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The Causes Behind the Ganges-bank Erosion in Malda: A Comparative Analysis Between the Contribution of Geographical and Manmade Factors in Historical Perspectives

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Abstract

From the ancient age, Bengal has faced various challenges from the changing course of the Ganges under various rulers and with these changes in the river course, the landscape of the affected area changed. This became a continuous process and huge amount of erosion occurred out of this, particularly in Malda and Murshidabad district of West Bengal. However, there has always been a struggle among scholars and intellectuals of various fields to attribute the problem of erosion in the riverine areas solely to any single factor. While recognizing the role of the geographical or geological factors behind the Ganges-bank erosion, the manmade factor - the construction of the Farakka Barrage has also been considered as one of the major one, even sometimes the more important one in this respect. The life of the affected people got shaped and reshaped in accordance with it. This phenomenon has made the people of the riverine regions homeless and land-less forcing them to be displaced from their roots. They had to struggle to fit in the new ambience and earn livelihood. Needless to say - the tragic part is that erosion has not shown any signs to be checked in future also. This paper is focused on how the several factors-as the natural factors and manmade factors contributed in their own way to the riverbank erosion in Malda that ultimately affected the life and living of the people over years in the erosion-prone areas of the district.

Keywords: *Farakka Barrage, Ganges, erosion, geographical or geological, manmade, Displacement*

Introduction

Man and environment are related to each other. Therefore, any disturbance caused to the environment leaves various consequences on the man- kind. The environmental hazards or disasters, caused by ecological disturbances or human activities, threaten the civilization by endangering the lives of its people. Amongst these environmental hazards, riverbank erosion is a major aspect of discussion for its direct interaction with physical and socio- cultural environment. In West Bengal -particularly in Malda district, the Ganges- river-erosion by devastating the riverine regions exterminated the people from their root and affects their living severely. The shifting courses of the river and the resultant changes in the landscape of the adjacent areas have been being continued from years in past centuries and have only been increased in magnitude and caused huge river-bank erosion as the time progressed. This has harmed the life of the concerned people and society to a large extent, by affecting their livelihood.

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Review of Literature

Ganga river erosion and its impact on human life have been a very interesting area to be explored by various scholars over many years.

The name of the article which should be taken at first in this regard is 'The Encroaching Ganga and Social Conflicts: The Case of West Bengal, India', written by Kalyan Rudra. He has shown in his article how the course of the Ganga upstream and downstream of the Farakka Barrage continues to change unabated. This has resulted in many problems like land reallocation causing border dispute between Jharkhand and West Bengal and creating a class of neo-refugees. While millions of rupees are wasted every year in bank protection, the programme of rehabilitating the erosion-victims was no taken into account. The land eroded from left bank of the Ganga in Malda is more than 200 square kilometers, while that from Murshidabad is about 356 kilometers. The article has also thrown light on the fact that the basic objective of Farakka Barrage has been frustrated as the problem of siltation in the Hugli estuary remains unsolved and port of Kolkata is not yet accessible to the large sea-going vessels. Official documents have admitted that the intensity of erosion in Malda and Murshidabad has increased after the construction of Farakka Barrage, but the question of rehabilitation of the erosion-victims has not been given any heed.

'A Report on the impact of Farakka Barrage on the Human Fabric' - written by Manisha Banerjee has shown how Ganga erosion has swept away large areas of Malda and Murshidabad causing large scale population displacement, border disputes with Bihar and Bangladesh, pauperization and marginalization of the rural communities living by the river and creation of neo-refugees on the chars. It has been highlighted that the solution is in looking at the problem as a whole, to go for a thorough study of the whole Ganga Basin and provide effective Basin- management plan by regulating the flow of the river.

'River Bank Erosion Induced Human Displacement and Its Consequences ' written by Tuhin K. Das, Sushil k. Haldar, Ivy Dasgupta, Sayanti Sen - has categorized the impact of river bank erosion into three - i.e. social impact (homelessness, migration, and identity crisis), ii. Economic impact (loss of productive land, loss of occupation, risk of poverty) and iii. Other impacts (improper care for health, lack of educational attainment, criminal activities). This has also emphasized on the frequent 'displacement and settlement' and 'emergence and submerge of land' problems.

