

Physical Environmental Setting of the Hugli – Saptamukhi Estuarine Deltaic Complex in South West Sundarban, West Bengal.

Dr. Satyajit Dhara, Assistant Professor, Acharya Jagadish Chandra Bose College, Kolkata- 20

ABSTRACT

The 350 km long coast line of West Bengal along the Bay of Bengal is dominated by the Ganga delta. The river mouths are significant sediment input areas of the coastal zones. They are the supply paths of fresh water and sediments of the catchment areas which are usually transferred from riverine to marine systems into the coasts. The sea water connections of the estuaries are largely influenced by tidal inflows. The shallow offshore portion of the Bay of Bengal is strongly influenced by Hugli estuary, Saptamukhi estuary, Thakuran estuary, Matla estuary etc. The lower portion of the South Western part of the Ganga delta where Hugli River entered Bay of Bengal is known as Hugli estuary. The lower portion of the Saptamukhi River is known as Saptamukhi estuary. Due to the deposition of the sediments at the mouth of the river Ganga, a large delta developed known as the Ganges delta. So many islands formed at the mouth of the Hugli River, Saptamukhi River and many other rivers of Indian Sundarban. Hugli- Saptamukhi estuarine deltaic complex is one of the dynamic geomorphological and ecological areas of the West Bengal coast. Numerous tidal creeks dominated by mangrove vegetation at the river bank margin, deltaic flat, high wave energy, continuous erosion and deposition process wind and tidal energy make the area very diverse in character. The fragile mangrove ecosystem along with tidal inflow and outflow along with tidal creeks and location of the Bay of Bengal at the Southern part of the Indian Sundarban make the deltaic planes a special character for researchers to do research works in Marine Science, Geology, Coastal Geomorphology, History and many other disciplines. Maximum portion of the Hugli and Saptamukhi estuary inundated during high tide and the water level goes down during low tide. During strong cyclones huge marine energy are generated which exerts on the coastal systems.

In the lower Ganga deltaic plane along with so many islands the Indian Sundarban is geographically distributed. The increased population in the low lying coastal plains of West Bengal and the direct impact of human activities the natural delta building process as well as coastal eco system is very much influenced. Land reclamation by mangrove degradation for agricultural purpose, disruption of the natural flow of the rivers for the construction of embankment, huge resource exploitation from the forests, rivers; estuaries have an adverse impact on the environment. At present global warming with sea level rise, increase salinity in a river and sea water, coastal erosion, shoreline shift, recreational activity and many other factors make this area most hazards prone and vulnerable for the existence coastal community. The present paper tries to explain and discuss the nature of relationship between the physical environment and cultural aspect of the study region. It will help us to make an assessment of the environment of the Hugli Saptamukhi river complex.

Keyword: Physical environment, Hugli Saptamukhi River, deltaic complex, river system, soil salinity, estuarine environment, global warming, sea level rise.

Introduction:

The coast line of West Bengal is dominated by the Ganga delta. Due to the deposition of the sediments at the mouth of the river Ganga, a large delta developed known as the Ganga delta. So many islands formed at the mouth of the Hugli, Saptamukhi and many other rivers of the Indian Sundarban. The Hugli- Saptamukhi estuarine deltaic complex is one of the dynamic geomorphological and ecological areas of the West Bengal coast. Numerous tidal creeks dominated by mangrove vegetation at the river bank margin, deltaic flat, high wave energy, continuous erosion and depositional process of wind and tidal energy make this area a diverse

in character. The estuarine environment and coastal systems are very much complex and dynamic in nature in this area.

Aims of the Study:

- To assess to the physical environmental characteristics of the Hugli-Saptamukhi Deltaic region.
- To understand about the geomorphology of the study area.
- To examine the nature of soil and climatic characteristics.
- To know about the flora and fauna of the estuarine environment.

About Study Area:

Location:-

The study area is bounded by Latitude 21°33'55.509"N to 22°0'25.93"N and Longitude 88°0'45.952"E to 88°31'53.469"E. (Figure: 1).

