



RESEARCH ARTICLE

HISTORICAL AND GEO-ENVIRONMENTAL APPRAISAL OF CHANGING GROWTH CENTRE,
URBANIZATION AND BEHAVIOURAL DYNAMICS OF THE RIVERS OF BARDDHAMAN TOWN,
WEST BENGAL

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ABSTRACT

Rivers play a vital role in the life of human beings as they supply drinking water, irrigation water and provide cheap means of transport. Due to these advantages, prosperous civilizations, big market centres as well as small settlement sites have developed along the riverbanks since historical past. In accordance with past and modern trend evolution of Barddhaman town (West Bengal), the rivers and streams had changed their surface expression in relation to recurrent floods. Historical development and changing growth centres of Barddhaman town are to be found very much related with the shifting courses of rivers (e.g. Damodar, Banka, Balluka, Sapjala etc.) and their temporal degradation. Though the glimpses of some rivers are demolished by urbanization within the Municipality area (except Banka), some patches of wetlands, ponds and 'Nalas' (literally, surface drains) are carrying out the former existences of sinuous linearity of those rivers. This article is an integrated draft to focus on the present existence of rivers, role of rivers, in settlement growth its successive decays and associated problems in the course of temporal expansion and development of human civilization.

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INTRODUCTION

The evolution of human settlement and its age-old history is inseparably attached with rivers and fertile flood plain. Along with the natural factors, the anthropogenic factors such as construction of embankments, roads, railways and residential buildings, collection of surface and subsurface water by unscientific techniques, building of communication network renders the flood-entrained sediments to spill it over the flood plain and makes the river bed shallow due to sedimentation. As a result, there is a decrease in the water holding capacity, which forces the river to change its courses. Due to this nature, it is true that river engulfs few prosperous villages but at the same time, it regenerates 'char lands' (literally, sand bars and depositional plain of quaternary sediments), on which new settlement evolves. Modern man with the aid of his science and technology modifies riverine environment to such an extent that the river and its various anatomies, which once supplemented the growth of human settlement, with the progress of time, have been altered and fragmented by the civilized man. Presently in an urban area, the rivers act as chief medium of waste disposal also on their banks.

However, the rivers are still revealing their survival in the midst of its behavioural dilemma quite silently in the form of wetlands, bills, isolated river channels, water bodies etc. In order to carry out the present study the following specific objectives have been considered

- To find out the major growth centers of the town from ancient to modern time;
- To evaluate the role of river in harnessing the settlement growth centres;
- To understand the expansion of town and degradation of river courses; and
- To explore the relationship between the old rivers courses, stagnant water bodies and bills or wetland in respect of contemporary situation.

MATERIALS AND METHODS

Addressing a topic like evolution of Barddhaman town and its relation with the behaviors of rivers is a subject matter of both history and geography of an urban area but it is unfeasible to conceptualize geography without shedding the light on history. To focus on above objectives the efforts have seen

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made to document all the ancient literatures and historical entities to get the chronological viewpoint of the study area. Therefore, only those literatures have been discussed here which directly or indirectly links the area with its journey of evolution in the domain of river. However, ancient maps of Van den Broke, Rennel, toposheet of NF 45-3 series U502 (1954) and Survey of India Toposheets (72 M/15 and 16) have been considered explicitly for the understanding of the behavioral dynamics of the river Damodar, Banka, Behula, Sabjala and Balluka. The maps and satellite images are used here as valuable tools to realize the locational aspects of palaeo-channels and degraded wetlands in relation to growth momentum of the town. To depict the temporal and spatial character of urban area we have taken the help of LANDSAT images (MSS, TM and ETM+) of 1970-2006 time spans. Irrespective of these, in some cases opinion survey among the aged people, oral history method followed by personal interviews taken into consideration to support the authors intuition and theorization relating to various issues. In this regard, pursuance of toponymy or place name approach is worthy to mention. However, it is important to mention that for the sake of the study it is not only restricted for the municipal area but the regions surrounding the Barddhaman Municipal area under the Barddhaman Development Authority (BDA) is discussed eloquently in various circumstances according to the need of the study. After creating a geo-referenced baseline map of Barddhaman, the spatial information is represented as thematic maps in ArcGIS 9.2 and MapInfo 7.0. Sub-setting the area of interest the LANDSAT and IRS images are processed in ERDAS 9.1 as per requirement. Then to verify the spatial information frequent rechecking, ground observations and surveys are done and many photographs are taken to prove those information as reality.

A brief geographical outlook of study area

The town Barddhaman or Burdwan, at present located in the south western part of West Bengal, evolved as an ancient human settlement on the fertile alluvial fan of the river Damodar. Archaeological evidences suggest that this region, forming a major part of Rarh Bengal, traced even back to 4000 BC. Burdwan is an anglicized version of the Sanskrit Vardhamana and the corresponding Bōrdhoman in Bengali. The literal meaning of the name is a prosperous and growing centre, to argue that this place represented a frontier colony of the progress of aryanisation through the upper Ganges River valley. However, the Aryans failed to proceed further east. So, the name retained. A second view holds that the origin of this name dates back to 4000 BC and is ascribed to Vardhamanswami or Mahavira, the twenty-fourth Jain Tirthankar, who spent some time in Astikagrama, according to the Jain scripture of Kalpasutra. This place renamed as Vardhamana in his honour. Established in 1865, Barddhaman municipality now consists of thirty-five municipal wards and having the population of 2,85,602 according to the 2001 Census. Latitudinal extension varies from 23°13' to 23°16'N and longitudinal extension varies from 87°49' to 87°53'E (fig 1). According to Census of India (2001), Barddhaman municipality having an areal coverage of 23.04 km². The Barddhaman railway station is well connected by eastern railway (main and chord line) and G.T. Road with its hinterland. It has an average elevation of 35-40 metres

