International Journal of Interdisciplinary Research in Science Society and Culture(IJIRSSC)
Vol: 11, Issue:3, (December Issue), 2025
ISSN: (P) 2395-4345, (O) 2455-2909
Impact Factor: 4.575

THE CHANGING GEO-ECOLOGY OF MUTANGA-NONA RIVER BASIN, ASSAM: A FLUVIO-MORPHOLOGICAL PERSPECTIVE

Dr. Anjan Kumar Talukdar
Department of Geography, Narangi Anchalik Mahavidyalaya,
Guwahati, Assam

ABSTRACT :
The Mutanga-Nona river basin being located partly in the Kamrup district and partly in Nalbari district, extends latitudinally from 26°N to 26°53′3′′N and longitudinally from 91°29′E to 91°37′30′′E and has a catchment area of about 338 km^2. The river flows for about 71 km towards south from its source (1068 m) in Bhutan to its confluence (48 m) with the Baralia river in Assam. In Assam the length of the river is about 59 km over an area of about 250 km^2.

The present study aims to examine the morphological and hydrological aspects in terms of relief, drainage, discharge, water bodies, etc., of the basin as well as erosional and prepositional aspects and their land form changes in different locations. In this study assessment will be also made on the impacts of climate on hydrological characteristics related to flood and sediment discharge, water level condition, run-off behavior, etc., from this study it appears that the above-mentioned aspects of the Mutanga-Nona river basin are changing gradually thereby affecting its geo-ecology.

Keywords: *Geo-ecology, Fluvio-morphology, Mutunga-Nona, river, Hydrological, characteristics, Flood, discharge.*

I.Introduction:

Rivers are dynamic entities and their characteristics vary over time and space in response to environmental controls. They usually drained well-defined areal units which can be analyzed. The drainage basin represents a working system of energy inputs and outputs and can rightly be recognized as a fluvial system of open type. Assuming importance as a fundamental geomorphic unit (Chorley, 1969), river basin has done been taken to be the most favorable and effective unit for morphological studies, which thereby provides physical basis for planning-oriented approach towards integrated management of its land and water resources, geo-ecology, etc.

Of late, river basin has been a significant unit of studies in respect of its resource base, land and landform dynamics, changes of hydrological regime and people's attitude towards the

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development. The land and landform pattern and dynamics of the basin are best reflected by the fluvial processes and morphological characteristics developed thereby. The present problem deals with the Mutanga-Nona basin drained by the river Mutanga-Nona. This combined river system oozing at the Bhutan Himalaya flows over an area of 338 km^2 in the Kamrup (presently Tamulpur district) and Nalbari districts of Assam and has developed floods and floodplain, river levees and low-lying areas, sand bars, point bars in addition to abandoned channels, marshes, *bīls*, etc., all these have given rise to a system of peculiar geo-ecological bases and processes. Such studies have now assumed a great significance while exploring resources for the sustainability of the human society, food production, etc., in the basin (fig. 1). The rationale behind the selection of such a problem lies on it.

II. Study Area:

The Mutunga-Nona river basin under study conforms to a major tributary basin of the Baralia river system in the Brahmaputra valley of Assam. This basin covers an area of about 338 km^2. The Mutunga-Nona river basin extends latitudinally from 26°N to 26°53′3′′N and longitudinally from 91°29′E to 91°37′30′′E.