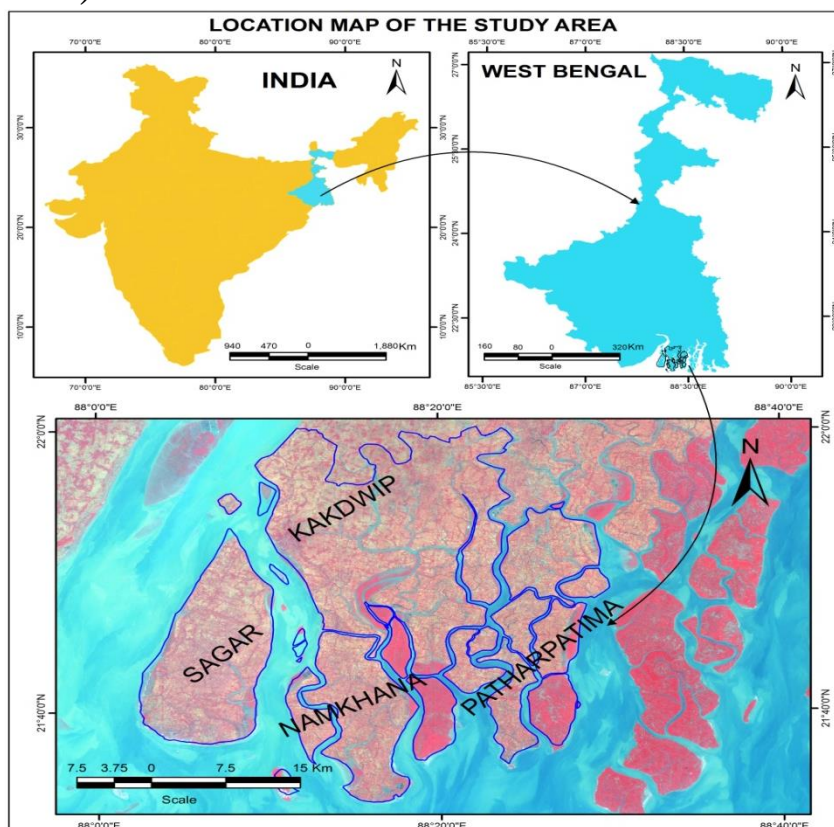


Figure-1: Location Map of the study Area.

Methodology:

For the completion of the present research work, pre-field, field, post-field methodology have been followed. The toposheets of the the study area have been consulted by me at the NATMO office in Kolkata. The toposheets are mosaicked by using the software ERDAS IMAGNE 9.2. AOI layers prepared by using ERDAS IMAGINE 9.2 on the satellite images. The block maps of Kakdwip, Sagar, Namkhana and Patharpratima had been digitized for preparing the thematic maps using map info 7.5. The sediment sample also analysed to get the various information about soil characteristics.

Result & Discussion :-

Deltaic Geomorphology

The entire study area is located in low lying deltaic plain separated by numerous streams and tidal channels. Most of the silt carried by the rivers like Ganges, Brahmaputra, its tributaries and distributaries. The regional Geomorphology is influenced by high annual sediment load carried by the rivers. Tidal activity and storm surge are also responsible for the evolution of deltaic islands. The high sediment load exerts a basic influence on the coastline and helped by the circulation system which results in a net accretion of the sediment and erosion of the south-western part. Change in major river courses and abandonment of the deltaic part are very significant recent episodes of the Bengal delta. Morgan and McIntire (1959) attributed

the change in river courses of the Ganges and Brahmaputra to faulting and resultant tilting of fault blocks. Abandonment of the deltaic part was caused by the capture of the Hugli River due to basement faulting. The large abandoned deltaic tract of the Ganga- Brahmaputra River is now occupied by a dense swamp area, the Sundarban mangrove forest. Many tectonic lineaments are identified by different workers (**Babu,1976; Rakshit,1980; Das et al, 1985**) across the Bengal coastal sediments and deltaic sediments at present by photo- geomorphic studies. Other relevant studies by **Nandi et al,(1983)** provided information about the possible extension of structural episodes of the Tripura-Mizoram Fold Belt below the alluvium of the Ganga delta within adjacent Bangladesh under an overall plate tectonic frame work. As deltas are topographically subdued areas at the margins of basins, they are extremely sensitive to subsidence trends, sea level fluctuations and basin tectonics. The delta sites of the Lower Bengal are affected by basement related tectonics as they are located in a down warped basin with numerous active normal faults. Very recent studies by **Nandy (1994)** indicates that the Bengal basin occupied by thick alluvium of different formations is traversed by many subsurface faults and lineaments, some of which might be seismographic in nature as evidenced in the southern part of the basin having coincidence with earthquake hypocenters. It is evident by the study that most of the earthquake events in the southern part of the basin are related to Eocene Hinge Zone and the earthquake to the east of the Hinge zone might have originated due to movements along the onshore extension of the curvilinear NE trending faults. There are also historical records of 28 low magnitude earthquakes in Calcutta from 1737 to 1906 A.D.

