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Geomorphological Mapping of Old Brahmaputra Flood plain Using Remote Sensing and GIS in and around Mymensingh Sadar, Bangladesh

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Abstract

A geomorphological map of Mymensingh Sadar (Paurashava) and its surroundings has been constructed through visual image interpretation based on toposheets, aerial photographs and satellite images. The study area comprises mainly two geomorphic units: Mymensingh terrace (Older flood plain) and Younger flood plain. The geomorphic units are further classified into point bars, lateral bars, natural levees, flood plains, flood basins, backswamps, abandoned channels, active channels depending on their image/photo characteristics. Ground checking and randomly distributed boreholes and auger holes have been done to find out the extent and the near surface lithology of the geomorphic units. Mymensingh Terrace/Older Flood Plain areas are composed mainly of silty and clayey sediments. Whereas Younger Flood Plain is composed mainly of very fine to medium sandy sediments. Older flood plain is comparatively elevated than Younger flood plain. The rivers flowing through the Mymensingh Terrace (older flood plain) are incised indicating that the terrace has been uplifted. The Mymensingh Terrace sediments are more compacted compared to Younger flood plain area and are suitable for constructing any structure while the Younger flood plain area are suitable for shallow structures only.

Keywords: Geomorphology, Aerial photo, Stereo-pairs, Mymensingh terrace, Flood plain.

Introduction

Geomorphological maps, at a variety of scales, are required, not only for geomorphological research and praxis, but also for other sectors of environmental research and for professionals dealing with landscapes and landforms, such as urban planners, construction engineers, soil and forest scientists, land conservation managers, and natural hazard and geological risk managers. Traditionally, geomorphological mapping has been based on information collected from the field and the interpretation of photographs, satellite images, and topographic maps.

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Geomorphological maps can act as a preliminary tool for land management and geomorphological and geological risk management, as well as providing baseline data for other applied sectors of environmental research such as landscape ecology, forestry or soil science (COOKE & DOORNKAMP 1990; DRAMIS *et al*. 2011; PARON & CLAESSENS 2011). Landform mapping has been a primary method of data collection across a wide range of earth sciences. According to BAULING (1950), lithology, stratigraphy, climatic variations are the important factors for the development of landforms. Landforms were originally mapped directly in the field (RAISTRICK 1933); however, the advent of remote sensing technologies has meant that larger areas can be mapped by fewer people in less time (CLARK 1997). Aerial photography and satellite imagery are the main remote sensing technologies and these have been used extensively to map landforms over a wide range of applications (DIXON *et al*. 1998). Also, derived products can be used to map landforms through their direct representation of surface elevation; these include topographic maps. Recent advances in remote sensing and geographic information systems (GIS) have led to a revolution in the field of geomorphological mapping and have placed remotely sensed data as a core geomorphological data source. A growing number of new airborne and space borne sensors are now delivering data on landform distribution, surface composition, land surface elevation, and subsurface characterization at increasingly higher spectral, temporal, and spatial resolutions. This, in addition to the extended capabilities of GIS and geospatial analysis, considerably enlarges the capacity of geomorphological mapping. Detailed information can be extracted accurately from high-resolution satellite data and large-scale aerial photographs. Further detailed information can be generated or represented using the data in a GIS. Geomorphological field mapping of such landform assemblages is therefore an important technique in identifying and interpreting landscape patterns and geohazards, and determining the sensitivity of landscapes to external forcing by climate change or human activity. Remote sensing data and aerial photographs offer such information to the science of geomorphology that cannot be obtained from any other source (GOUDIE 1990; COOKE & DOORNKAMP 1990). In this study, remote sensing images have been analyzed by the visual interpretation technique, as this technique is economical, easy to use as compared to the digital analysis technique (RICHARDS 1993; SABINS 1997). In addition, visual interpretation of remotely sensed data is an essential step to learn the technique for various applications, and subsequent to convert the interpreted maps into digital from for use in a GIS. The aerial photographs are valuable historical records of the spatial distribution of natural and man-made phenomena. The study of change increases our understanding about the natural and human-induced processes in the landscape. To obtain a 3-dimensional view of the terrain by viewing the two images of the terrain from two slightly different vantage points at the same time. Stereoscopic analysis process provides us the information of object's height, depth, and volume. So, ancient aerial photographs are used here for proper land feature and probable hazard assessment. The study area comprises two flood plains named Mymensingh Terrace / Older flood plain and Younger flood plain. Mymensingh Terrace is situated in the southern part of the Brahmaputra River and Younger flood plain is situated in the northern part of the Brahmaputra River. The area is mainly covered by the recent alluvial flood plain deposits which are underlain by the Pleistocene Madhupur Clay deposits.These flood plains are flat, except for the relief produced by natural levee, point bar, lateral bar, depression, abandoned channel, etc. The elevation of the area stands from 8.23 m to 15.25 m above water levels of the Brahmaputra River and its distributaries including the Banar and Sutia rivers.