from mean sea level and has peculiar topographic character in respect to Damodar River; because the ground slopes (W-E) do not permit surface runoff to meet with Damodar River (GSI, 2005). Throughout the past the river Damodar, flowing at the southwestern corner of the town, had changed its courses in several times. The River Damodar (Sorrow of Bengal) and its paleo-channels like Balluka, Bahula, Gangur, Banka etc., nourished the land of Barddhaman with fresh silt deposits (Fig 2). The original materials, composed of a wide variety of rocks of Chotanagpur Plateau, were deposited in the Miocene epoch through repeated marine transgressions. Recent Holocene alluvium is deposited by Damodar River, which was evolved after last glacial episode (GSI, 2005). Urban growth centers evolved on the natural levees in course of time shifted along with flood and changing courses of river. By analyzing satellite imageries, cadastral maps and toposheets it has been found that at present huge pressure of population, urbanization, construction of rail lines, road ways and multistoried buildings altered the rivers, once used for trade and commercial activities turned into some palaeo-channels, stagnant water bodies, drains and marshy lands.

Chronological chorology of barddhaman town and its relations with changing face of rivers

In the ancient literature of Rarh, the region known as Barddhaman or the so-called Barddhamanbhukti or Barddhamanpur had an eminent place for its various physico-social and cultural values. Barddhaman town was the gift of river Damodar and its various paleo-channels like Banka, Bahula, Gangoor and Balluka. Geomorphologically Barddhaman town is located in the 'doab' region (inter-fluvial tracts) of Damodar, Banka and Khari rivers. Throughout the historical past, the river Damodar had so many times changed its courses that most of its distributaries in the Barddhaman town remained as fragmented and decaying water bodies and paleo channels. To evaluate whether river had a dominant control for the growth and prosperity of Barddhaman town, the deep insight related to the chronological chorology of Barddhaman town and its surroundings must be explicitly discussed. However, according to Dr Sukumar Sen that the history of modern town is no longer older than 16th century. For the understanding of the sequential growth of Barddhaman town (Fig 3 and 5) in riverine environment, the evolutions have been discussed under the following heads:

Talitgarh: An ancient civilization of barddhaman (535-540AD)

There is no perfect clue to know the actual name of Barddhaman town. No single theory or opinion is acceptable to analyze the origin of the actual name of famous Barddhaman because of its fallacy. However, an evidence of gold coin found from the time of Kumar Gupta the III from Gar Talit, which is located very close to Barddhaman municipality, clearly symbolizes that the region flourished during that period as like the whole of Barddhamanbhukti (Samanta, Chhotopadhyay et al., p34). There is no dispute that the fertile alluvial tract along with natural levee drained by River Damodar, its various trade routes provided the favourable environment, which was conducive for the river centric growth of the town in near future. A meandering course of narrow channel is observed across the Railway station of Talit (Fig 3 and 4).