The tectonic set up of southern Bengal Basin influences the evolution of the deltaic alluvial and strand plain coast of West Bengal. Morpho tectonic lineaments of the coastal tract have a close relation with different episodic formations and tectonic history of the Bengal Basin.

Physical Environmental Setting of the Hugli- Saptamukhi Estuarine- Deltaic Complex Region

The coastal plain of the present land building processes is classified into many physical environmental settings for ecological diversity. The classification done based on the method of Thom (1982). The geomorphic approach highlights the various character of diverse ecosystem of the coastal belt. Two types of environmental settings can be seen here.

❖ Setting – 1;

Hugli, Damodar, Rupnarayan and Haldi Rivers with their fresh water discharge and sediments have led to the deposition of sand, silt and clay to form deltas. Sea ward advancement of the deltas was checked by the southward trend of delta building activities of Bhagirathi – Hugli River in the Bengal Basin. Many abandoned distributary channels of such delta plain regions are usually flooded by rain water and over bank flow of active channels in the rainy season. The Hugli River is debouching into the sea and other estuaries acting as feeder channels into the river system. All the rivers are causing devastating floods in the low lying delta plain region of South Bengal. In this way the rivers contribute a large amount of fresh silt accumulation over the delta plains during the period of floods. The reworking of sediments takes place into the estuaries and sea faces by tides and waves. Morphologic diversity of the physical setting is resulted from drainage switching in the head links of freshwater discharge and sediment deposition and significant rates of subsidence. Alluvial floodplain surface, active delta face and chain of marshes or lowlands are characterized by significant habitat diversity in the region. High salt tolerant mangroves are not found along the estuarine complex. Both freshwater swamps and brackish water swamps are distributed over the areas of inner estuaries and low alluvial plains.

❖ Setting 2:-

At present the low lying coastal zone is influenced by physical process of high tidal range with strong bidirectional tidal current. Various elongated sand bodies in the shallow offshore zone, parallel to north-south extension of larger tidal mouths, exhibit the current dispersion of sediments brought to the coast by active rivers (Wright et al, 1973). All the past distributary channels (Saptamukhi, Jamira-Thakuran, Matla-Vidyadhari, Gosaba etc.) are typically funnel shaped and fed by number tidal creeks.

Tide dominated distributary channels are widely separated by tidal flood basins and numerous tidal creeks are separated by extensive tidal mud flats. The entire study area are covered by dense mangrove forests. More salt tolerant species dominate over the abandoned delta surfaces while some less salt tolerant species do not survive due to lack of riverine silt deposition and sufficient freshwater discharge at present

.Vegetated tidal flat surface increases in height with siltation by high water spring tide inundation level. Mature swamp surfaces of the many deltaic islands are also affected by sheet and lateral erosion. Many saline banks are developed over the higher surface of tidal flats. Swamp edges are cliffed on the seaward side and also on the channel side by the water level erosion of storm surges and high water spring tide stages. Sub-tidal shoals and bars are supplied by bank erosion, offshore bed scouring and current dispersion of sediments Hugli, Saptamukhi, Thakuran estuary into the physical domain.

The Coastal Geomorphology is influenced by high annual sediment loads carried by the rivers. Tidal and Storm surges are also responsible for this incident. The high sediment load exerts a basic influence on the Coast line and helps by the Circulation systems which results in a net accretion of the sediment and accretion of the south western part. Actually this is the part of active Ganga delta.

