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Historical Environment and Present Implications of Riverine Dykes - A Case Study in Hugli Estuarine Coast of Purba Medinipur District, W.B.

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Abstract

River-front dyke is the central theme of this paper. Since time immemorial riverine dykes became an integral part of a cultural landscape through protecting riparian lands of rivers from the frequent flood occurrences and to utilise that riverine water for the irrigation purposes at a required place and time. In this paper an attempt is being made to review the historical environment behind construction and maintenance of riverine dykes, and also to evaluate their present implications within the estuary-coastal socio-economic environment. The Hugli estuarine coast of the district of Purba Medinipur in West Bengal has been taken into consideration as the study area. Dykes are manmade features. With the growth of population, riverine dykes were built to protect river-front settlements and agricultural lands from the frequent flood occurrences and tidal hazards. In the pre-British period, dykes were constructed discontinuously with a very slow rate. Then, in the British period, they were progressively increased. And, after Independence the number of dykes is being increased gradually. It is observed that the aim of construction and maintenance of these dykes has been changed with time. Dykes interact with the coastal processes on the one hand and coastal environment based socio-economic activities on the other. Physically they are used through several ways. They have physical, socio-economic, political etc. implications. In our estuary-coastal socio-economic environment they have some positive significance with some negative significance as well. There is nomothetic method when we consider the general laws of dykes' construction; and it is ideographic considering the space and time specific characteristics of them. It is an empirical study based on field observations. Primary and secondary data have been used to infer some of the specific conclusions as well.

Introduction

From the very beginning of our civilisation, water-front riverine dykes are significant through protecting riparian lands of the rivers like Nile, Tigris and Euphrates, Indus, Huang-Ho and Yangtze from the frequent flood occurrences and also to utilise that riverine water for the purposes of irrigation at a required place and time. At present, in the context of global warming and rising water-level in the oceans simultaneously, estuarine coastal dyke is becoming an environmental issue. Simply estuary is considered as the meeting place of rivers with sea. Environmentally, it is a fragile zone in the mouth of rivers on the sea coast. 'Coast' refers to the immediate land surface behind a water body like sea, river, estuary, canal, lake, creek etc. For our convenience study, we have considered 'Hugli estuary-coast' which is the landward zone of the Hugli estuary. It is due to the fact that dykes are found on the land surface of an estuarine belt. Hugli estuarine coast is continuously affected by the tidal currents, flood waters, siltation, formation of the bars and islands within the river channel, changing water courses, and cyclones. Throughout the world, there are more than twenty big cities situated in the estuarine coastal environment. Water-front coastal dykes protect the riparian lands of the rivers, canals, creeks, estuaries, and seas from the frequent flood occurrences and also from the intrusion of water --- that may be fresh-water or saline tidal-water. River-front dykes are significant from time immemorial due to their various aspects of utilisations corresponding to our socio-economic environment. From the geographical perspective, it reflects a 'man and environment' relationship. Dyke is a product of man; and it is a part of our environment. Dyke is conventionally known as an artificial earthen mound built to support a road and also to control movement of water. It is a manmade feature in our cultural landscape. More precisely, it is an important part and parcel of a flood-plain cultural landscape. After their construction they take part in our environment.

Objective

The prime objective of this paper is to review the historical environment behind construction and maintenance of riverine dykes, and also to evaluate their present implications within the estuary-coastal socio-economic environment.