The study area lies at the eastern part of the Indian Plate, which is subducting beneath the Eurasian plate to the north and being over ridden by the Burma plate to the east (ALAM *et al*. 2008; HOSSAIN *et al*. 2019; HOSSAIN *et al*. 2020). According to COLEMAN (1969) the Brahmmaputtra was flowing southeast at the north end of the Madhupur tract emptied into the Meghna River before a major earthquake occurred in 1762. The study area lies south of the west end of the Shillong massif between the Sylhet trough to the east and the Jamuna River to the west. Mymensingh is situated in the north-central part of Bangladesh. It is about 110 km away from the Dhaka City, the capital of Bangladesh. Mymensingh stands on the bank of the Old Brahmaputra River. Main rivers are the Old Brahmaputra, the Sutia and the Negeshwari. The area of the Mymensingh Sadar is about 21.73 sq. km. Because of the Old Brahmaputra River the area is mainly dominated by fluvi- al landforms and deposits. The purpose of the study is to prepare a geomorphological

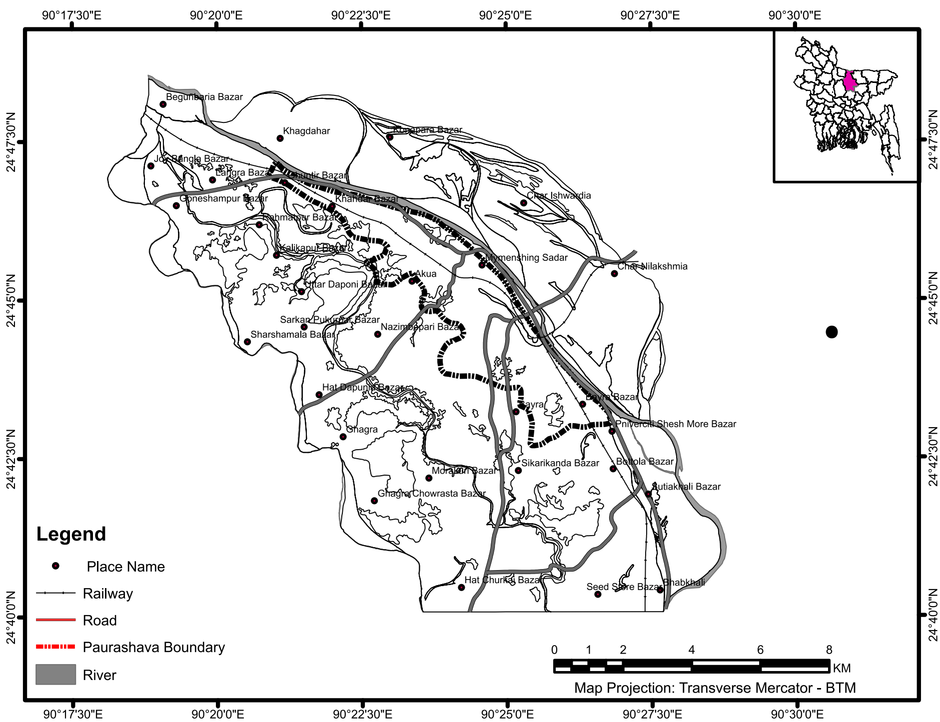

Fig. 1. Location map of Mymensingh Sadar (Paurashava) and adjacent areas.

map to identify the old landform of Mymensingh Sadar for the development of the area. The mapped area lies between longitudes $90^0 16'$ E to $90^0 30'$E and latitudes $24^0 38'$ N to $24^0 48'$ N (Fig.1)

Materials and Methods

Sketches and maps of landscapes and landforms (DYKES 2008) have been fundamental methods to analyse and visualize Earth surface features ever since early stages of geomorphological research. Geomorphological maps can be considered graphical inventories of a landscape depicting landforms and surface as well as subsurface materials (OTTO *et al.* 2013). For the purposes of this study the data from satellite imagery (aerial photo-acquisition year 1954), Landsat 7 Image (acquisition year 1999), SPOT Panchromatic Image (acquisition year 2013), and Google Earth Image of (acquisition year 2014), topographic sheets- 78 L/5 & 78 L/6 and base maps (GSB's) are incorporated first to prepare a morphological map. The information obtained from the satellite imagery by the process of manual image interpretation techniques. SPOT image gives a good detail of different geomorphic features to classify different geomorphic units, depending upon different visual photographic elements. DEM data acquired from topo maps and from field surveys.