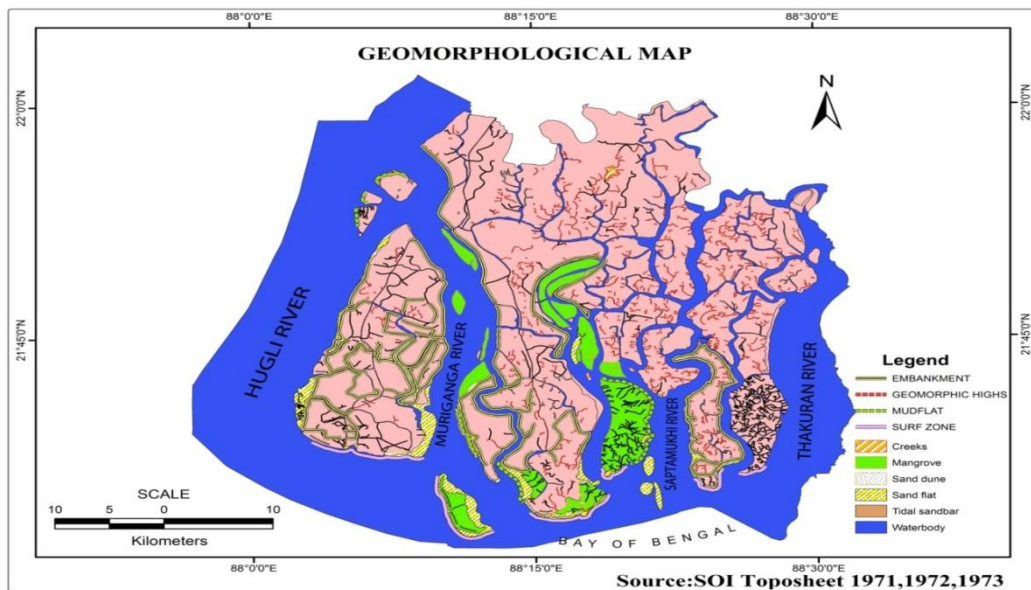


Figure-2;
Geological Map
of the study
area.



Coastal features of Sagar South



Tidal channel with salt mass



Exposed sandy beach with plantation of casuarina at south sagar



Burir Khal - A tidal Creek at south sagar



Exposed mud surface with sandy cover west of sagar south



Casuarina plantation on the shore front, south sagar



Paddy field with settlement near Tapoban

Photo Plate: - 4

DIFFERENT BEACH FEATURES AT BAKKHALI SEA BEACH



Ridge and runnel



Prominent rill marks on the middle beach face



Ripple marks on the exposed runnel surface



Rill marks connecting small runnels across the ridge on beach face

Photo Plate: - 5

River System:

The Sun Photo Plate: - 4

darban region is surrounded by so many rivers, creeks and rivulets. Almost three fourth of this area is full of rivers which demarcate the boundary of Sundarban. The main rivers of this region are as follows :-
i) The Hugli ii) The Muri-Gnga-Baratala iii) The Saptamukhi and the distributaries of the Ganga etc.

The Kakdwip subdivision which includes four blocks (Kakdwip, Sagar, Namkhana and Patharpratima) is a part lower Ganga delta. The southern part of this region still delta building process is active. The rivers and tidal creeks separated the islands from one another. The distributaries of the Ganga which criss-cross this region include the Hugly, Muriganga or Baratala, Saptamukhi, Thakuran, Mridangabhanga, Gagadal, Gabadia, Hatania-Doania etc. These rivers are fed by sea tides twice a day. During high tide sea water enters almost 100 km interior portion from their mouths or creeks. It inundates the lower portion of the entire region.

The Hugli River:

The Hoogly is the main river of the study area. It is a meso tidal river. The tides of Hugli are occasionally so strong that it gives rise to a phenomena called Tidal Bore or Ban. The point where it meets

Sagar (Bay of Bengal) its breadth is about 30 km. Before entering sea its main channel divided into two parts - one is the Hoogly another is Muriganga or Baratala. Sagar Island is located at the mouth of Hoogly River. The Hatania-Doania connects the Muriganga with Saptamukhi.

The Saptamukhi:

The Saptamukhi river is spread over both North and South 24 Parganas district. It is wide and shallow. It has a number of shoal features at its bed .One such big shoal separates the main stream from the Ghughudanga Bill Creek.From north to south the Banstala-Ghughudanga Gang-Saptamukhi West Gully may be said to from one continuous arm, the east Gully is a distributary of the same on other side of Prentice and Lothian Island. The major branches on the west are Kalnaginikhal the Ghuhgudanga Gang and blind creek, Patiboniariver, Edward Creek, Chandpirikhal and Bagkhali river around Fresuregaunje Island.

The Thakuran River (Jamira River) :

The Thakuran River is very wide near the sea. The major lateral branches are Kadrakhalikhal, the Damdamakhal, the Moni River,the Pakchora,the Phakirali and Ross creek .It links a channel on the eastern side with Matla River.

The Calchara-Curzon Creek :

The estuary lies between the estuaries of the Saptamukhi and the Thakuran. The Curzon creek is almost an estuary and finds its way into the sea in the last lap through the last lap through the Saptamukhi East Gully for the last 10 km .The Sutarbeg-Mridangabhanga-Calchara-Curzon Creek-Saptamukhi East Gully form one continuous estuarine area.

