin has been affected by Himalayan orogeny. Owing to the existence of phyllite and schist in the source region of the Rayeng River occasional dark soils are found. Soil of the lower reaches of the basin is composed of alluvium. In the basin area erosive activity of the streams are vigorous in the monsoon season as huge amount of water received by the river. On the other hand in non-monsoon season due to lack of water discharge is reduced remarkably.

The morphometric analysis of the drainage network of the basin show dendritic pattern with fine to moderate drainage texture. The variation in stream length ratio of the streams of different order of Rayeng basin might be because of sudden changes in slope and topography. Bifurcation ratio of the basin indicates that these are not distorted by geological structures, but lithology has significant role. The presence of high to moderate drainage density suggests that it has impermeable to moderate permeable sub-soil, and moderate to fine drainage texture. The high value of stream frequency points out that the watershed has positive correlation with increasing stream population with respect to increasing drainage density. The value of form factor and circularity ratio suggests that Rayeng is a pear shaped river basin. High values of the hypsometric integral signify that most of the topography is high relative to the mean, such as a rugged upland surface cut by deeply incised streams indicating young and less eroded areas. Scenario of cross profile indicates that, cross section area, hydraulic radii, wetted perimeter and discharges fluctuate seasonally due to variation in rainfall in monsoon and non-monsoon season.

Vigorous soil erosion is mainly concentrated in the rainy season (June to August). Soil erosion is accelerated by the human activities mainly on the vulnerable slope. Rills and

gullies are the main natural tools of the soil erosion of the Rayeng Basin. Landslides are the most significant geomorphic process accountable for degradation of Rayeng Basin. Throughout intense rainfall in the monsoon period, the weathering process is accelerated reducing schists and mudstones into silts and fine sands and succeeding failure of these fine materials triggers landslides in the Rayeng Basin. At the downstream area of the Rayeng River excessive siltation has been observed. Owing to siltation, the water holding capacity and transport capacity of Rayeng at the lower segment has been reduced. This is mainly owing to supply of huge loads for soil erosion and landslides and obstruction in natural flow by the manmade construction.

From the land capability classification of the basin it is revealed that basin has no class - I and class - II category of land. Maximum land of the basin is belonging to class - VII and class - VIII category. Major portion of the basin is covered by dense vegetation, although in many parts of the basin vegetal covers are disturbed by human interference. From the general study of geomorphic and environmental scenario of the Rayeng Basin it has been observed that the basin is being faced different problems. The identified problems are environmental hazards, deterioration of ecological balance, hydrological disturbances and land use problem. The ecological balance of this basin has been disturbed due clearance of forests. For the encroachment of settlement, agriculture and plantation and construction of road huge amount of forests have been cleared. Thus not only ecological quality of the basin but also the biodiversity of the basin have been hampered. Constructional works within the river bed disturbed the hydro geomorphic characteristics of the basin. This basin is important for the supply of water for drinking and energy. Freshwater from this basin also supports unique ecosystems and biodiversity of this basin area. But the basin is under pressure of deforestation, agriculture and tourism and heavy construction. For the security of the local people water resource of this basin must be restored. Improvement in science and technology in conjunction with reorganization of means of achievement of development activities is desired for enhancing the element of sustainability in Rayeng Basin scenario. Near the confluence sands, gravels and boulders deposits are spectacular. Constructional works introduced by the man at the confluence of Rayeng River with the Tista River caused an interruption in the natural channel behaviour. Near the confluence, the channel of Rayeng River has been bifurcated in a number of channels by the mid-channel bars. Settlements have been built-up on the mid-channel bar. This basin has attractive scenic beauty. The major portion of the basin is covered the flora of different species. But recently the land use pattern of this basin has been changed due human interference. Construction of roads, establish of tea garden and cinchona plantation has

altered the land use pattern. The unplanned land use of this basin is responsible for the deterioration of the basin. Thus to restore the natural characteristics of the basin the land used must be operate with proper planning strategy. Manifold facets of problems and potentials of the basin demand integrated approaches.

*Sanjoy Saha*

**Sanjoy Saha**

(Researcher)