ABSTRACT

Man's involvement with the earth surface creates changes, therefore professional secreting of these activities also falls within the realms of geomorphology. Change is an integral and natural part of all ecosystems. However, human disturbance has introduced a source of change that is foreign to the geomorphic and biotic conditions of river system. With the scientific growth and technological development, man has emerged as a significant geomorphic agent and degrading environment of geographic milieu is capable of changing the earth's surface at much faster rate than many of the natural processes. The Buriganga River catchment has developed natural forest landscape. The southern part represents low lying built up area of the basin. But the natural vegetation in this region of Karbi Plateau is highly degraded due to shifting cultivation in Karbi Plateau. The built up plain areas of the basin is intensely cultivated with a variety of crops. Moreover, this part of the basin has been characterized by complex pattern of human habitation.

The main objectives of this thesis is to study the geomorphologic characteristics of the Buriganga basin, to analyze the hydrological characteristics of the basin, to assess the impact of human economic activities on land use changes using remote sensing and Geographic Information System, to assess soil erosion hazard with respect to changing land use of the study area using empirical and physical models, to identify and analyze some Geo-environmental problems caused by the human activities within the drainage basin, to study the current state of water quality of the river and uses of water resources in the basin and to suggest some management measure for sustainable development of the basin.

The standard methodology of data collection, classification, integration, interpretation and analysis has been adopted at different levels. Library works were done to consult of books and Journals for reference. Meteorological data for rainfall, temperature and humidity, groundwater data and water discharge of Buriganga River, geological, Soil map, data on types of forest, population and village map of the study area were collected from different secondary sources. Base map of the basin is preparation using Survey of India topographical Sheets No 83 B/15 and 83 B/16 at 1: 50,000 scale.
Three sets of Satellite imageries were used (for the period 1987, 1997 and 2007 at 1:50,000) to prepare Land use/land cover map in using GIS software ERDAS 9.1 and ArcGIS. The outline map of the study area is superimposed on the Satellite imageries to identify and demarcate the category of land use and soil erosion. Morphological and tentative thematic maps were prepared based on topographical, geological, Soil, Hydro-geomorphic and land use etc of the study area. Population, socio-economic parameters and resource data are collected using questionnaire is prepared on the basis of the objectives and research questions of the study. The household Survey is undertaken by the stratified random sampling techniques. Water samples of definite sources are collected and chemical analysis for selected parameters are carried out to assess the quality of water. The information's collected from the primary and secondary sources are tabulated, summarized and analyzed using quantitative and computer aided techniques and prepared with thematic maps, charts, tables, graphs using appropriate cartographic methods. The present study has been organized into eight chapters. The first chapter incorporates the introduction containing statement of the problem, objectives, methodology, research question, review of literature and significance of the problem. In the next six chapters deals with a geographical overview in terms of soil, geology, climate, vegetation and agriculture; geomorphological characteristics; population and settlement; land use and land cover change which shows the results of the land use and land cover classification and an analysis of the evolution of land use and land cover changes for each spatial pattern and geographical and environmental changes takes place due to man made sources of the study area. Conservation and management measure of selected problem are also incorporated in the study. Summary and conclusion is attempts in the last chapter of the thesis.

The Buriganga basin lies in an area between 26°7'12" N to 26°18' N latitude and 92°49'12" E to 92°56'24" longitude. The river Buriganga is draining through an area of 118 km² from its source up to its confluence with the Jamuna River. Geologically Buriganga basin comprises of Gneiss, shiestic Granite of Karbi Plateau of Shillong group of formation of Pre-Cambrian age and recent alluvium of Quaternary epoch. On the basis of absolute height, structure, general terrain characteristics, drainage, landscape characteristics the Buriganga basin of Nagaon and Karbi Anglong district can be broadly
divided into the four micro level physiographic regions- the Dobaka hill range, the Plateau topography, the Piedmont Plain and the southern alluvial plain. The basin consist of southern plain of recent and old alluvium, brought down by the Jamuna, Buriganga and its tributaries from Karbi plateau as Clay, Silt, Sand and gravel with occasional boulders. The Karbi plateau and Dobaka hill in the northern and south western part of the basin consists of lateritic and red soil having steep slope and Gneisses, Shiest, Phyllites and Granite structure. The basin falls within the humid sub tropical climate and characterized by hot summer and dry winter. The average annual rainfall of Buriganga river basin is 168 cm. In January, minimum temperature of the basin is recorded 9.74 °C and rises up to a maximum of 36.8 °C in the month of July and August. The forest cover of the study area is characterized by Eastern Hill Sal Forest (Khasi Hill Sal) and Moist mixed Deciduous Forest.

Analysis of morphometric and hydrological behavior of the basin represent distinct characteristics owing its input-output mechanism. This has been justified by the data generated through the application of various parameters of morphometric and hydrologic aspects. The morphometric analysis of Buriganga river basin provided an understanding of the relationships among the different aspects of the drainage pattern and their influences on the landform processes, drainage and land erosion properties. The results revealed that the types of morphometry, underlying geology and slope factors have great influence on landform development processes. Fluvial landforms are produced by erosion and deposition of streams that are connected into network. The properties of fluvial landform are studied with respect to stream network (stream order, stream length), relief aspects (absolute relief, Average slope, relative relief, and dissection index), drainage aspects (stream frequency, drainage density). The micro-morph units exhibit an assemblage of micro level morphological features. There are five micro morphometric zone are drawn for the systematic and scientific analysis of the morphological mosaic of the study area.