Another two articles, one named as 'Migration as Source of Risk Aversion Among the Environmental Refugees: The Case of Women Displaced by Erosion of the River Ganga in the Malda district of West Bengal, India' written by Priyanka Dutta and another one named as 'Women and Displacement: a case study of women displaced by Ganga erosion in Malda district of West Bengal in India' written by Brian O' Neil have drawn the issue of women suffering to Ganga-erosion into light. These two articles found out how institutional and structural factors have affected the migration decision of women belonging to various social and economic groups in Malda. The uniqueness of this situation is that here, the decision to migrate has often saved the affected households from the perils of starvation death caused by loss of cultivable land and other livelihood resources from the engulfment of river Ganga.

Some articles have given important insight on the morphometric changes of the river, the changes in braidedness, sinuosity, such as -'Evolution of River Course and Morphometric Features of the River Ganga: A Case Study of Up and Downstream of Farakka Barrage' by Md Nawaj Sarif, Lubna Siddiqui, Safikul Islam, Neha Parveen, Monojit Saha, 'River Bank Erosion Hazard Study of River Ganga, Upstream of Farakka Barrage Using Remote Sensing and GIS' by Praveen K. Thakur, Shiv P. Aggarwal, Chalantika L. Salui.

The article - 'Dynamics of the Ganga in West Bengal, India (1764–2007): Implications for science–policy interaction' deals with the changing course of the Ganges in the late 18th Century and how the Farakka Barrage led to these changes. 'The Shifting of the Ganga and Land Erosion in West Bengal A Socio-ecological Viewpoint' is another article written by Dr. Rudra which offers an analysis of the limitations of traditional engineering

approach to water management and reinforces the urgent need for a new and holistic knowledge base, in order to develop the river system in a sustainable manner.

The article named as 'Analysing the influence of Farakka Barrage Project on channel dynamics and meander geometry of Bhagirathi River of West Bengal, India' written by Aznarul Islam and Sanat Kumar Guchhait has analysed how the Farakka Barrage Project has largely altered hydro-geomorphic processes changing the channel dynamics of the Bhagirathi River.

Rennell's 'Memoir of a Map of Hindoosta', J. N. Sarkar's 'The History of Bengal: Muslim Period 1200-1757' give us a clear picture of the earliest courses ogf the Ganges River and how it went through changes at various point of time. P. L. Madan's 'River Ganga: A Cartographic Mystery' highlights the ancient river-course from the perspective of cartograpy.

F.C. Hirst's 'Report on the Nadia rivers', C. Ray's 'Farakkar Ujane Paschimbange Ganga Bhangan Samasya', H. Rizvi's 'Comparative Physiography of the Lower Ganges and Lower Mississippi Valleys'-all these have provided important insights into the river-system of Bengal and particularly the Ganges bringing in light the other river-systems.

M.O. Carter's 'Final Report on the Survey And Settlement Operation In The District Of Malda: 1928-35' has given a detailed description of Malda at that point of time including the river system, various geographical divisions etc.

'Flood and Erosion Induced Population Displacements' written by Showkat Iqbal, 'River Bank Erosion Hazard Study of river Ganga' written by Praveen K. Thakur, Chalantika Laha and S.P Aggarwal are also very important contributors in this respect.

The book - 'The Changing Face of Bengal: A Study in Riverine Economy' written by Radha Kamal Mukherjee with an introduction by Arun Bandopadhyay is indeed a very important work in this context. The book contributes a lot in describing the gift of the Ganges in the region in the form of delta creation- old and new. It also throws light upon the agricultural decadence and public health in the early twentieth century. It is very much helpful to build ideas about the changes of the river courses in the sixteenth and seventeenth centuries.

The book 'Migration, State Policies and Citizenship' by Dr. Rup Kumar Barman has conducted a detailed study on the different category of Migration including environment-induced migration. The question of the statelessness and resettlement of the forced and voluntary migrants have been raised in this book. The book deals with the migration of the socially marginalized people from East Bengal / East Pakistan/ Bangladesh to India and their struggle for survival. The forced migration of the voluntary migrants to from Bhutan to other countries and their struggle for resettlement have also been discussed in this book. These has given very good insight into the struggle for existence which the migrants have to go through.

The book ' Ganga-Farakka Barrage Project and Rural Economy of India' by Manab K. Bandyopadhyay has made a detailed work on the impact of the Barrage on the socio-economic sphere so far the living condition of the people is concerned. In this book, the role played by Farakka Barrage in the erosion of the Ganges has been described. The impact of the erosion on the life of the rural population has also been described.