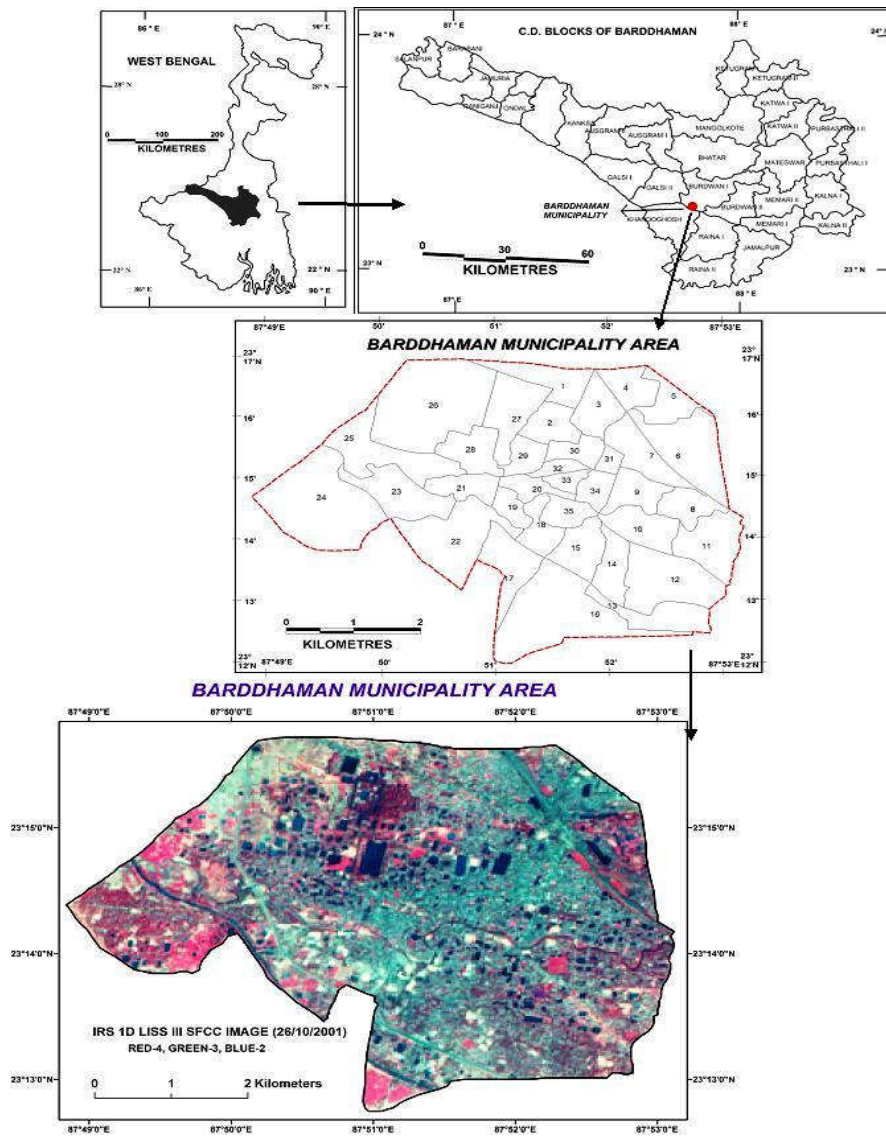


Fig. 1: Location Map of Bardhaman municipality

DRAINAGE OF BARDHAMAN TOWN

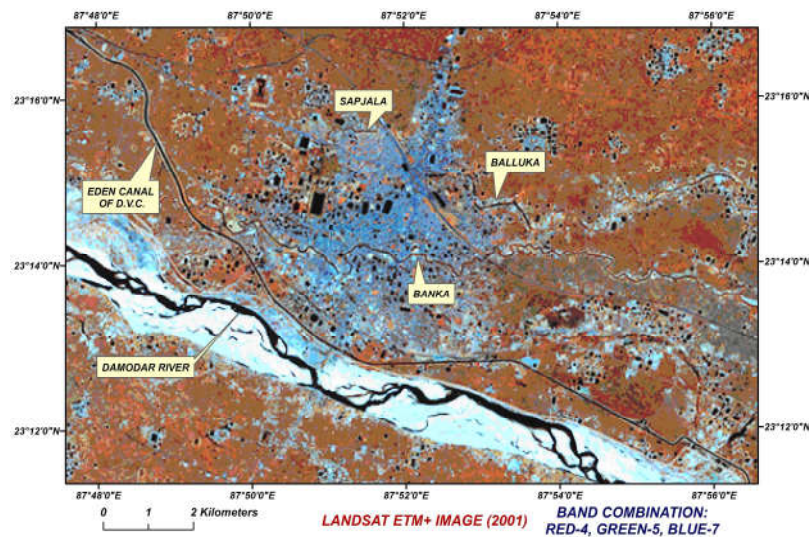


Fig. 2: LANDSAT image showing the present existence of rivers of Bardhaman

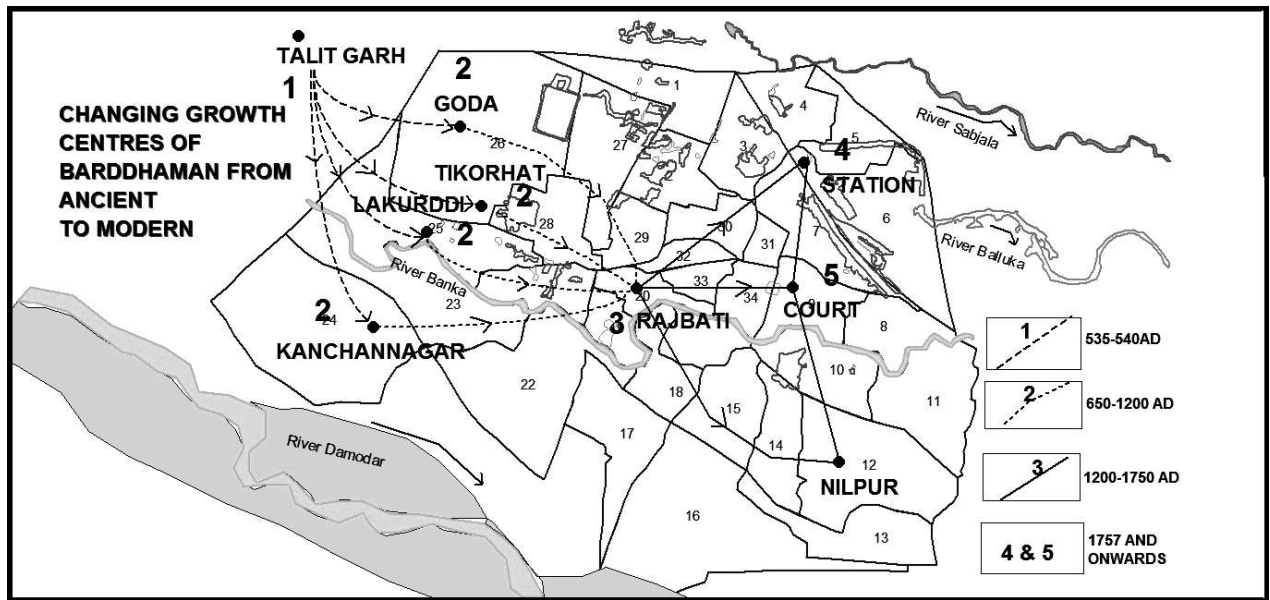


Fig. 3: Map showing the changing growth centres of Bardhaman town from ancient to modern