The study of hydrological regime of the Buriganga river basin is carried out through the analysis of four hydro-meteorological parameters viz. rainfall, flow regime, underground water and frequency of flood. The greater amount of rainfall recorded during the summer season, while during winter season atmospheric water resources
availability is limited. The seasonal variation of precipitation in the study area results in pronounced, predictable runoff pattern during the rainy season, with peaks occurring after each substantial storm events. The occasional rainstorms during monsoon season result in increased runoff which causes high discharge in the downstream of Burigonga and results in recurrence of floods in the riverine regions of the Jamuna basin and Buriganga plain. From ground water investigation in the low lying areas, it is observed that there is very low rate of infiltration or sub surface flow. Ground water fluctuation (January-August) is gradually decreased from 1.47 meter in the 1997 to 0.26 meter in 2005.

The most remarkable demographic feature of the Study area is the rapid growth of its population and uneven distribution and density of population. During 1991-2001, the total population increased from 7161 to 8947 at the rate of 24.94 per cent. During 1991-2001, the total number of households of the region increased from 1135 to 1525. The concentration of population is high only in the alluvial plain area. In the southern alluvial plain, significant amount of rainfall for agricultural practices, fertile soil; irrigation facility through the construction of Buriganga canal and due to transportation facilities, the concentration of population is relatively high in this region. Agriculture is the main economic activities among the people living in Buriganga river basin. About 87 per cent of the total worker of the basin engaged as cultivator and agricultural labour. In the upper catchment of the basin, jhum cultivation is commonly practiced of agriculture. Due to Jhum or slash-and-burn cultivation of Karbi Anglong part of the basin, flow of migrants and human illegal encroachers lie on Dobaka reserve forest, fuel wood gathering, inefficient commercial logging operations and large scale, and uncontrolled forest fires, there has been rapid change of land use categories. As per the topographical sheet prepared by Survey of India, 1967, the land use and land cover in Buriganga basin are-Natural vegetation, degraded forest, wasteland, water bodies and agriculture and built up area. Land use change over the last 40 year period reflects that, about 92 per cent of the total geographical area of the basin in 1967 was covered by forest land which has reduced to 45 per cent in 2007 due to expansion of cultivated land and cultivable fellow land. A significant human induced change in the study area is deforestation. From 1967-2007 about 31.71 Km² forests area is converted into non-forest area at the rate of -0.72 % per annum.
Soil erosion is another crucial problem in Buriganga basin. Soil losses are minimal in dense forest and irrigated rice fields in the Plains. Soil erosion is the result of combine effect of Slope length and steepness, vegetation cover, surface soil condition and intensity of rainfall. Apart from these, particle size distribution, effect of slope exposition and shifting cultivation seem to have substantial influence on soil erodibility and development of erosion features in the study area. Results estimated by running a soil erosion assessment model (Morgan et al., 1984) show that annual soil loss rates are the highest (up to 16.99 tones/km²/yr) in the areas under fellow land, whereas less amount of soil loss is estimated (less than 1 tones/km²/yr) under land use types, such as dense forest and open forest areas of the basin. Soil erosion is result of conversion of forest land into agricultural land in the villages of Karbi Anglong and Nagaon.

In the downstream area of Buriganga river basin, the direct modification of channel processes by man is the diversion of channel water through irrigation canal, supply of water for domestic use and water for irrigation. It reduces normal discharge of river which causes the siltation and sedimentation of river bed. Resident and cohesive bank materials restrict correction and lateral erosion in the bank by stream channel and hence limit increase in channel width. Similarly, armoring of channel beds provided by cohesive coarse bed materials restricts bed erosion and hence deepening on channel bed.

Sand and gravel are the two most important material resources extracted from the Buriganga River. About 34.61 per cent of total households are directly engaged in extraction of stone from the river bed and bank. It is observed that heavy soil erosion in the foothill region of Dobaka Reserved forest and bank erosion in the downstream segment of Buriganga River occurs due to illegal felling trees and digging pits for on the river bank for extraction of sand, pebbles, gravels etc.

In the water quality investigation of drinking water of the Buriganga basin, it is observed that some of the parameters of water are found to be above the safe limit of WHO standard and ISI tolerance limit. Contamination of fluoride, calcium and chloride in ground water as well as river water are found to be higher than the WHO and ISI permissible limit.

Human impact on river systems in type and extent, ranging from site specific works along a particular reach to catchments wide change in ground cover. River basin environment have suffered detrimental effects of human disturbance. Strengthening of the scientific and technical information base, assessment of available technologies vis-à-
vis the unique nature of the region and introduction of more appropriate strategies are other aspects that need to be emphasized. Sustainable development strategies require through an integrated, multi-disciplinary approach that covers not only technological aspects but also social, economic and environmental aspects and legitimate societal needs that the structural measures are capable of satisfying in an underdeveloped region like Buriganga river basin.