

Abstract

The Dhansiri (South) River Basin is an interstate basin covering an area of 12,240 sq.km spreading over parts of Golaghat, Karbi Anglong and Dima Hasao districts of Assam; Kohima, Wokha, Mokokchung, Zunheboto and Phek districts of Nagaland and Senapati district of Manipur. It is drained by the river Dhansiri and originates in the south-west corner of the Naga hills in Laishang peak of the Barail range at an altitude of 1,868 m and outfalls into the Brahmaputra at Dhansirimukh (Sarma, 1993). The hydrological station on the river at Numaligarh indicates its danger level as 77.42 m and maximum, minimum and average water discharges as 209,185, 4.88 and 513 m³ s⁻¹ respectively. The lower part of the river basin lying within the state boundary of Assam is considered in this study as the upper part is difficult to access for field study and very scanty data and information are available for this study. It is a 6th order basin with drainage density and stream frequency of 1.59 km/km² and 0.5 km/km² respectively. The river Dhansiri is an intensely meandering river resulting in frequent shifting of its bankline which contributes to severe river bank erosion associated with loss of land and sediment deposition along the river. Forest and Agriculture provide the main source of livelihood to the people of the basin, most of them belonging to various ethnic communities. The basin also includes important biodiversity rich areas such as the Nambor Reserve Forest, Part of Dayang and Rengma Reserve Forests, Garampani-Doigurung Wild Life Sanctuary and the Kaziranga National Park.

Substantial work on the problem of flooding and bank erosion of the Dhansiri river has been carried out by researchers on various aspects but these lack a

comprehensive approach which takes into consideration the geo-environmental, geotechnical and socio-economic aspects covering the whole basin. The present research work was taken up to study the pattern of landuse/landcover change within the basin, nature of channel change and bank erosion as well as relevant geotechnical properties and soil erosion pattern taking into consideration the geo-environmental aspects of the basin.

A thorough literature survey was carried out to formulate a methodology to fulfill the objectives proposed for the research in the study area. The conventional method of mapping and field survey are expensive and time consuming. Geospatial technologies provide an effective tool for getting information on terrains that are inaccessible having large spatial dimension. The interpreted thematic information obtained as a result of analysis and integration in GIS are presented in the form of maps and graphs and results obtained through laboratory investigations are presented in the form of tables and figures.

The first chapter contains a general introduction to the statement of the problem of the research theme. It also presents a review of existing literature on works related to the research theme carried out by different researchers in various parts of the world and significance of the study. The second chapter presents the objectives identified for the research theme and the methodology adopted for achieving the same. It contains the details of the database used for the study and the methodologies for each objective are described in detail.

In the third chapter the geo-environmental setting of the study area is described in terms of its location and extent, drainage network, climate, geology, geomorphology,

soil, landuse, communication and population and human settlement. The basin under study spreads mainly over the districts of Golaghat and Karbi Anglong with a small portion falling in Dima Hasao former N.C.Hills of Assam.

The fourth chapter presents the various thematic maps prepared during the study and their interpretation. The interpretation of these thematic maps was carried out in consultation with published literatures and maps. The various thematic data generated during the period of the research include: preparation of Base Map of the study area, Landuse/Landcover map of 1999 and 2008, NDVI map, Drainage Network map, Slope map, Geology map, Soil type map and Rainfall map.

The fifth chapter presents the results of the pattern of landuse/landcover change in the study area during the period 1999 and 2008. The Landuse/Landcover change analysis indicates that the areas under agricultural land in the plains have decreased from 19.43% in 1999 to 16.83% in 2008. Areas under rural settlement and homestead garden and urban settlement have increased from 15.33% and 0.27% in 1999 to 20.57% and 0.41% in 2008 respectively. The area under wetland category also shows a reduction from 0.68% in 1999 to 0.60 % in 2008. Area under tea gardens shows a positive change from 2.88% in 1999 to 3.05% in 2008.