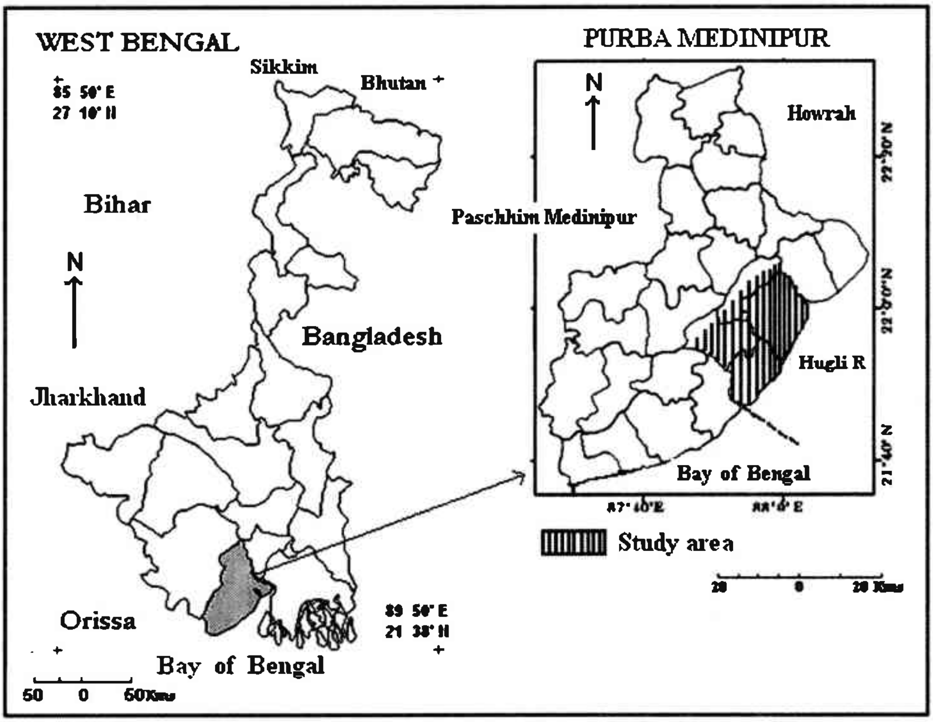


Fig. 1: The study area

Study Area

The Hugli estuarine coast of the district of Purba Medinipur in West Bengal has been taken into consideration as the study area (Fig. 1). For our convenience study it is bounded by Haldi river on the east, Rasulpur river on the west, Hijili tidal canal on the north, and Hugli river on the south. It is situated within the blocks of Khejuri II and parts of Khejuri I, and Nandigram I and parts of Nandigram II. At present there riverine dykes are administratively controlled by the Khejuri irrigation section office under the Kanthi irrigation sub-division of the Kanthi irrigation division, Department of Irrigation and Waterways, Government of West Bengal, India. Latitudinal extension is about 21°45' N to 22°04' N; and it is in-between longitudes of 87°46' E and 88°13' E.

Database and Methodology

It is an ideographic study with respect to the space and time specific characteristics of the riverine dykes of the study area. It may also be said that it as an empirical study based on field observations. Method is nomothetic when we consider the general laws of dyke construction, and dyke maintenance also. Some figures and tables are prepared to corroborate the observations. Primary and secondary data are taken into consideration to infer some of the specific conclusions in the climax of this paper as well. In this geographical study to review historical environment and present implications of the riverine dykes' parameters are taken together as follows: protection of coast for agriculture and human lives, assets etc; protection from coastal floods and tidal effects; surface fresh-water irrigation; transport and communication; house hold uses; and revenue collection by the government.

Chronological Progress and Environment

History of an area begins with the first settlements. In the context of the historical environment of riverine dykes in the study area, it is relevant to specify some of the important historical points of the district of Purba Medinipur during the pre-British and British period. Here only those points have been outlined which have relevance to the dykes. During the Muslim period, *zamindari* system or local landlord system was introduced for socio-politico-economic purposes. Landlords were classified on the basis of nature of revenues to be paid to the Muslim rulers. Subjects of landlords were also classified according to their socio-economic status. It is just stated that landlords had started construction of coastal dykes to protect lands, immediate behind the dykes, from fresh-water and/or saline floods.