The book 'Dui Banglar Nadikatha' written by Kalyan Rudra is a very important work on the river- science. It has reflected the changing course of the Ganges in various point of time. The evolution of the Ganges-Brahmaputra- Meghna delta has been described here. Also the problem of flood and flood- control in Bengal have been emphasized in this book.

The book 'Titas Ekti Nadir Naam ' written by Adwaita Malla Burman depicts the life of the Mallas, a community of the fishermen who live off fishing in a river called 'Titas'. The novel paints the life of the fisher community in great detail. It showed that the life of the community and the life of the river were closely tied. Their end comes when the river dries up. Thus this novel presents before us the horrifying picture of environment

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induced displacement/ migration, where the movement of the river directs the movement of the life-graph of people.

Objectives

The specific objectives of the study would be to throw light upon the points mentioned below:

1. To trace how the river Ganges has shifted its course over various period of time, and brought changes in the geography of Malda.
2. To explore the contribution of the geographical factors behind the changed landscape in the study area.
3. To highlight upon the role of the construction of the Farakka Barrage behind the acceleration of Ganges-bank erosion in the concerned area.

Research Questions

1. How the shifting courses of the Ganges continued to disturb the landscape of Malda from past?
2. What are the causes behind such a magnitude of loss caused by the erosion?
3. Whether the geological/ geographical causes were much responsible or the man-made factors, behind the erosion?
4. What was the contribution of the Farakka Barrage behind the erosion of the Ganges in Malda?

Methodology of the study

The study is based on a field survey conducted on different locations of Malda and Murshidabad districts. As the study is focused on the erosion- led migration of the people, those who have been living in the mainland as well as char-lands, after migrating, were interviewed during the field survey.

The study is a mixture of both quantitative and qualitative kinds of research. While doing this study, the first step was the data collection. Both primary and secondary data were collected for the purpose of this study. The starting point for the study was the collection of both published and other available resources, particularly from books, journals, newspaper cuttings. Along with these, various maps were thoroughly gone through to understand the overall historical scenario of the course of the Ganges. In the second stage observation from the field survey was made that helped this work to get insights of the problem very much.

Historically tracing the changes in the course of the Ganges and the resultant river-bank erosion

From 12th Century to the early part of 20th Century Bengal- particularly the Malda and Murshidabad region were noticed to be going through several changes in the course of the Ganges. As a result, from 12th-16th Century the ancient rulers of Bengal- Lakshansena, Alauddin Ali Shah, Nasiruddin Mahmud Shah, then Mansingh (the Mughal governor of Bengal and Bihar) shifted their respective capitals in accordance with the haphazard movement of the river (DHDR, 2007). In 1505 an earthquake occurred as a result of which the Ganges left its old course leaving Gaur and started flowing southwards (Hirst,1915). The ancient capital of Gaur lost its importance and was abandoned in course of time and when Rannell visited the region two centuries later in 1776, he found the Ganga flowing more than 16 km to the city's west. Gour, the ancient capital of Bengal that was located on the old bank of Ganges left its ruins at 4 or 5 miles from the bank." (Rennell,1788). The water of the Ganges flew through the Kalindri river mainly around the 13th Century, at which site later remained the ruins of Gaur (Sarkar,1973).

De Barro and Gastaldi Provided the oldest of modern maps of Ganga delta (Mukherjee, 1938) to the Dutch explorer Matheus Vab Den Brouche of 17th century. They are the predecessors of the first correct map of the rivers of Bengal by Major James Rennell after his long survey of the Bengal province between 1764 and 1779 (Madan, 2005). From all these sources it is found that 17th and 18th century where the periods of great changes so far as the course of the Ganga is concerned (Rizvi,1995). Bhagirathi, through which waters of Ganges used to

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pass from 12th to 16th century, was no longer the main stream of the river, losing its connection with Ganges except only during the Rains. Padma channel was shown as a broad stream in 17th century to 18th century, carrying the bulk of water

Further in the second half of the 18th Century, the Ganga was bifurcated near Rajmahal, with a riverine island or 'char', which was Bhutni. The island which was said to have risen during the reign of Aurangzeb, was protected later against erosion by a ring bund encircling the diara. According to maps of Rennell (1764-1767) and those of the revenue survey (1847-1849), the Ganga then flowed flanking the northeastern side of Bhutni. During the later decades, the river again formed a mighty bend. The famous surveyor Buchanon Hamilton showed, in 1810, the general set of the river was away from the plains of Malda and Rajmahal was on the riverbank. while later in 1870, due to the eastward migration of the Ganges, Rajmahal, became deserted. Behind this, it was the river which after rounding the Rajmahal hills, came against the island char of Bhutni Diara, followed the eastern channel instead of the western. This resulted in considerable erosion on the left-bank i.e Malda bank, affecting the Manikchak and Kaliachak-2 blocks. (Carter,1935) This reflects the erosion being caused by mere natural factors, long before any considerable changes made by human-intervention.