Fig. 4: Image showing the existence of Talit and adjoining river

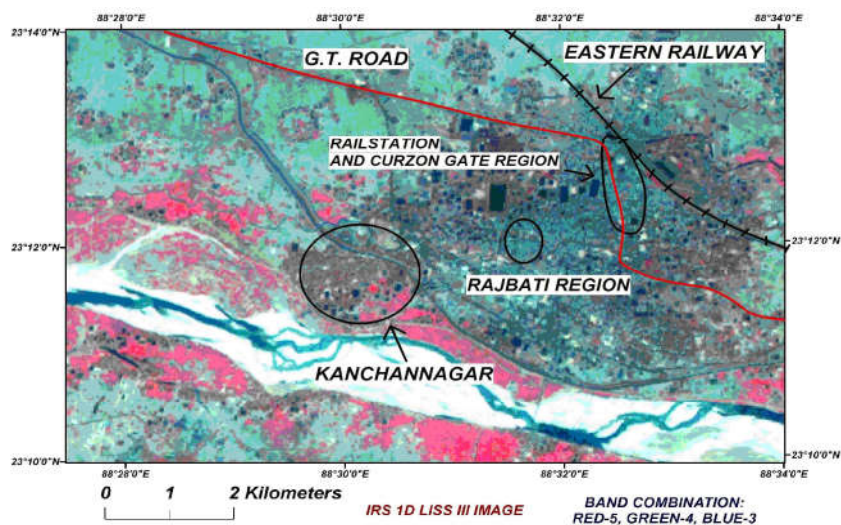


Fig. 5: Satellite image showing the locations of Kanchannagar, Rajbati region, Rail station and Curzon Gate region (encircling black portion)

Kanchannagar: An emerging growth centre (650-1200AD)

The age-old journey of Barddhaman town during this phase started to evolve from Kanchannagar (Ward No. 24) through Kanainatsal to Lakuddi, Tikorhat and Goda (Ward No. 26) due to its location in the Doab region between river Damodar and Banka. Relatively higher ground level elevation, fertile agricultural land drained by Damodar, Bahula and Balluka etc. Kanchannagar evolved on the bank of the navigable river Damodar (fig 5) as a supplementary trade centre of Mongalkot, which was an important trade route on the bank of river Ajay during Mourya period for the whole South Bengal.

Shifting of growth centre during the pathan and the mughal period (1200-1750 AD)

Sher Kahn Fariuddin Abul Muzzaffar, a soldier, by taking the name of Sher Shah captured the territory of Gour in 1539 AD. He classified the whole Vongo Empire into few administrative unit known as Jaigir and appointed his obedient men as administrators of these Jaigirs. Lakuddi, Tikorhat and Goda (Ward No. 26) were one of the most prosperous regions of Barddhaman during early medieval period and for this prosperity Goda region invaded for the first time by pathana. Rakhraj Roy in his writing have mentioned about the relics of temple of king of Goda (Roy, p 17). The historical mosques of Goda area and the places like Mollarhat, Ajgubitala and Katrapota mouza even today bears the imprint of the Pathana even today. The new centre of gravity of Barddhaman shifted from Kanchannagar to Puratanchack region. The new ruler selected this place for habitat simply to escape from flood because of its location on upland region between River Damodar and Banka. During this time, the fame of Barddhaman was well renowned to a distant palace for its agricultural and trade prosperity and known as 'Sarifabad' i.e. dwelling place for the rich. The two rivals Mughal and Pathana had the keen intention to conquer Barddhaman (Bhattacharya, 1998). During 1600 AD, Mughal battalion with the leadership of Mansingha, defeated the Pathan. It is known that Sher Afgan and Maher-ur-nissa resided in their so called Maher mahal whose bengali pronunciation is Mayur mahal which is still evidenced as Nur Jahan gate of Mayur mahal (Chaudhuri, J.1990 p 345).

The main centre of mughal activity was the at present Rajbati region (Ward No- 21 and 28).The present Rajbati was the old Barddhaman fort (fig 5). Golam Hussain Selim has written about this in his book Riaz us Salatin (Chaudhuri, J. 1990 p347). This region is, locally known as Dangapara i.e. upland. Two years before present a 10 to 12 kilogram weight shield discovered from this Dangapara signifies the establishment of Rajbati as mughal fort. Even few years before a tunnel have been discovered from Rajbati area which was, probably a parts of ancient mughal fort. In the western side of the fort, there was a mughal tulli i.e. local market, which is still recognizable by the name of Puratan Chack and Chandni Chack. Rakibi market, Baharam market (Ward No. 21) developed in harmony with mughal tulli market. The foreign traders to change their currency used Mahajan tulli. A bridge constructed (over Banka River) by Ajim- us- San, to communicate Alamganj from Barddhaman fort, is still alive by the name of bridge of Radhaganj (Chaudhuri, J. 1990 p347).