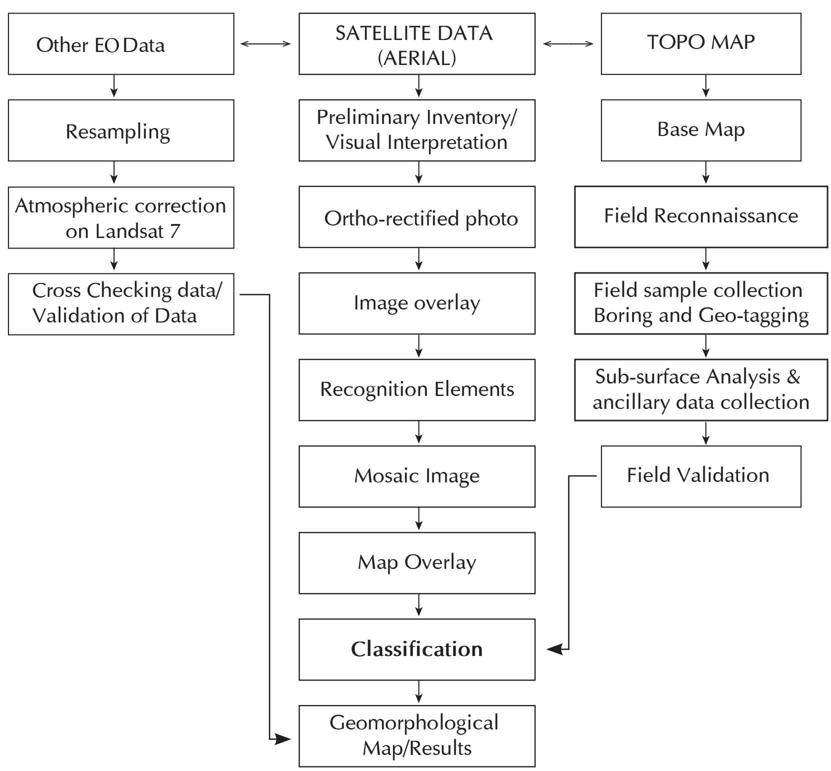

Fig. 2. The flowchart illustrates the detailed procedures applied for the preparation of geomorphological map from satellite image.

The geomorphic/landform units are classified on the basis of visual Interpretation technique of satellite data. Stereoscopic analyses provide the information of object's height, depth, and volume. The six primary elements of visual interpretation are tone or colour, size, shape, texture, shadow and pattern (ESTES & SIMONETT 1975). In addition of those heights, size and association may be added (HOWARD 1970). Tone refers to the relative brightness or colour of objects on imagery. Size, shape and position (site), are combined under the term contextual information. Shape relates to the configuration or the general outline of objects as recorded on imagery. Texture is the frequency of tonal change on the photographic image. It determines the overall visual smoothness or coarseness of image features. Pattern relates to the spatial arrangement of objects. Association refers to the occurrence of certain features in relation to others (LILLESAND & KIEFER 2000). Detailed information can be extracted accurately from high-resolution satellite data and large-scale aerial photographs. The methodology adopted for the present study is given in figure 2.

Results

Geomorphological Mapping

Geomorphology deals with the surface features of the earth, their forms, nature, and origin. The geomorphological units are identified on the basis of the fluvial features and their sedimentary characteristics formed in the area. Landforms have their individual distinguishing features dependent upon the geomorphic processes responsible for their development (BRADSHAW *et al.* 1978). Remotely sensed data have capability to mapping geomorphic units (REDDY *et al*. 2003). On the satellite image, different geomorphic features are identified on the basis of the image elements such as size, shape, texture, tonal variation association etc. Geomorphic units are classified on the basis of differential erosion processes (YOKOYAMA *et al.* 2002). Most units are characterized by their distinct textural and sedimentological characteristics; however, some units either lack of distinct sedimentological characters or the characteristics have been modified by post depositional process such as weathering and biological activities. Moreover, geomorphological maps can be considered graphical inventories of a landscape depicting landforms and surface as well as subsurface materials. Based on satellite imagery, aerial photograph and field survey, regionally, the study area comprises mainly two geomorphic units-a. Mymensingh terrace b. Younger flood plain.

According to ALAM *et al*. (2008), the area between the Old Brahmaputra and the Madhupur Tract is referred to Mymensingh Terrace which stands above the flood level. The Older Flood Plain (Mymensingh Terrace) is mainly separated from Younger Flood Plain unit by Old Brahmaputra River.Terrace is featured by point bars, lateral bars, natural levees, floodplains, flood basin, depression, ox-bow lakes and abandoned channels. The younger flood plains are flat, except for the relief produced by natural levees, point bars, lateral bars, flood basins, backswamps and abandoned channels. Natural levees are comparatively elevated than bars and backswamps. The drainage system shows dendritic pattern (Fig. 3). Brahmaputra, Sutia and Barera are the main rivers. The study area also comprises some beels or low lying areas which are marshy in nature (Akter *et al*. 2018). Detailed aerial photo interpretation and their characteristics are shown in Table 1. And aerial extent of the identified geomorphic units of the study area is presented in Table 2.