The geographical factors behind the changing courses of the river and consequences

The Diara stretching over the ancient floodplain comprises a sandbank-base, overlaid by colloidal silts. These are vulnerable to saturation. The river by increasing its flow, strikes the layer, the base is scrubbed, and causes bank failure. The natural composition over several time-periods did not change considerably which resulted in the same consequences later, ang got aggravated. In case of the Ganges-bank erosion in Malda and Murshidabad, the natural fluvial system of the deltaic river, as well as the geological structure of the study area - all combined in the resultant shifting courses of the river and consequent bank-erosion. These geological or geographical reasons were no doubt behind the human-control and contributed to the circumstances in their own way. While arriving at the lower segment, the slope and the velocity of the Ganges-water decreases. The river losing the ability to carry the eroded materials of the upper and middle segments (particularly those of high and medium diameter) starts depositing them in the river-bed. This siltation process creates river-islands or 'char'. The river getting obstructed by these chars, becomes bifurcated and various single flow-passes are created (not tributary). Through these comparatively narrow streams, the water is flowed with increased velocity. Ultimately this pressure is exerted on the river-bank which causes bank- erosion. Also, the feeble geological structure of Malda diara is noteworthy here. This region sedimentary which is composed of sand-silt-clay structure. At top of the soil, there is alluvium stratum, under this silver sand stratum. The materials of this type of soil do not have good compactness, which makes it vulnerable to water pressure. When the quantity and current of the water of Ganga rises, the silver sand stratum hollows out into the river. Being unable to stand strong, the riverbank gets eroded along with agricultural lands, residences and also floras.

Radha Kamal Mukherjee in his book recognized the geographical factors and gave them due responsibility for causing changes in the river regime. He, while discussing the causes of the river changes and development in undivided Bengal, stated that- in this deltaic region, the premature decline of the old rivers or sudden rise and violence of the new ones are natural features of the landscape intersected by many rivers, spill channels and sub channels. As the river-beds rise higher, the river loses connection with the head water and may erode one of its banks in a curve or over- step or breach the flow embankment. Thus, it is the natural process through which a deltaic river goes on and allows the regime to be shaped and re-shaped in course of time. The various other geographical factors behind Ganges-erosion are meandering channel, hydraulic and hydrological characteristics, sediment load and filtration, heterogeneity of bed and the bank's material, location of the ground water table, current wave action etc.-which further strengthens the logic of the geographical factors being responsible behind the Ganges-bank erosion in the study area.

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The changes in the course of the Ganges caused by the Farakka Barrage: its impact on the river-bank erosion

The Farakka Barrage- being a man-made project, was commissioned in 1975, mainly to improve the navigational status of Calcutta port. It created an obstruction in the normal or usual flow-path of the river Ganges which forced the river to divert its water-course to another direction. In search of a new channel, it thus flowed through the side-banks. The geological structure of the bank in Malda made it softer and vulnerable to water-strike finally led to the terrible erosion here, though no less harm was witnessed by Murshidabad. Both these districts went through the natural disaster over years rendering innumerable people homeless.