Growth of existed town during british and barddhaman raj family (1757 AD and onward)

After the defeat of Nawbab Sirajuddala in 1757, the mughal fort at Rajbati region lost its relevancy. Maharaja Tilakchand after occupying the deserted fort of the moghal took initiatives to establish his palace, administrative building and the temple of Laxmi-narayan jue at their. His effort completed possible on 1851 AD with the construction of Mahatab Manjil i.e. a place for worshipping the god located at Ramnabagan. Mehadibagan, Khosbagan, Baburbag, Golapbag-Ramnabagan, Motibag, Anandabag, Sundarbag, Tarabag, Salbagan are some of the places glorifying the tale of famous Barddhaman Raj even today. In this regard, the images of the growth and prosperity of Barddhaman as depicted by the famous poet Raygunakar Bharatchandra in his famous poetry of 'Vidyasundar' is worth mentioning. After the death of Maharaj Tilakchand (1770) Maharaj Mahatabchanda took the duty of ruler with the fruitful help of East India Company. At first he developed the town and its peripheral areas in his own architect style (giving the town his right name Barddhaman, literally meaning a prosperous and growing centre).

Raj families were relocated their permanent settlement at Rajbati (1.5 km south of The University of Burdwan). Mahatabchanda and his son Aftabchanda developed schools for males and females, present hospital, temples, Curzon Gate, base of Burdwan University, Golapbag, Ramnabagan zoo, drinking water supply, Shri Ramkrishna Ashram, technical college, medical college, Municipal school, Raj school, embankment of Damodar River, treatment of Banka River and construction of bridges over it etc. Business and trade were going on intensely at two spots of Barddhaman- Sadar Ghat and Kathgola Ghat. After the reconstruction of G.T. Road and establishment of Eastern Railway (1855) the growth centre of town had shifted towards north-east- rail station and Curzon Gate region (Fig 5). From that time, the tracts of rivers were starting to degrade or modify gradually by urban expansion and flood protection structure. The main characters of behavioral dynamics of rivers are as follows:

- (1) Though, most of the uplands along the course of river Damodar and Banka were encroached during the Mughal period, the alluvial fan and levee produced by river Banka and Bhalluka was the next virgin land on which expansion of Newer Barddhaman took place by the next generation of Abu Ram Ray (Raj Family of 1657 AD) for their immense prosperity and richness;
- (2) Flood of Damodar was then a recurrent phenomenon of monsoonal period. Damodar River shifted its course consecutively towards left bank. It created many wet-marshy lands within the low-lying municipal areas and it created many small rivulets in flood periods. Excess surface runoff water was released by the network of Banka, Balluka, Sapjal etc. (fig 2) in flood periods;
- (3) For getting a short-term relief (from floods), some initiatives were taken to construct embankments on both the side of the main channel of Damodar. As a result, there was a decrease in the water holding capacity of the river due to the sedimentation in the riverbed and for that reason, the decision was taken to abolish the right side embankment of the river

Damodar. The left embankment detached the river Damodar from the Banka, Khari, Bahula and Gangur, transformed them into fragmented and degraded wetlands, and isolated channels (Saha, 2008);

- (4) In addition to construction of embankment, the second most important factor, which reshaped the geo-environmental dimensional of the Barddhaman, was the construction of G. T road in 1838 and expansion of railway line in 1855 up to Raniganj. These acted as secondary embankments for Damodar River and it created hindrance of natural flow of Banka, Balluka, Sapjal;
- (5) In this regard, the circumstances of the breaking out of Malaria and other severe epidemic diseases caused due to obstruction of natural flow to make artificial embankment during 1853 AD was unprecedented for which the town was notorious. Statistics reveals that during 1859 AD the total population of Barddhaman was 46000, which decreased up to 32700 during 1862 AD (Saha, 2008, p 48); and
- (6) The British ruler established their colony at places like Kanainatsal, Neilpur, Birhata, Court compound and Sadhanpur, which are roughly located on the eastern part of the town (Roy, 1990. p361). The British engineer for the safety of their settlement designed the 'L' shape lahar of Khachari Road near court compound on an old river course. The new rulers built B.C Road by cutting chunk of soil from the surrounding wetlands to make communication between the native town and the British Colony and that is why even today it is easy to perceive that this road is to some extent elevated than its surrounding counterparts.

establishment (1865) the population was 39,618 and now the population is 2,85,602 (2001). Barddhaman Municipality with a population of 285,602 (2001) fall in class-I M2 category. Barddhaman has an area of 23.04 km² and all total 59517 numbers of households are counted in Census of India, 2001. The increasing number of urban population and growing urban space are considered as level and phase of urban development as well as burden on provision of urban facility and healthy riverine environment (Fig 6 and 7).

At present, there are five embankments (main left side embankment of Damodar, Eden Canal, Bypass and G.T. road, National Highway (NH) 2 and Eastern Railway Line) on left side flood plain of Damodar River. These act as dual roles to the surrounding environment- (a) good protection from sudden flood of Damodar and (b) low deposition of fresh silt to the flood plain, sedimentation of Damodar, squeezing of River cross-sectional area and obstacles of water supply to tributaries, i.e. Banka, Balluka, Sapjal Rivers (Fig 8).