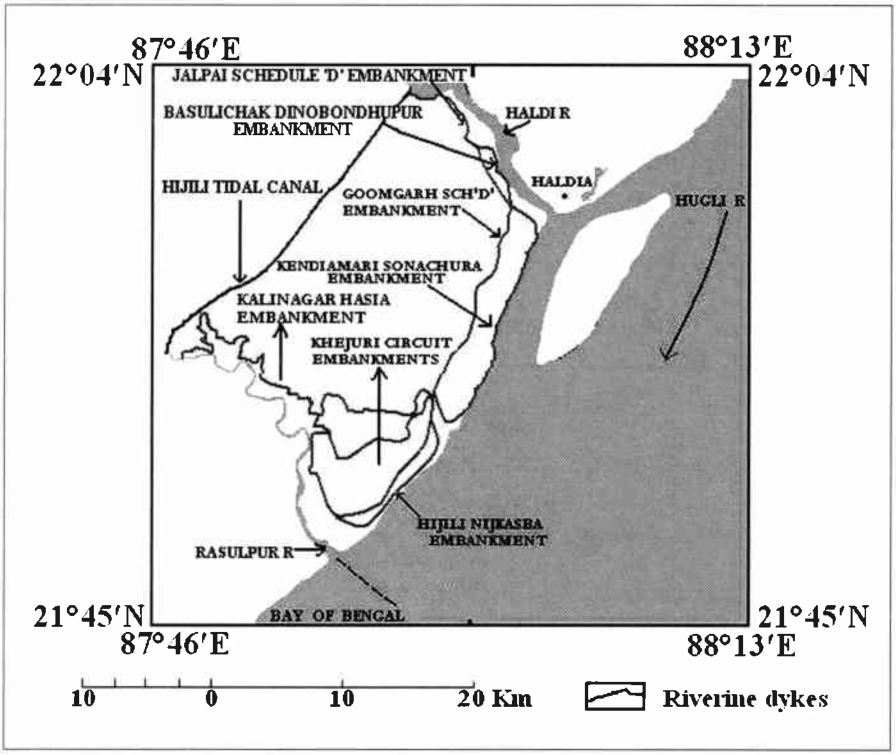
Bhattacharya (2004) has described that in 1760, after the *Battle of Palashi* in 1757, British rulers (East India Company) captured the district of Medinipur (undivided). After the appropriation of *Dewani* in 1765, the British rulers decided firmly to overhaul the land tenure system. But in case of Medinipur the task was very hard since almost two-third of the district had been covered by deep forests. In that period their actual interest was to trade salts from the *Nimakmahal* (Tamluk and Hijili belt). Their interest was to collect the revenue from agricultural lands and other cultivated lands. In this respect they streamlined the haphazard previous coastal dykes to protect the riparian lands from the fresh-water and saline floods, and also from tidal effects. Dykes were strengthened. More and more areas were fortified under the coastal dykes. Engineers were appointed to construct and maintain these dykes by the British rulers. Different laws were formed with respect to the dyke maintenance. But, due to collection of more revenue from the local people many movements were formed therein (Pal, 2004).

From the early twentieth century the district of Medinipur was a breeding place of freedom fighters against British rulers. There were periods of intense nationalist agitation in 1919, 1921-22, 1930-34, and 1942-44. There was a large group of nationalist workers who worked regularly for the Congress through constructive activities and political propaganda (Saynal, 2000). October cyclone of 1942 made havoc damage in the coastal areas of Medinipur. But the colonial government did not pay any attention to relief work. The incident was not even notified in the Calcutta Gazette. Even Calcutta (presently Kolkata) newspapers suppressed the event; instead war news of *Second World War* was given priority (Dhara, 2002). This shows the government's apathy toward Medinipur district. That the coastal dykes were not maintained in the district regularly may partially be related to the apathy of the government we are speaking of. However, it is the colonial government who started recording the dykes in the study area more systematically. In the district of Purba Medinipur of West Bengal, dykes on the Hugli estuary were not constructed at a time. With the growth and extension of settlements and also to reclaim agricultural lands in the study area these were built to prevent salt-water intrusion and also to prevent flooding. To understand their chronological distribution, riverine dykes are classified into pre-British, British, and post-British period. In the pre-British period, there the dykes were constructed discontinuously with a very slow rate. Then, in the British period, they were progressively increased. And, after Independence i.e. in the post-British period, the number of estuary-coastal riverine dykes is being increased gradually. Colonial government at-first started to take the records of the water-front dykes of different types. Hunter ([1876] 1997), Inglis (1909), Harrison ([1909] 2002), O'Malley ([1911] 1995), et al observed and classified embankments based on their locations and purposes served by them. But, unfortunately, they did not follow the same nomenclature. W.A. Inglis ([1909] 2002) had mentioned that the dykes were present in Khejuri I block. He had estimated specifically the construction of Hijili embankment --- which is at present known as Khejuri circuit embankment in our study area. The Hijili embankment of the year of 1782 is the first recorded embankment in the study area. In 1823 it was totally devastated. In 1824 it was re-constructed, but in 1831 it was again destroyed. Then, in 1832, it was renovated. In 1834-35 a long continuous section of dyke in Khejuri I was constructed on the retired line of dykes which was devastated in 1833. In that period embankments were under the Salt department. The government's interest to collect more revenue was behind the construction of these coastal dykes. Hijili tidal canal embankments were constructed also in the British period for the purpose of navigation. Pre-British or *zamindary* dykes were constructed by the local landlords to meet the local demands therein. It was the saving of lands from the saline tidal and flood-water intrusion. The British had constructed and maintained water-front dykes to collect more and more revenue from the embanked lands by providing the opportunity of high agricultural productivity. After Independence, new dykes have been constructed with a better technique but the purpose is shifted from the protection of rural agricultural lands to the protection of urban industrial land of Haldia, administrative town of Tamluk, and the beach tourist spot of Digha in the district of Purba Medinipur. Therefore it is found that there is an observable change in the question of prioritisation.