Flow of rivers is often modified by the construction of dams or barrages and open pits on river bed to meet human needs. Virtually half of the world's large rivers are affected by construction of dams and barrages. Thus, controlled hydrology has not only altered the channel morphometry but has also induced severe bank erosion and inundation along the banks of river Bhagirathi–Hooghly (Islam and Guchhait, 2017). Thus, there is an obvious relationship between Farakka Barrage construction and river bank erosion in Malda and Murshidabad also. In the reach between Rajmahal and Farakka, the Ganga flows between outliers of the Rajmahal hills along the right bank and the old alluvium of Barind tract along the left Bank. But contemporaneous to the construction of the Farakka barrage i.e from the early 1960s, the Ganga formed a mighty bend encroaching eastward. As the direction of the river flow was altered, and the hydrology was controlled, the river remained no longer co-axial to the Barrage. It was due to the reduction of the cross-sectional area and gradual meander formation between Rajmahal hills and Farakka. Being oblique, the flow concentrates more towards the right side of the Barrage causing swelling of water during the peak of the monsoon (Mukherjee, 2011). Three moribund distributaries, Kalindi, Chhoto Bhagirathi and Pagla mark the old course of the Ganga (later these channels started flowing through newly emerged riverine islands or chars). As part of the Farakka Barrage Project, an afflux bund was constructed over several rivers upstream of Farakka, like Choto Bhagirathi, Pagla etc to divert water into the Barrage. The complete diversion of water killed these rivers in the downstream, severely affecting the people. Farakka Barrage, thus profoundly changed the character, sediment regime and flow of Ganga. In this way, it has been affecting lives of lakhs of people in Malda and Murshidabad through cycles of erosion, sedimentation, flood. After 1974 a change was induced by new hydraulic regime. Controlled hydrology has not only altered the channel morphometry but also has induced severe bank erosion and inundation along the banks of the river Bhagirathi-Hooghly. The river continuously transferred water and sediment load in the downstream direction (Rudra,2010). Kalyan Rudra, the eminent river-expert also pointed out that since the inception of the Farakka Barrage, the hydraulic gradient of the river has been changed. Relatively silt free water released from the under sluices incised the valley deeply in the downstream section and the river has become progressively deep and narrow. The water released from the Barrage eroded the right bank and the channel gradually shifted further west. This is clearly visible by comparison of the US Air Survey Map of 1982 and the satellite images of 2006 to 2007.

During 1985 to 1991, Indian Institute of Remote Sensing of Derhadoon and Research Centre of Calcutta Port Trust jointly investigated the changing situation of meandering belt of Ganga and Bhagirathi River at pre and post Farakka Barrage Project on the comparative analysis of satelite picture of pre and post monsoon. In this investigation, 1971 was taken as base year. Some important results of the Barrage as given in the report reflects the facts that -

1. In the north part of the Barrage, the course of Ganga was shifted towards east.
2. From 1971 to 1991 the length of Ganga from Farakka to the Bay of Bengal has been decreased from 571.775 to 566.479 kilometres (Banerjee,2012).

The gnawing river has engulfed the interfluve between Pagla and itself, it had even breached seven embankments till 2000. (Rudra,2000)

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The dangerous flood of 1998 has already been mentioned in the earlier chapter. The principal cause of 1998 flood was the unprecedented rise in high flood level upstream of the Farakka Barrage and the consequent breaking of the flood embankments. The highest erosion between 2003-2005 took place in Kakribondha Jhaubona and Panchanandapur- I of Kaliachak- II block. By 2005, in fact the whole of Kakribondha Jhaubona gram panchayet was eroded. Other badly erosion affected areas came under Dakshin Chandipur, Manikchak and Dharampur gram panchayets of Manikchak block. (Thakur et al., 2011)

The Irrigation and Waterways Directorate, Government of west Bengal, was firm to opine that construction of Farakka Barrage and the menace of erosion in Malda are intimately related (Ray, 2000). According to the report of Government of West Bengal (Irrigation and Waterways Department) between 1979-2005 the amount of eroded land was however 19,685 hectare which is much than earlier phase clearly. From around 1975-2005, more than 1 lakh people of 40,000 families from 150 mouzas of Malda lost their homes or were displaced**.** In 2001 itself**,** 2500 (approx.) families in Malda were displaced. Farakka Barrage, by causing erosion has not only frustrated the river-science, but has resulted in population displacement and huge sufferings in the life of the victims. In Malda, the upstream area of Farakka, on the left bank of Ganga, five community development blocks have been being affected more or less by erosion, for a long time. These are- Manikchak, Kaliachak 1, Kaliachak 2, Kaliachak 3 and Ratua since last three decades. According to the report of the Committee set up by Planning Commission (1996) mentioned earlier nearly 4.5 lakhs of people lost their homes due to the left bank erosion and 22 mouzas have gone into the river of Manikchak, Kaliachak -I and Kaliachak- II. Thus, it was observed that since the beginning of the Barrage construction, the severity of erosion has increased. It was admitted by the Barrage authorities- The severity of erosion has increased after the construction of Farakka Barrage vide memorandum for Expenditure Finance Committee, Proposal for Central Grant for prevention of erosion of the Ganga/ Padma in the districts of Malda and Murshidabad in the State of West Bengal to be executed during 9th Five year plan. (Banerjee, 1999).