Other flaws and disadvantages of the anthropogenic activities are as follows:

- (i) Due to construction of embankments, the town Barddhaman got rid of flood hazard but at the same time, it has obstructed the flood plain fluvial process. Naturally, the river thalweg was uplifted from its flood plain due to sedimentation and as a result, whenever there was an increase in the total amount of discharge, river Damodar breached the embankment with its destructive attitude. The events of last century flood on 1913, 1916, 1935, 1956, 1978, 1995, and 2000 turned

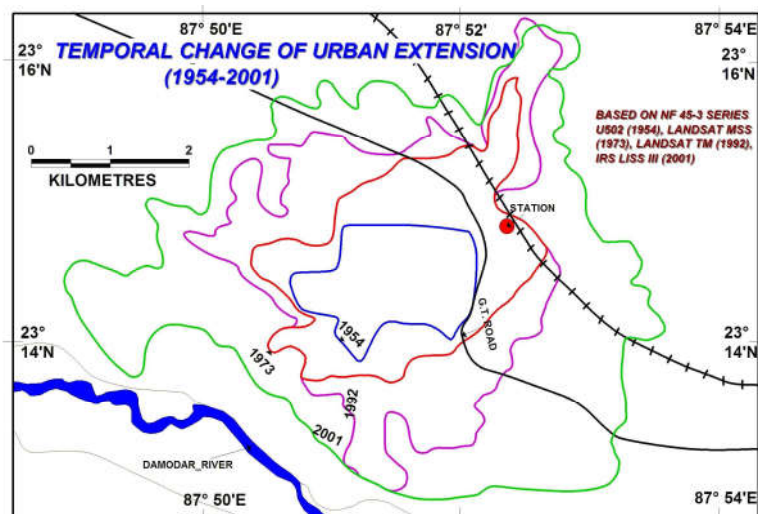


Fig. 6: Map showing the spatio-temporal change (1954-2001) of urban area of Barddhaman

Twentieth century urbanization and associated problems of riverine environment

At first, the whole town was subdivided into five wards in 1865 (the year of establishment of municipality) and in 1957, five wards turned into 25 wards. During 1961 the municipal area was 22.62 km²; it is increased to 22.74 km² in 1981, 23.04 km² in 2001 and 26.54 km² in 2008. At the time of

into catastrophes for their larger dimension of human death and destruction (Saha, M.K. 2008 p48). Indirectly these embankments cause stagnation of floodwater due to low frequency of culverts that release the surface runoff in monsoon.

- (ii) With the introduction of road and railway network river Damodar started to loose its past glory as a means of transport and communication for Barddhaman. River

Banka separated from Damodar by its left side embankment transformed into Banka Nala or drain and river Bahula-Gangur fragmented at various places and remained as water bodies. Following Kanchannagar, Goda, Ullsah, rail station area was the next activity hub for Barddhaman town and its hinterland.

- (iii) At the time of previous floods when there was no embankment, the channels of Banka, Balluka, Gagur, Sapjal etc, removed the excess floodwater. In 1943 (before the establishment of Damodar Valley Corporation-D.V.C., 1945), Damodar River was flowing 8-10 miles north from present position in the western parts of Barddhaman town due to flash flood. If the embankments were not built at that time, the main Damodar would follow permanently the paths of Banka and Gangur. However, the present urban expansion and construction do not favour the free flow of excess water (in peak monsoon season and prolong rainfall of cyclone) from the urban areas to those channels, due to degradation of channels' width-depth ratio, low density of open-surface drains, obstacles of embankments of roads and rail lines. That caused the massive flood in 1978 and 2000, including the direct effects of heavy rainfall and peak volume of discharge by D.V.C. dams.
- (iv) The rigorous sand quarrying activities on riverbed of Damodar (creating hollows), are the next weakest points of river shifting in the time of heavy flood discharge (fig 9). Therefore, it can aggravate the flood occurrence in near future, for example, in 2008, due to heavy discharge (monsoon rainfall) of D.V.C. dams Damodar River shifted its little course near Saktigarh (5 km east of Burdwan town), destroyed the left side embankment and submerged the local agricultural land.

good produced by people from various occupation of Kanchannagar voyaged to the foreign (Singha, 2000). It signifies the locational proximity of river that is not persisted today. On July 2009, few old coins found at Khatgola ghat during digging of land at there. However, it is not easy to identify the exact location of the ferry points on river Banka during early medieval period but the woeful situation of Dauji's Ghat i.e. the ferry point, its down deepings flat steps towards the thalweg of river Banka is still present in the midst's of its destruction. By observing these steps, it is not tough to perceive the extensiveness of river Banka during that period. Very close to Dauji's Ghat was Raja's Ghat or Nirmal Jhil, which is a burning ghat. Close to the pull of Radhaganj, Radhaganj ghat is located near Banka. The location of Alamganj ghat is just in opposite to the Radhaganj ghat. In this regard, the existence of Bandha Ghat i.e. well structured by cementing materials opposite to the Kalpotaru Play Ground is worth mentioning. In search of historical ghat, the famous Gardgara ghat draws special attention. However, according to Ashok Mukherjee, an old citizen of Bhatchala area, for the extraction of sand from the riverbed the sound of sliding down of bullock cart down the river was symmetrical to the bengali term 'gard gard' and that's why this point was known as Gardgara ghat. Opposite to the Gardgara ghat, the sand also extracted from the Bongpur ghat. Known from the ancient literatures, during the time of establishment of the temple of Goddess Sarva Mangala a form of Devi Durga, the river Banka was very much active. Therefore, there is every possibility to have a separate ghat of Sarva mangala temple; in reality, no such ghat found. The nature of geographical distribution of ancient mughal architecture and sculpture