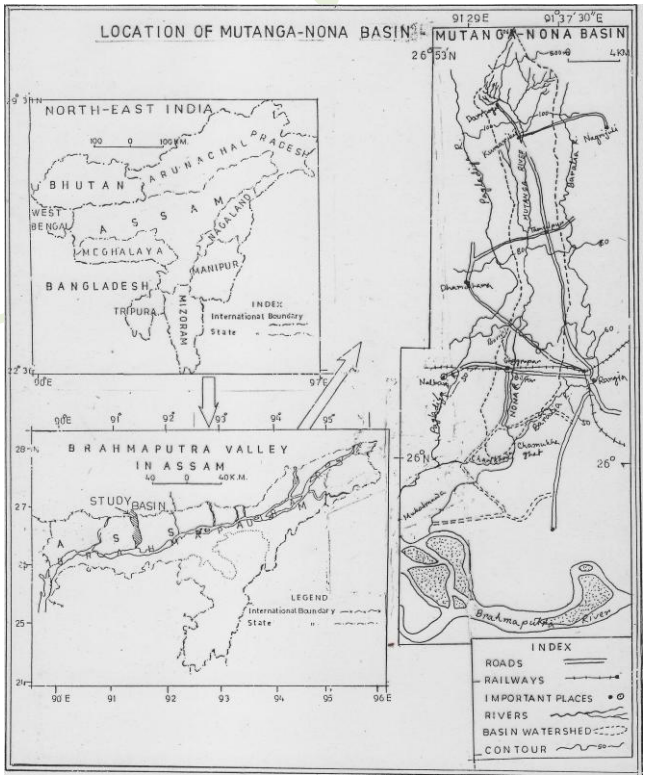

Figure 1: Map of Study Area

III. Objectives of the Study: The main objectives in this paper are:

1. To evaluate the flood analysis in different methods and estimate the projected flood flow pattern, their impacts on fluvio-morphological to create such a hydrological process on the geo-ecology of the basin.
2. To examine the relief, slope and drainage and water bodies of the basin and their changing characteristics which impact on geo-ecological environment of the basin.
3. To suggest some remedial measures to mitigation of frequently changing fluvio-morphological and geo-ecological problems.

IV.Methodology:

The study is based on empirical method of investigation and its conducted using information from both primary and secondary data. Field visit is conducted to gather information regarding responses from the people towards their adjustments and adaptation to the flood and natural hazards along with observation of bank and bed materials and the diversion of river channels as well. Base map for the secondary data and information is formulated based on topographical sheets of 1:50,000 scale at two points of time, namely 1911-13 and 1954-60, satellite images of 1988. Relevant hydro–geomorphic data comprising water level and discharge, silt, etc. are collected from Flood Control Department (Government of Assam) and the Brahmaputra Board (Government of India). Finally, the study basically deals with the processing of raw data into some tables, index forms, maps, etc., were then drawn with the processed data using some statistical and simple cartographic techniques and their analysis and explanation are done to write up this paper.

V. Results and Discussion:

The Mutunga-Nona basin in its northernmost part is the outer fringe of the Bhutan-Himalaya followed by the narrow Bhabar-Tarai there lies the built-up zone and in the extreme

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south of the basin is the low-lying area antagonized by frequent floods (