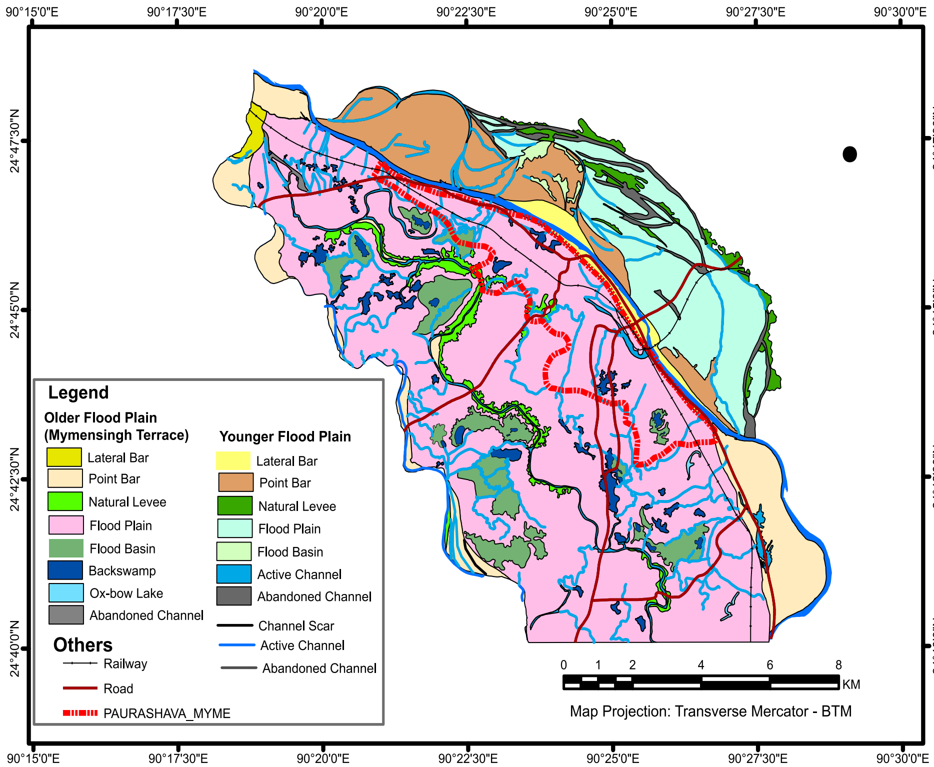

Fig. 3. Geomorphological map of Mymensingh Sadar (Pourashava) and surrounding areas (Akter *et al*. 2018).

The Older Flood Plain (Mymensingh Terrace)

Morgan & McIntire (1959) recognized that the Old Brahmaputra is incised in some areas and the Mymensingh Terrace is above flood level, although they did not name or describe the terrace. The area between the Sutia River and the Old Brahmaputra is nearly flat surface that stands above flood level is known as Mymensingh Terrace (Alam *et al*. 2008). Based on tonal variation, Mymensingh Terrace is subdivided into two parts, Mymensingh Terrace-1and Mymensingh Terrace -2 (Akter *et al*. 2012). The Terrace stands about 2 m above flood levels of the Old Brahmaputra River and its distributaries including the Banar and the Sutia rivers. Sutia river flows from northwestern part to southeastern part. This terrace is featured by point bars, lateral bars, natural levees, floodplains, flood basins, backswamps, ox-bow Lakes and abandoned channels.

Table 1. Geomorphic units of Older floodplain and Younger floodplain of Mymensingh Sadar and their characteristics.