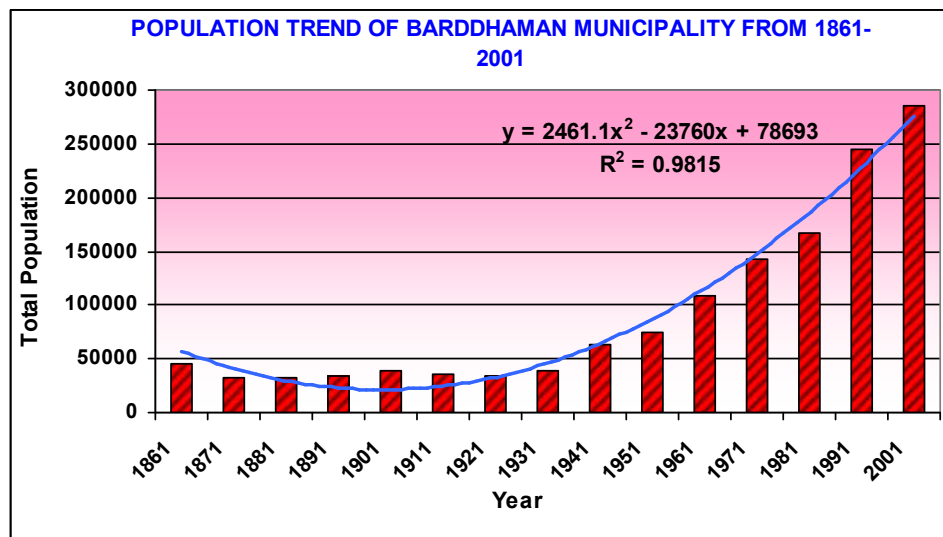


Fig. 7: Diagram showing trend of population growth (polynomial curve of 2nd order) of Barddhaman town from 1861 to 2001 (source of data: Joytirmoy Bhattacharyya, 1992 and Census of India, 2001)

Finding the locations of the ancient courses of rivers through its trade and communication relation

In spite of development of communication routes, the course of river Damodar and Banka was still treated the main route for the traders during early and late medieval period. Goutampur Ghat, Kathgola or the present Idilpur Ghat and Sadar Ghat were the main ferry point through which various

roughly followed the courses of river Banka and Bhalluka and their surrounding upland during that time. The chronological chorology of Kanchannagar, Goda and Lakudi region have valready been discussed in the preceding discourses. In addition, places like Payrakhana Lane, Sarkhana Lane,

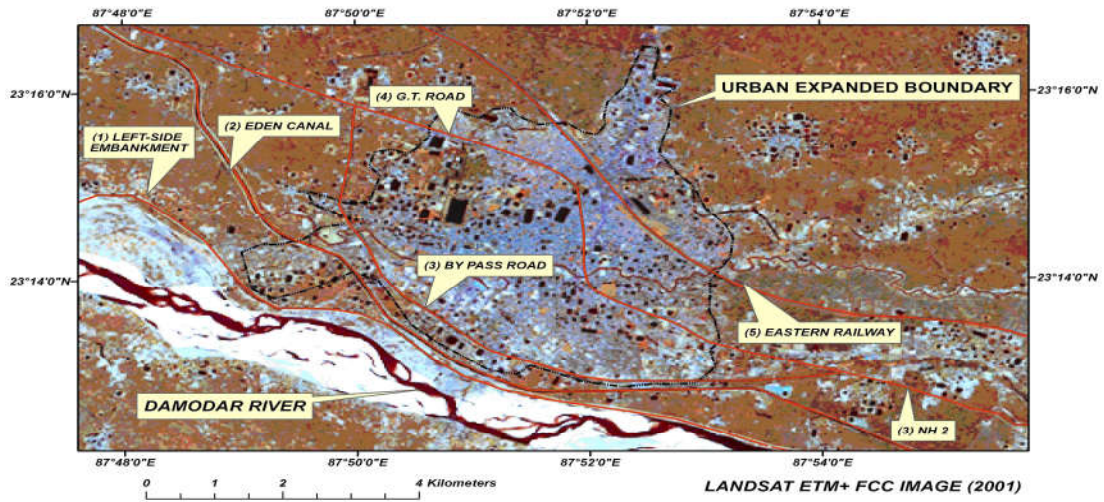


Fig. 8: Satellite image showing the five embankments (in red polylines) of Damodar River and expanded urban area (in black polylines) of Bardhaman (2001)



Fig. 9: Image showing the evidence of sand quarrying activity, which is the weakest location of next shifting of Damodar River in high discharge period