The sixth chapter deals with the nature of channel change and bank erosion of the Dhansiri River for the period 1999 and 2008. While studying the nature of the channel change, the sinuosity is found to vary from 1.22 to 4.91. Different types of meander movements have been noticed which include neck cut off, formation of new meander bends, rotation, translation, extension, lateral, narrowing/widening of the channel and complex. Straightening of channel by neck cut-off along the studied reach

is observed at seven places during the period 1999-2008. The neck cut-offs had resulted in shortening of the channel course from 313.94 km in 1999 to 307.74km. Similarly rotation has been observed at 13 places , translational has been observed at 11 places, extension at 11 places, lateral at 8 places, narrowing/widening at 3 places and complex type observed at 1 place along the river channel. These types of meander bends cause shifting of the bankline of the Dhansiri River channel. This leads to heavy loss of land due to erosion by the river channel. It has been found that the total area lost as a result of erosion is 13.13834 sqkm. and the total area gained as a result of sediment deposition along its bank is 15.15894sqkm. It also presents the results of investigation of geotechnical properties of soil samples collected along the bank of the river and their classification according to Indian Soil Classification System (ISC). The soil samples show their variable composition from clays and silts of low plasticity to silts and clays of high plasticity.

The seventh chapter describes the methodology adopted for integration and analysis of multilayered thematic data using geospatial technology and preparation of a soil erosion risk zone map for the study area. The chapter explains the calculation of weights assigned to particular thematic classes and their sub classes that have been identified to contribute to the soil erosion in the study area. Finally, a soil erosion risk zone map of the study area is prepared adopting the principles of Analytical Hierarchy Process developed by Satty (1980). A reality check of the prepared soil erosion map is also done by field verification of the sites which reveal the presence of many visual indicators of erosional and depositional geomorphic features like cut bank erosion, abandoned channel, sand point bars and so on. The areas under different soil erosion

risk are calculated and found as follows: 225.108 sq.km under very high erosion risk zone, 1325.71 sq.km under high, 2257.25 sq.km under moderate and 715.89 sq.km area is vulnerable to slight erosion in the river basin.

The eighth chapter presents the underlying causes of flood inundation and its spatial extent in the study area. It also presents data collected from secondary sources on the damage done by flooding in the study area. A flood inundation map is also prepared showing the spatial extent of the chronically inundated areas on which the revenue village map of Golaghat district is overlaid and the villages falling under the risk zones are identified. The flood inundation map shows that 687.75 sq.km areas suffers chronic inundation which covers 276 villages in the revenue circle of Golaghat district. A flood inundation thematic layer for Kaziranga National Park is also prepared showing the spatial extent of inundation. It has been found that an area covering 378 sq.km of the park suffers inundation. The flood frequency analysis has been done using Log Pearson Type 3 Distribution method by taking 24 years data of High Flood Level data from 1982 to 2005. It reveals that the recurrence interval of flood of the lowest intensity is 1.5 years and of highest intensity 100 years.

The ninth chapter presents an integrated river basin management plan for the study area with special emphasis on minimization of the impacts caused as a result of deforestation, soil erosion and flooding in the area.

The above observations reveal that the Dhansiri (South) River Basin is facing the problems of deforestation and land degradation, soil erosion and flooding in its lower reach. One of the major causes of these land degradation and deforestation is shifting cultivation that has been practiced by the ethnic hill tribes of this region.

Shifting cultivation practice results in soil erosion and flood problems on the lower reaches of the basin. The problem of flood in the lower reach of the basin is a recurrent phenomenon every few years. This causes heavy loss of agricultural production, loss of livestock and human lives. Moreover the river with its intensely meandering nature causes frequent shifting of its banklines leading to bank erosion and flooding in the adjoining flood plains. This also causes heavy loss to human life and property. The soils of the study area are also characterized by poor stability, are susceptible to liquefaction and have poor drainage characteristics. . Other reasons contributing to intensification of the hazard potential include growing population which leads to conversion of agricultural lands and filling up of wetlands to settlement area. Since the basin includes a number of important biodiversity rich areas such as the Nambor Reserve Forest, Part of Dayang and Rengma Reserve Forests, Garampani-Doigurung Wild Life Sanctuary and the Kaziranga National Park, an integrated basin management plan for the basin covering various geoenvironmental and socio-economic aspects is the need of the hour. The present study is expected to help in better understanding of the baseline condition and potentialities of the Dhansiri (south) River basin, Assam and help in recognizing the linkages between highland-lowland interactive processes to minimize the natural hazards and gainfully utilize its existing natural resources. The findings and recommendations made based on this study in regards to conservation and management of the river basin may be used by decision and policy makers besides enhancing the existing knowledge and perspectives in regards to this ecologically rich yet economically backward region located in the extreme northeastern corner of the country.