Sl. No	Mapping Units	Tone	Texture	Association	Pattern	Size	Shape	Probable rock type
Older Flood Plain (Mymensingh Terrace)								
1	Active Channel	Dark grey	smooth	-	meandering	wide	Linear & Curved	Sand with silt and clay
2	Point Bar	Light grey	smooth	Along the meander channel	-	-	Crescent or oval shape	Sands and silty clay
3	Lateral Bar	Light grey	smooth	Beside the channel	-	long	Elongated	Loosely consolidated sand and silt-clay
4	Natural levee	Light to medium grey	coarse	Along the river bank	-	elongated	Linear	silt with fine sand and Clay.
5	Flood plain	Medium gray	blocky	Within two river	-	flat	geometric	Silty clay, clayey silt and fine sand , reworked Madhupur Clay
6	Flood basin	Light grey	blocky	-	anastomotic	flat	irregular	Organic clay, peaty clay& partially decomposed vegetal matter
7	Back swamp	Dark grey	patchy	Behind a stream & natural levee	-	-	Irregular or bowl	Clay, silty clay and peaty clay & partially decomposed vegetal matter
8	Ox-bow lake	Dark to medium grey	smooth	Cut off channel	Meander loop	-	Curved	Interlayered silty clay and clay
9	Abandoned Channel	Grey to light grey	smooth	Shifting of streams course	-	Elongated & narrow	lenticular	Silty clay (Surface) & underlain by silty sand to fine sand
Younger Flood Plain								
1	Channel Bar	Light grey	smooth	Along the meander channel	-	-	Crescent or oval shape	Sands and silty clay
2	Point Bar	Light grey	smooth	Along the meander channel	-	-	Crescent	Fine to very fine sands and silty clay

3	Natural levee	Light grey	uneven	Along the river bank	anastomatic	narrow	linear	-
4	Flood plain	light gray tone	blocky	Between natural levee & channel bar	-	flat	geometric	Fine to medium sand with silt
5	Flood Basin	Light grey	blocky	-	anastomotic	flat	irregular	Organic clay, peaty clay& partially decomposed vegetal matter
6	Abandoned Channel	gray to light grey	smooth	Shifting of streams course	-	Elongated & narrow	linear	sand with thin clay and silt

Table 2. Aerial extent (in sq. km) of the identified geomorphic units of the study area.

Geomorphic Units / Sub-	Lateral Bar/ Channel Bar (Y)	Point Bar	Natural Levee	Flood Plain	Flood Basin	Back swamp	Ox-bow Lake	Abandoned & Channel Scar	Active Channel
Mymensingh Terrace	0.662	11.862	3.479	87.387	0.155	3.86	3.86	0.137	0.308
Younger Floodplain	2.52	13.42	2.32	17.866	0.740	-	-	3.05	

Point Bar

Point bar deposits are crescent bodies which are developed on the convex side of the meander belt attached to the main channel. These bars are slopping gently towards the main channels. Point bars are mostly developed along the Sutia River whereas along Barera it is hardly originated. The bars are prominently buildup in Younger flood plains than in Older flood plains in the northeast bank of Brahmaputra River. On Aerial photo imagery these are identified by light grey tone smooth texture and crescent or oval shape on the river bank. Point bar deposits are composed of sands with silty clay. It covers an area of 11.862 sq. km in geomorphic maps.

Lateral Bar

Lateral bar deposits are elongated shaped bars deposited along the river. In Older flood plain one bar is found in the northwest corner of the mapped area. On the aerial photo imagery this is identified by light grey tone with smooth texture and elongated shape in river. Lateral bar deposits are composed of loosely consolidated sand with silt and clay. It covers an area of 0.662 sq. km in geomorphic maps.

Natural Levee

Natural levee deposits are linear, somewhat irregular wedge-shaped ridges of silty sand and sandy silt. They are elongated deposits parallel to the channel and developed on both sides of the river. This unit is thickest near the channel margin and thinned towards the floodplain. Slope is steep towards channel and very gently towards the floodplain. Along the bank of the river, these deposits are mostly silt and fine sand and become clayey silt at the distal edge of the levee where it merges with the flood plain deposits. Along the Sutia River on the natural levee, coarsest sediments deposited near the bank and decreases away from the channel. The maximum height of the natural levees indicates the water level reached during the highest flood. Natural Levee sediments comprise of somewhat finer grained material than their neighboring point bar sediments and coarser sediments than flood plains. This unit is mostly vegetated areas. The higher elevation of this unit in comparison to the surrounding areas results dense settlement. On the Aerial photo imagery these are identified by light to medium gray tone, coarse texture and linear shape along the river banks. It covers an area of 3.479 sq. km in geomorphic maps.

Floodplain

Floodplain lies between natural levee and flood basin and is lower in elevation than those of natural levee. This is the largest unit in the study area. Floodplains have very gentle slope toward the flood basin. Floodplain deposits in the study area are composed of reddish brown silty clay, clayey silt, and fine sand to reworked Madhupur clay. Decomposed to partially decomposed grass roots and organic remains are common in the sediments of this unit. On the Aerial photo imagery floodplains are identified by medium gray tone and blocky texture and poor drainage system. Most parts of this unit in the study area have been converted to cultivated lands, which exhibit geometric shape and even textural distribution on the satellite imagery. In the study area these units are commonly observed on side of the Sutia, Barera and old Brahmaputra River. It covers an area of 87.387 sq. km in geomorphic maps.