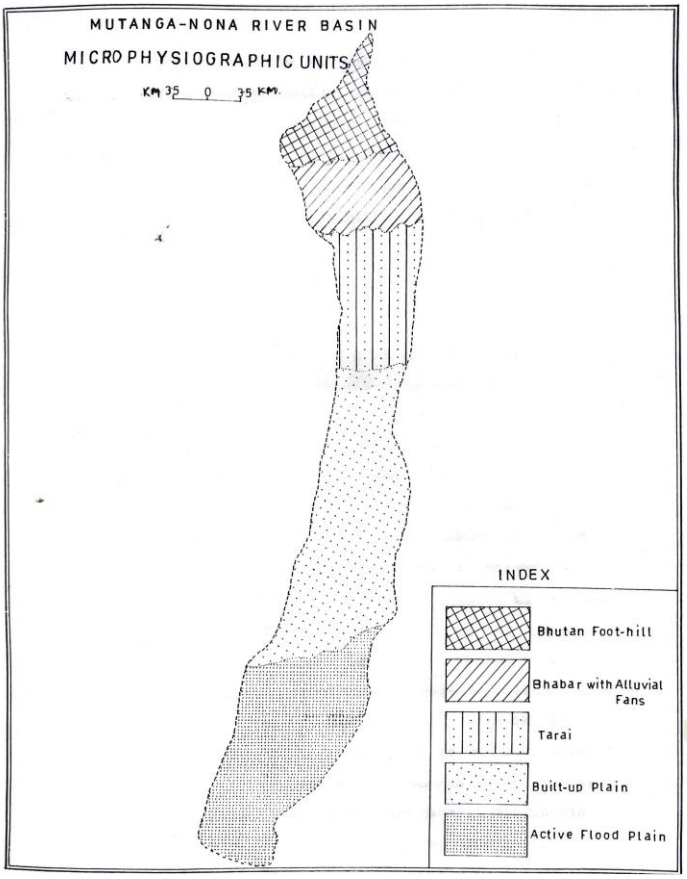

Figure 2: Physiographic Unit). The relative altitude in the first zone indicates abruptly rising mountainous area with tertiary rocks formations and the Siwalik sedimentary layers which are being easily eroded by streams running down to the basin. The Bhabar area of the foothill zone comprises unassorted deposits of gravel, pebbles, cobbles, sand, and silt which have been conducive to percolation of stream water under the alluvial fans and cones. The Tarai belt of the foothill zone signifies the reappearance of streams and has therefore been characterized by damp ground with mashes, *bīl*, etc., and tall grasses. The built-up area below the Tarai comprising the flood-free zone is characterized by heavy concentration of human settlement.

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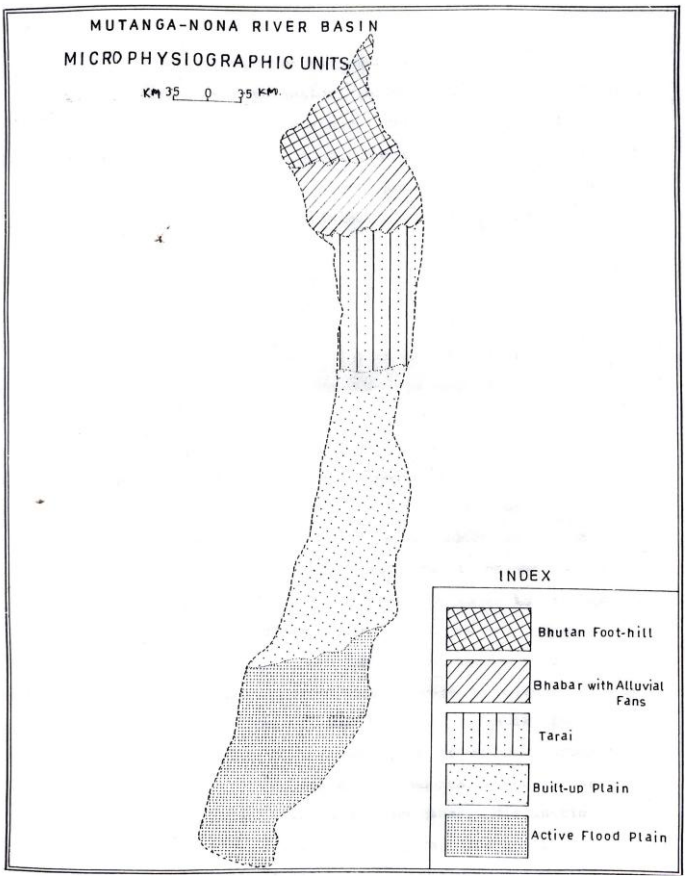