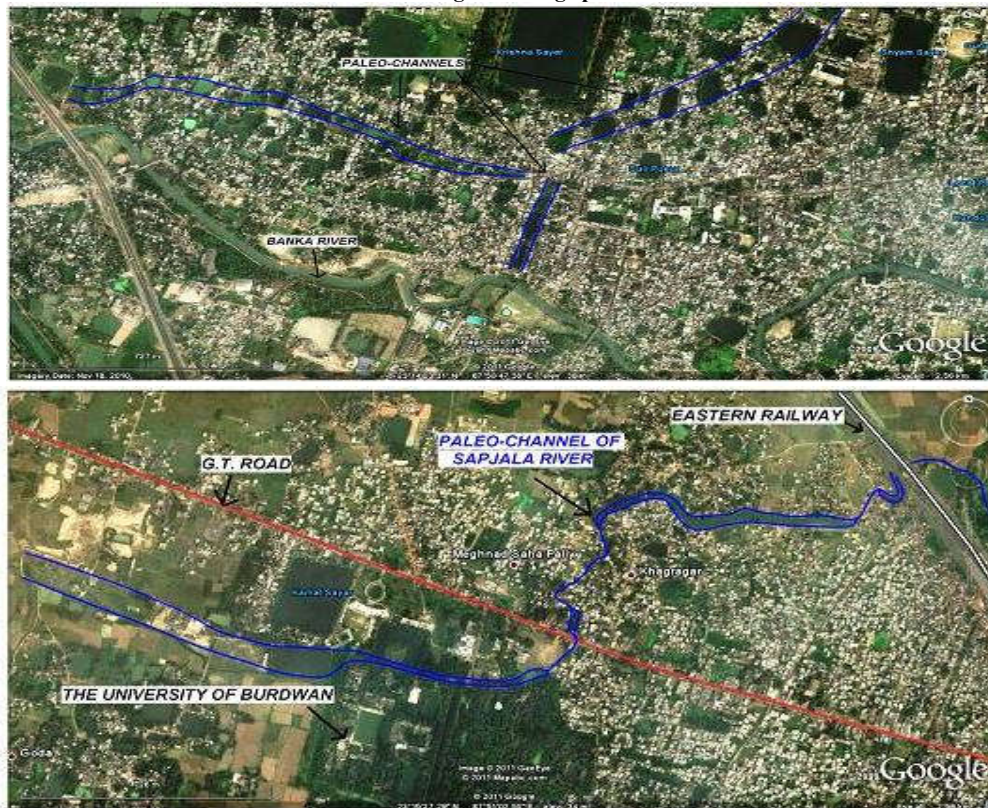


Fig. 10: Images showing the indentified paleo-channels (in blue polylines) of former rivers

mosque of Ichlabad, Ban mosque of Khan Pukur, Bhatchala and Golghat are some of the ancient historical places that have flourished along the side of river Banka and Baburbag Pirtala and Hazipota mosque flourished on the bank of river Balluka respectively during the mughal period (Jana, p 110).

Identification of old river courses in respect of contemporary Barddhaman Town

In present Barddhaman two main rivers are existed, one is Damodar flowing to the southwestern part of the town appears as non-living desert tract for most of the time in a year except for few months of monsoon. River Banka is the second one flowing with its fragile appearance through the midst of the town by carrying all the polluted sewerage. Near about 60.5 million years ago the then Barddhaman was located on a corner of the Bengal basin which evolved as an alluvial fan (Rudra, 2008). So-called Barddhaman, a part of 'Rarh Plain', formed by the sediments of Caniozoic epoch entrained by river Ganges and Damodar as a process of delta building. Perhaps the first abandoned path of the river Damodar joint with the Bhagirathi-Hooghly River at Ambika Kalna was the probable path of the fragile river Balluka, an ancient one that is, now almost in its declining stage and river Banka, Gangur and Bahula all are the branches of the river Balluka (Konar, 2000). It is very much perplexing that even today wetlands and patches of deserted rivers, stagnant water bodies still exist by the name of river Bahula, Balluka and Balluka at a various places of the town. The place of origin of river Balluka assumed to be at Borhat, Kamalakanta Kalibari Region (through ward no. 25 and 21) that is very close to the Rajbati (Konar, G., 2000). However, according to Akkari Chattopadhyay 'the patches of present dry river courses between Barddhaman town and Nawbabhat were the old course of river Bahula'. Balluka and Sapjala rivers are fragmented by the construction of rail line and G.T. Road. In this regard, it is important to mention that during the time of Rennel in 1779 river Banka taken off from the Damodar at the southwestern part of the town. As Damodar River had shifted his course frequently towards its left bank then, most of the rivers are considered as the remnants of former flood ways (Fig 10). Side by side, the wetlands and back swamps (locations-Samlal wetland, Galgali jala, Khaluibil, Locokalani, Kestopur wetland, Borhat Dighir pul etc.) of Chuchura Formation (lithology- sparsely oxidized sand, soil and clay with fining upward sequence- middle to upper Holocene in age) are the direct products of flood submergence of low-lying areas and silt-clay deposition (GSI, 2005).

Conclusion

Third world urbanization is a phenomena characterized by different causative factors to be explained in modification of urban physical environment. Sometimes few factors remain overlooked to discuss the growth and development paradigm of an urban area, the town Barddhaman is not an exception. The role of river Damodar is merely evaluated by calculating the flood damages, formation of fertile flood plain,

groundwater resource, wetlands, tributaries and it has an impact on formulation of blueprint to setup urban drainage system and land uses within the town. In the preceding discussions an attempt has been made to shed light on the story that how River Damodar and its distributaries guided the growth dynamics of the town from a virgin land full of wetlands, bills, deserted river courses and jungles to its present form and no doubt it was a romantic story to depict. However, unfortunately those rivers failed to maintain its landmarks through their perennial flow of water, except active Damodar. Those rivers and remnant wetlands are now polluted by increasing dump of solid wastes, sewerage and sludge of the town and becoming the grazing ground of the pigs and other domesticated animals. Above stated all sections suggest that present unplanned urbanization of Barddhaman will be the main causative factor of next flood of Damodar and environmental deterioration in near future.

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