Flood Basin

Flood basins are featureless areas of poorly drained, flat to centrally slopping into stream depressions. Topographically flood basins are the depressed portion of the stream floodplain and oval, semi-circular or irregular in shape. These are small to large depressions in the floodplain having marshy to boggy environment. Most of the areas are usually under water round the year but few become dry during the winter. Marshes have also been mapped as flood basin.

The flood basin deposits in the study area consists of gray to light gray organic rich clay, dark gray to blackish gray peaty clay with abundant decomposed or partially decomposed vegetal matters. Some alternations of silty layers are present in this unit. Sand and silt units grade upward into finely laminated clayey sediments. On the Aerial photo imagery the flood basins are identified by light grey tone, blocky texture, anastomotic drainage and irregular shape. These are monotonous featureless areas. Flood basins are found in the western side of the old Brahmaputra River in the study area. However, flood basins are sparsely distributed in the Older flood plain of the study area. Flood basins act as settling basins in which suspended fine grained sediments settle down from overbank flows after the coarser sediments have been deposited on levees and crevasse splays. It covers an area of 0.155 sq. km in geomorphic maps.

Backswamp

Backswamp usually lie behind a stream and natural levees. These are the deepest part of the flood basins having water all the year round. On aerial photo imagery backswamps are identified by dark to very dark tone, patchy texture, irregular shape and less drainage density. The swamp deposits of the study area composed of clay, silty clay and decomposed organic materials. This deposit consists of dark gray to blackish gray peaty clay with abundant decomposed or partially decomposed vegetal matters. It covers an area of 3.86 sq. km in geomorphic maps.

Ox-bow Lake

Ox-bow lake deposit is curved shaped cut-off channel with a permanent water body. On aerial photo imagery these are identified by dark gray to medium grey tone, smooth texture and curved shape. The ox-bow lake deposits of the study area composed of interlayered siltyclay and clay. Organic matter is present in the upper part of the deposit. It covers an area of 0.137 sq. km in geomorphic maps.

Abandoned Channel

The abandoned channels are elongated narrow depressions and shallow discontinuous streams with or without water. On the aerial photo imagery the abandoned channels are marked by gray to light grey tone, smooth texture and lenticular shape. Surface deposits are clay or silty clay which underlain by silty sand to fine sand deposits. Vegetation is also present. These channels are flooded in the rainy season and dry in winter and summer. Organic remains in abandoned channels are found. Abandoned channels found in Charshehra, Kursha and northern part of the study area. It covers an area of 0.308 sq. km in geomorphic maps.

The north eastern part of the old Brahmaputra covered with Younger Flood Plain deposit consists of mainly unconsolidated sediments. Frequent changes of the main courses of old Brahmaputra lead to develop a bar complex and latterly subsequent inundation form some flood plain on the bar deposits in the northeastern part of the river. This flood plain is comparatively lower than the Older flood plain along the south western bank of the river.

Younger Flood Plain
Channel Bar

On the aerial photo imagery channel bars are identified by light gray, smooth to patchy texture and elongated within the channel. The deposit of channel bar is fine to very fine sand, silt with clay. It covers an area of 2.52 sq. km in geomorphic maps.

Point Bar

A point bar is a crescent shaped accumulation of sediments. It is formed in meandering streams along the convex bank. The former position of the river banks is shown by accretionary lines, which consist of alternating ridges and swales. The point bar is prominent in the area, located at north-western corner of the Old

Brahmaputra River. The other is an active lateral bar of the present channel of the Old Brahmaputra River. Point bar deposits of the area composed of fine to very fine sand, silty sand, and clayey silt to silty clay where the bar grades into the floodplain and abandoned channel. Fining upward facies sequences is found in the point bar deposits. The thickness of the deposits is variable. It covers an area of 13.42 sq. km in geomorphic maps.

Natural Levee

Natural Levees are not well developed in the area probably due to the anastomosic characteristics of the drainage system. However natural levees are present along the old course of the Brahmaputra River. On the aerial photo imagery the natural levee are identified by light tone, uneven texture linear shape and position. Dark tone occurred due to settlement and it is found along the river bank with narrow high cultivated land. It covers an area of 2.32 sq. km in geomorphic maps.

Floodplain

Floodplain deposits are composed of unconsolidated sediments which are mostly fine to medium grained sands with some silt and clay. On the Aerial photo imagery floodplains are identified by light gray tone and blocky texture and poor drainage system. Most parts of this unit in the study area have been converted to cultivated lands. In the study area these units are commonly observed on north eastern side of the Old Brahmaputra River. It covers an area of 17.866 sq. km in geomorphic maps.