Result and Discussion

The field survey of this study took place in Panchanandapur GP of Kaliachak-II block of Malda district. Out of 30 households who were interviewed there, 60% had 2-3 the members migrated out of West Bengal. They had been agricultural families over years, but had been displaced from their roots for earning livelihood. After huge amount of lands being grasped by the river, they had to shift from farming to labour-work in various factories/construction work in the outside states such as Gujrat, Maharastra, Kerala. All these villagers who had migrated belong to the families who have shifted at least 4-5 times from their earlier home (land) due to Ganges-bank erosion in Malda. More than 50% of them belong to the families who have experienced the river-erosion in the highest magnitude after the construction of the Farakka Barrage. The loss of land, home, assets, work made their sufferings reach a height unimaginable to rest of the civilization. This brings the question of the human intervention in the natural domain into light again and highlights the need to rethink it.

Conclusion

It is therefore clear that the Ganges-bank erosion in Malda is a phenomenon having a clear chronology of the shifting courses of the river that disturbed the river-morphology and structured the living condition of the habitats accordingly. This, in course of time affected the life of the people of the adjacent areas to such extent that they lost their identities along with home and land.

While highlighting upon the natural or geographical processes that lead to river-bank erosion, the factor of the Farakka Barrage in this respect cannot be underrated at all. From the statical information also, given above it is clear. This kind of project comes with some after-effects which should have been reviewed and rethought, especially when the life of a large number of populations was involved. Artificial projects

from the colonial period have shown their consequences which have been paid for by the mother earth at various point of time. Hence, the dangerous effect of the artificial construction cannot be justified at the cost of the life of the people. The society at large come forward, with the help of experts from various fields of science-engneering-geology etc, in order to find some alternative options.

References

Bandyopadhyay, M.K. (2012). *Ganga-Farakka Barrage Project and Rural Economy of India.* Uppal Publishing House.

Banerjee, M. (1999). A Report on the impact of Farakka Barrage on the human fabric (A study of the upstream and downstream areas of Farakka Barrage). *SANDRP*, 13. andrp.in/wp-content/uploads/2018/03/impct_frka_wcd.pdf

Carter, M.O. (1938). *Final Report On the Survey And Settlement Operation In The District Of Malda: 1928-35*, Bengal Government Press, Alipore.

Development and Planning Department: Government of West Bengal, 2007, *District Human Development Report: Malda.*

Hirst, F.C. (1916). Report on the Nadia rivers, Calcutta.

Islam, A., Gucchait, S.K. (2017). Analysing the influence of Farakka Barrage Project on channel dynamics and meander geometry of Bhagirathi River of West Bengal, India. *Saudi Society for Geosciences,* 245. https://doi.org/10.1007/s12517-017-3004-2

Madan, P. L. (2005). *River Ganga: A Cartographic Mystery.* Manohar. S.A.I.

Mukherjee, J. (2011). No Voice, No Choice: Riverine Changes and Human Vulnerability in the 'Chars' of Malda and Murshidabad. *IDSK, July*, 9. https://idsk.edu.in/wp-content/uploads/2015/07/OP-28.pdf

Mukherjee, R.K. (1938). *The Changing Face of Bengal.* C.U.

Ray, C. (2000). Farakkar Ujane Paschimbange Ganga Bhangan Samasya (in Bengal), Sechpatra, Gov. of West Bengal, Jan-Mar.

Rennell, J. (1788). *Memoir of a Map of Hindoostan*. London.

Rizvi, H. (1995). *Comparative Physiography of the Lower Ganges and Lower Mississippi Valleys* [unpublished doctoral dissertation]. Lousiana State University. https://doi.org/10.5555/arwg.14.3.772689q254201p31

Rudra, K. (2000). Living On the Edge: The Experience along The Bank of the Ganga in Malda District, West Bengal. *Indian Journal of Geography & Environment, 5,* 57-67.

Rudra, K. (2010). Dynamics of the Ganga in West Bengal, India (1764–2007). *Quarternary International: Implications for science–policy interaction*, *227* (2), 166. https://doi.org/10.1016/j.quaint.2009.10.043

Sarkar, J. N. (1973). *The History of Bengal: Muslim Period 1200-1757*, Patna: Academia Asiatica.

Thakur, P. K., Aggarwal, S.P., Salui, C.L. (2011). River Bank Erosion Hazard Study of River Ganga, Upstream of Farakka Barrage Using Remote Sensing and GIS. *Natural Hazards: Springer*, 980. https://doi.org/10.1007/s11069-011-9944-z