Riverine Dykes

Simply riverine dykes are the river-front embankments. In our study area some of the important selected riverine dykes are Khejuri circuit embankments, Hijili Nijkasba embankment, Rasulpur river Kalinagar Hasia embankment, Nandigram schedule 'D' goomgarh embankment, Nandigram Kendamari-Sonachura embankment, Haldi river Basulichak-Dinobondhupur embankment, and Haldi river Jalpai schedule 'D' embankment (Fig. 2).

Fig.2: Spatial distribution of the selected riverine dykes



Based on IRS 1D, LISS – III, Path_Row – 108_57, and Kanthi Irrigation Division maps

Physico-socio-economic View

It is the study of the present socio-economic implications of the Hugli estuary-coastal dykes in relation to the physical context of the region. Physical environment of the Hugli estuarine belt in the district of Purba Medinipur has guided the alignment of the river-front dykes and also their form and behaviour which are intricately related with the socio-economic environment therein. Bay of Bengal coastal region of West Bengal is characterised by hot-wet monsoon type of climate. General elevation of the study area varies from 0.5 to 2.0 metres. And, height of the dykes remained around one to three metres, whereas danger level of the river-water is more or less two metres. Slope remained as 1:2 to nearly vertical. There top-width and base-width of the dykes are not properly maintained following the engineering methods. Table 1 shows the historical environment and contemporary aims and objectives behind construction and maintenance of the selected dykes. It is a self-explanatory table as well. Only the Hijili Nijkasba embankment has no change in between its purpose of construction and the present reasons behind maintenance. Dykes are manmade features. They had been super imposed on the open Hugli

Table 1: Historical and contemporary aims and objectives behind construction and maintenance of the selected dykes

Dykes	Historical-old nomenclature	Blocks	Period of construction	Initial purpose of construction	Contemporary reason for maintenance	Causes of changing purpose
Khejuri Circuit Embankments	Gungoorea bundee and bahar-bhera	Khejuri II	Pre-British to British	protection from saline tidal and flood-water	transportation	another water-front embankment
Hijili Nij kasba Embankment	-	Khejuri II	Post-British	protection from saline tidal and flood-water	protection from saline tidal and flood-water	-
Rasulpur River Kalinagar Hasia Schedule 'D' Embankment	Gungoorea bundee and bahar- bhera	Khejuri I Khejuri II	Pre-British to British	to protect riparian lands from saline tidal and flood water	besides the very water-front section others are village roads	changing river course
Nandigram Schedule 'D' Goomgarh Embankment	Bherabandhi	Nandigram I	Pre-British to British	protection from saline tidal and flood-water	transportation	Kendiamari-sonachura embankment
Nandigram Schedule 'D' Kendiamari-Sonachura Embankment	-	Nandigram I	After Independence	protection from saline tidal and flood-water	transportation	natural levee on the water-front
Haldi river Basulichak-Dinobondhupur Embankment	-	Nandigram I	After Independence	protection from saline tidal and flood-water	protection from saline tidal and flood-water, and transportation	increasing population
Haldi river Jalpai Schedule 'D' Embankment	Gungoorea bundee and bahar-bhera	Nandigram II and I	Pre-British to British	protection from saline tidal and flood-water	protection from saline tidal and flood-water, and transportation	increasing population

Based on Different government reports and records, embankment manual and field observation estuarine coastal environmental system. Thus the estuarine coast has been closed. Estuaries are characterised by admixing of fresh-water with salt-water, which generates turbulence along the river course. With the help of blowing easterly wind turbulences have multiplied their speed and thrown into the estuary-coast, and particularly to the meandering sections. Generally due to this reason Hugli estuarine coast is being eroded continuously. There saline-tide is a regular phenomenon which disturbs the riverine dykes to be attuned with the developmental process of the Hugli estuarine coastal environmental system. Saline soil is not suitable for construction of the river-front dykes. Salts are prone to be diluted into water and then they are going to be eroded during tides and also during rainy season. Thus the gully erosion is formed on the water-front slope of the riverine dykes. In summer season fissures and fractures are developed on the dykes and they are also vulnerable when comes into contact with the rain-water, particularly in the hot-wet monsoon period. In addition, seasonal cyclones and frequent flood hazards are significant to create a fragile environmental condition in Hugli estuarine coastal belt. Physically estuary-coastal riverine dykes usually give a positive message against the negative phenomenon like cyclone, flooding, and saline tidal-water intrusion.