Flood Basin

The flood basin deposits in the area consists of gray to light gray organic rich clay, dark gray to blackish gray peaty clay with abundant decomposed or partially decomposed vegetal matters. On the Aerial photo imagery the flood basins are identical by light grey tone, blocky texture, anastomosic drainage and irregular shape. It covers an area of 0.74 sq. km in geomorphic maps.

Abandoned Channel

Abandoned channels are presents in the northeastern part of the Brahmaputra River and are formed by meander cut-off and river avulsions. On Aerial photo imagery deposits are identified by gray to light grey tone, smooth texture and linear shape. The deposits composed of sand with some thin layers of clay and silt. It covers an area of 3.05 sq. km in geomorphic maps.

Active channel

Active channels have permanent water flow throughout the year. The Old Brahmaputra River is the main active channel in the study area which is meandering river. Two other small meandering channels (Sutia and Barera) are present in the study area. In Aerial panchromatic imagery, the active channel has been identified by their dark grey tone, smooth texture and morphologic position. It is distinguished by linear and curved shape and wider in nature. This active channel is observed at the Shambuganj Bridge on the Old Brahmaputra River. Sediment deposits are mainly consisting of sand with silt and clay. The active channels provide the drainage facilities in the flood plains areas. The channel bed is composed of coarse grained sediments mostly carried by saltation or rolling as bed load. It covers an area of 3.83 sq. km in geomorphic maps.

Discussions

Geomorphologic units are dynamic in nature as they are affected by various anthropogenic activities, including the expansion of cultivated and irrigated lands, industrialization, urbanization, and hence it requires monitoring and mapping for land use planning. Third World countries like Bangladesh have difficulty in meeting the high costs of controlling natural hazards through major engineering works and rational land use planning (GUZZETTI *et al*. 1999). Rising demand of the city are considering low lying flood plain and backswamps areas for further development nowadays. Old flood plain and natural levee areas are composed mainly of silty sand and sand which are mainly the washed sediments of adjacent Madhupur Tract could be appropriate for heavy structure. In addition, older flood plain is comparatively elevated than Younger flood plain. Sediments are more compacted in Older flood plain compared to Younger flood plain area as well which could be considered as the suitable place for constructing any structure. In contrast, Younger flood plain sandy sediments are mainly very fine sands and are loosely consolidated in nature. Some backswamps are found in older flood plain. It is recommended to avoid development and expansion of the city towards areas of backswamps covered by black organic clay deposits and in the areas of new bar deposit along the north eastern part of the Old Brahmaputra River. These backswamps including flood basin and abandoned channel could be used as open place, park or site for playground with light structures or as water retaining zone. The study area is bounded by the Old Brahmaputra on the northeastern part and Sutia and Barrera, the distributaries of the Old Brahmaputra River on the southwest part are the major sources of water supply. Apart from these there are many bills on the flood basin and depressions which could be a good source of surface water.

The lack of basic knowledge about geomorphological and geological characteristics of the studied area may cause hazards like erosion, silting up of culverts, flooding, cracking of buildings, etc. which will threatening people, property and infrastructure networks. Considering the existed problems and studying the probable forthcoming geo-hazards in the areas, the engineers, planners and decision makers can take appropriate decision to construct any type of structures in low lying areas.

Conclusion

In this paper Geomorphological Map of the Mymensingh area is presented. The map is the result of the interaction of different data sets, both traditional and innovative in geomorphology. Land use planning is continuous process due to natural and human causes. For future land use planning, it is necessary to understand the existing geomorphic units and extents. Remote sensing and GIS have capability to mapping geomorphic units. It provides the large view of earth surface features and has various techniques to explore the geomorphic features. A geomorphological map of Mymensingh Sadar (Paurashava) and its surroundings has been constructed. The study area comprises mainly two geomorphic units: Mymensingh terrace (Older Flood Plain) and Younger flood plain. Mymensingh terrace (Older Flood Plain) is mainly separated from Younger Flood Plain unit by Old Brahmaputra River. Terrace is featured by point bar, lateral bar, natural levee; floodplain, flood basin, depression, ox-bow lake and abandoned channel are mapped by aerial photos using visual interpretation technique along with field check. The Younger flood plains are flat, except for the relief produced by natural levee, point bar, lateral bar, flood basin, backswamps, abandoned channel etc. are identified at the same way of terrace. The study area is bounded by the Old Brahmaputra on the north eastern part and Sutia and Barrera, the distributaries of the old Brahmaputra River on the southwest part. Most parts of this unit in the study area have been converted to cultivated lands, which exhibit geometric shape and even textural distribution on the satellite imagery. It is observed that the low-lying units have already undergone fill-based development on field checking. In the study area Older flood plain and natural levee units are comparatively better for urbanization or infrastructure construction than Younger flood plain areas. Although, both floodplains areas containing backswamps, ox-bow Lake and abandoned channel units which are not suitable for infrastructure construction. Geomorphology and subsurface geology of the area should be considered prior to any development works to reduce the hazards and potential risk. Now, based on mapped geomorphic units local and government authority can make decision to land use planning for human activities.