Figure 2: Physiographic Unit

In this portion down cutting of river is more important than lateral cutting. Geologically the Mutanga-Nona basin, especially its northern margin is closely linked with the Himalayan geology. Geological formation of the northern part of the basin conforms to a thin strip of upper tertiary sandstone (Siwalik group) associated with clay alterations all over the Bhutan foothills. The sandstones here are light grey, buff and whitish grey in color. They are compact with soft and massive micaceous rocks. In the low-lying areas, the basin has been characterized by gentle slope, consequent morphological features like levees, marshes, etc. While the basin has more drainage densities (4 to 9.33 km/km^2) and frequencies (4 to 11.45 No. per km^2) in the foothill and mountainous zone, they are a bit less in the built-up areas (2 to 4 km/km^2 and 1 to 3 No. per km^2) respectively, but least in the low-lying flood plain (<1 km/km^2 and <1 No. per km^2). Again, the slopes of the basin and the river fall abruptly from the foothill zone (4° to 35°) to built-up areas (1° to 2°). All these hydro-geomorphic parameters have yielded a peculiar geo-ecological

environment conducive to positive as well as negative developments of geo-ecological and geo-economic dimensions.

Year	Total Annual Runoff (Ha M)	Total Annual Suspended Sediment (Ha m)	Year	Total Annual Runoff (Ha m)	Total Annual Suspended Sediment (Ha m)
1971	19477.16	4.83	1982	17580.31	1.19
1972	28180.3	6.1	1983	13354.98	0.79
1973	9329.83	0.59	1984	16362.48	1.87
1974	19817.86	1.12	1985	14292.55	1.05
1975	12286.16	0.65	1986	7004.23	0.37
1976	9945.24	0.53	1987	21337.29	2.62
1977	20505.92	1.24	1988	49883.83	7.38
1978	7567.3	0.23	1989	18429.37	1.77
1979	12110	0.43	1990	26591.44	3.37
1980	15308	0.57	1991	18701.21	1.53
1981	8339	0.27	1992	12709.45	1.17

The entire basin lies on the monsoonal effect of climate having rainfall (average annual rainfall within 140 to 320 cm) and co-efficient of rainfall variability ranging between 10 and 40 per cent, the foothill areas show annual rainfall of 300 cm to 340 cm (*e.g.* Darranga 320 cm), while the built-up and low-lying areas are having annual rainfalls of 200 cm to 280 cm and 140 cm to 180 cm, respectively. It has been observed that about 80% of the total annual rainfall occurs during May through September every year. The climate coupled with topographic condition and hydrologic water balance yields net effect of vegetation on ecology. The mountainous part is characterized by coniferous wet temperate evergreen forests while the Bhabar and the Tarai belts comprises wet tropical evergreen species. The built-up and the low-lying areas are having tropical deciduous rainforest intermixed with dry deciduous vegetation and grasses. The climatic, hydrologic, geologic and biotic environment in the basin has invariably been doing for favor of high degree of chemical weathering. The incessant downpour during the rainy season creates extensive sheet floods over the lands and the channels of the

basin thereby carrying silt and sand etc., Moreover, the continuous flow of water by the streams and river carries debris and detritus to be deposited on the down valley areas. The varying floods and hydraulic pressure of waters on the river beds and banks have caused drastic changes in the persistency of channels and create volatile morphological features, especially in the vicinity of the channels and fulvio-geomorphologically weak areas. The Nona, as for example near National Highway 31 crossing has since few years back been characterized by hydraulic abnormality and topographic anomaly. The heavy floods have created heavy sedimentation over the bed of the river and it is seen in the field that the bed rises by about 1.7 m to 3.13 m above the nearby paddy field. Moreover, the bed has been characterized by small channel and point bars, etc. The basin on the other hand, shows channel diversions to be spotted as abandoned channels, *bīls*, swamps, etc. Thus, the fluvio-geomorphological environment coupled with hydrological situation, biotic and anthropogenic developments have all created geo-ecological conditions which need proper investigation. The changes of fluvially developed landform in the basin clearly show the complex response and threshold situation to varied hydrologic and landform dynamics.

VI. Conclusion:

The Mutanga-Nona basin is no doubt a small one but it signifies importance as a system of geomorphic, hydrologic and geoecologic entities. The basin is highly settled by indigenous rural people. The basin, therefore, needs proper investigation in all the aforesaid three aspects for finding out rational meaning and application to development processes and prospects.

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