Environmental impact of unplanned and/or poorly maintained portion of dykes is negative in the long run. In this context present vulnerable pockets of the riverine dykes in the study area are important to mention (Table 2). There at present in all three vulnerable pockets are located within the array of the dykes. Generally they are treated as engineering faults. But, vulnerability shows environmental disagree of the coastal environmental system which once upon a time was open to the nature. Social, political and economic environment of an area also shape the face of a vulnerable pocket. In the study area, the department of irrigation did not pay his attention only because of its rural agro-based economy. Long vulnerable stretches need immediate repairing for the well-being of the local people of rural agro-fishing caste. From the historical past all the riverine dykes of the study area suffer political propaganda. Due to this reason also vulnerability is being continued to spread. All river-front dykes have restricted movement of sediments of the rivers toward the country side. Therefore, excess sediments are deposited on the river sides'; and thus there formed marginal longitudinal bars as well. These accumulated sediments are used for brick manufacturing in the brick-kilns. Saline-water of the estuary affects the cultivation system of the coast. Riverine dykes protect agricultural fields. These dykes also protect brackish-water and fresh-water fisheries from the invasion of high flood-water and tide-water, particularly during the period of monsoon-cyclones. Dykes in the study area are also used as the medium of transport and communication. Thus they play an important role in the spatial network system of the region. They have become a medium of social interaction. They are used as the places for building of houses, a resting place for villagers, for drying leaves, grains, clothes etc. in the rural areas. They create a safe environment for rural activities. Breaching of these dykes creates socio-economic hazards in the flood affected zones of the study area. Social significance of the dykes thus cannot be ignored.

Table 2: Vulnerable Pockets

Vulnerable Pocket	Dyke	Length
Kanthibari to Alichak	Rasulpur left Kalinagar Hasia Sch 'D'	8 km
Talpati to Nij kasba	Hijili Nijkasba	15 km
Dinobondhupur Section	Haldi river Basulicahk-Dinobondhupur	1 km

Based on field observation

Conclusion

Riverine Dykes of the Hugli estuarine coast in the district of Purba Medinipur have some positive significance with some negative significance. In conclusion major findings are as follows. (1) Throughout the history of the riverine dykes, in the context of human protection and socio-economic utilisations, they are positively significant. (2) Physical environmental set-up of the Hugli estuarine coast shapes the riverine dykes and their vulnerability which are solely related with the socio-economic environment therein. In hot-wet monsoon climate local saline soil of the riverine dykes weakened them to make it vulnerable, and thus creates a flood environment. (3) Chronologically, there is some change in the aim and objective behind initial purpose of construction and present reasons for maintenance of theses dykes. All the studied dykes were constructed to protect riparian lands from the saline tides and flood-water intrusion. At present, with the same purpose of the initial stage, they are used as a place of complex variety of socio-economic implications. (4) Department of irrigation has maintained only those vulnerable pockets which are socio-politico-economically sensible. The study area has remained neglected from the government side in the context of the construction of new riverine dykes and repairing of the existing dykes, because there has only prevalence of the rural activities. (5) With time from pre-British through British to contemporary period, there is a shift of prioritisation behind construction and maintenance of the riverine dykes throughout the district of Purba Medinipur from the protection of rural areas to the protection of urban areas. (6) British government had only interest of revenue collection through protecting riparian lands of the rivers. (7) Political disturbances with relation to the catastrophic disturbances like cyclones and floods in the British period affected dyke construction and maintenance process. (8) Riverine dykes interact with the coastal processes on the one hand and coastal environment based socio-economic activities on the other. (9) Riverine dykes create new resource base like brick-kiln which produces job opportunity to the locals. (10) At present all the riverine dykes in the study area are commonly used as the means of transport and communication. It is due to the fact that number of population increases continuously and they are being settled in the neighbouring areas of the dykes to get several economic opportunities. They are mostly belonging into agro-fishing caste. (11) Construction of riverine dykes in an open estuarine coastal environmental system and its breaching show different types of environmental hazards which are treated as negative significances.

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