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দূর অনুধাবন এবং জিআইএস প্রযুক্তির মাধ্যমে পুরাতন ব্রহ্মপুত্র প্লাবন সমতল ময়মনসিংহ সদর, বাংলাদেশ এর পার্শ্ববর্তী এলাকার ভূপ্রাকৃতিক মানচিত্রায়ন

মাহমুদা খাতুন, সালমা আক্তার, শাহতাজ করিম, মোহাম্মদ ফিরোজ আলম ও রেশাদ মহম্মদ ইকরাম আলী

সারসংক্ষেপ

ময়মনসিংহ সদর (পৌরসভা) এবং এর পার্শ্ববর্তী এলাকা মুলতঃ ময়মনসিংহ চত্বর সোপান এর উপর অবস্থিত। ময়মনসিংহ সদর এবং এর পার্শ্ববর্তী এলাকার ভূপ্রাকৃতিক মানচিত্র দৃষ্টিনির্ভর প্রতিচ্ছবি বিশ্লেষণ এর মাধ্যমে তৈরী করা হয়েছে। উক্ত এলাকার দৃষ্টি নির্ভর প্রতিচ্ছবি বিশ্লেষণ ভিন্ন ধরনের ও সময়ের [Topo Sheet (১৯৫৯), Aerial Photograph (১৯৫৪) এবং Satellite Images-Landsat ৭(১৯৯৯), SPOT (১৯৫৪) & Google Earth (২০১৪)] উপর ভিত্তি করে ব্যাখ্যা করা হয়েছে। ষ্টেরিওসকোপিক বিশ্লেষণ পদ্ধতিতে Aerial Photograph ব্যবহার করে দৃষ্টি নির্ভর প্রতিচ্ছবি বিশ্লেষণের মাধ্যমে তথ্য সংগ্রহ করা হয়েছে এবং পরবর্তীতে অন্যান্য উপগ্রহ চিত্রসমুহের সাথে পরীক্ষা করা হয়েছে। বর্তমান গবেষণায় ভূপ্রাকৃতিক মানচিত্রটি জিআইএস প্রযুক্তির মাধ্যমে ডিজিটাইজ করা হয়েছে। গবেষণার ক্ষেত্রটি মূলত দুইটি ভূপ্রাকৃতিক এলাকা নিয়ে গঠিত - ময়মনসিংহ চত্বর সোপান (পুরাতন প্লাবন সমতল) এবং নতুন প্লাবন সমতল। এছাড়া বিভিন্ন ভূপ্রাকৃতিক এলাকা, সেগুলোর অবস্থান ও প্রতিচ্ছবির উপর ভিত্তি করে শ্রেণীবদ্ধ করা হয়েছে। বিভিন্ন ভূপ্রাকৃতিক এলাকা সমূহ হলো- নদীর চর, নদীর পাশ্ববর্তী চর, নদীর উচুঁপাড়, প্লাবন সমতল, প্লাবন অববাহিকা, পশ্চাদবর্তী জলাভূমি, পরিত্যক্ত খাত, সক্রিয় নদী খাত। এই এলাকা সমূহের সীমানা ও ভূপৃষ্ঠের শিলাস্তর নির্ধারনের জন্য যত্রতত্র কূপ খনন (Boreholes & Augur holes) ও ভূপৃষ্ঠ পরীক্ষা করা হয়েছে। ময়মনসিংহ চত্বর সোপান (পুরাতন প্লাবন সমতল) এর পললসমূহ পলিযুক্ত কর্দম এবং পলি দ্বারা গঠিত। নতুন প্লাবন সমতল এর পলল সমূহ খুব সূক্ষ থেকে মধ্যম বালু মিশ্রিত। পুরাতন প্লাবন সমতল ভূমিটি তুলনামূলক ভাবে নতুন প্লাবন সমতল ভূমির চেয়ে উঁচু। ময়মনসিংহ চত্বর সোপানে (পুরাতন প্লাবন সমতল) এর প্রবাহিত নদীগুলো খোদিত যা নির্দেশ করে যে এর পৃষ্ঠটি উন্নীত হয়েছে। ময়মনসিংহ চত্বর সোপন এর পললসমূহ বেশি সুদৃঢ় বিধায় যেকোন ধরনের বুনিয়াদ নির্মানের জন্য উপযুক্ত। অপরদিকে নতুন প্লাবন সমতল এলাকাটি কেবল অগভীর কাঠামো নির্মানের জন্য উপযুক্ত।