Flora and Fauna:

The name ‘Sundarban’ has been given due to the presence of huge amount of ‘Sundari trees’ in this biotic unit. Tidal and cyclonic effects are very common factors which control plant growth in the low lying flat. Mangrove vegetation grows here. The saline Soil also affects plant growth. The deposition of silt brought various types of grass seeds and other vegetations in the forest floor. Wind also plays an important role for dispersal of seeds. The main trees are Sundari, Passur, Keora, Gnewa, Garan, Hental, Bain, Amooa etc. Important fauna are Crocodile, Snake, Monkey, Birds and Dear etc.



Mangrove Tree

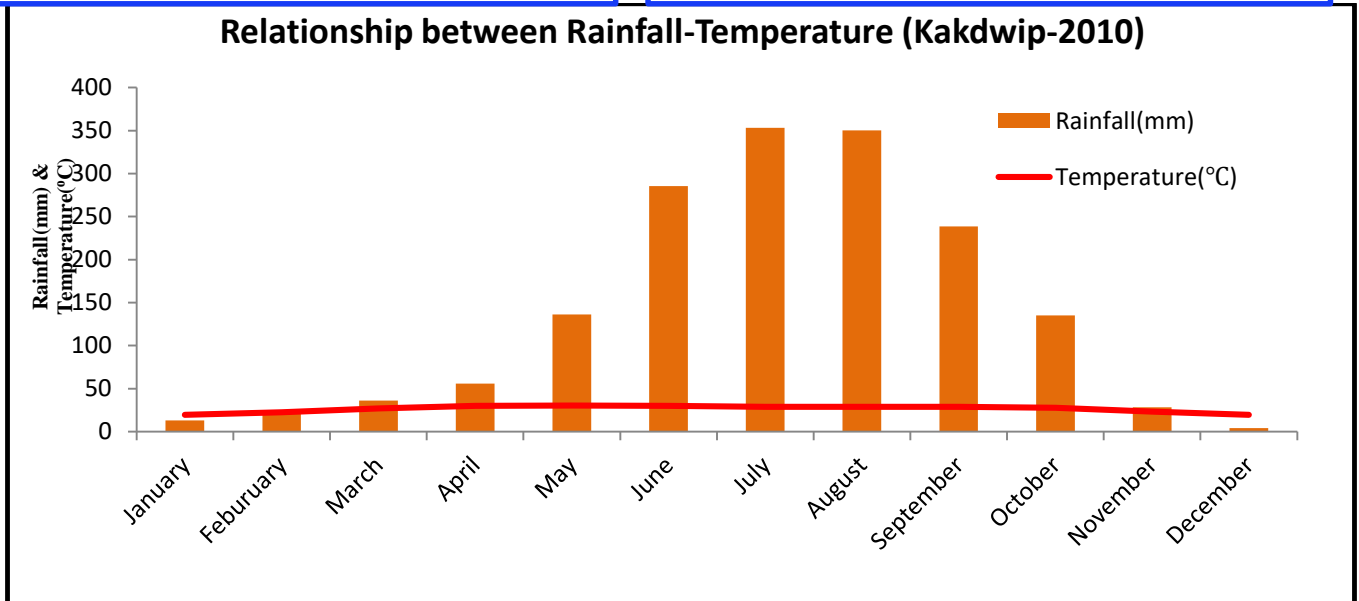
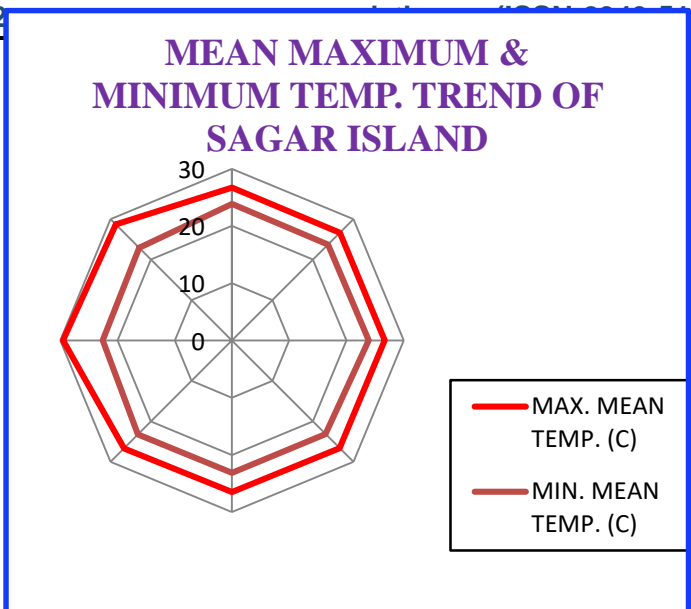
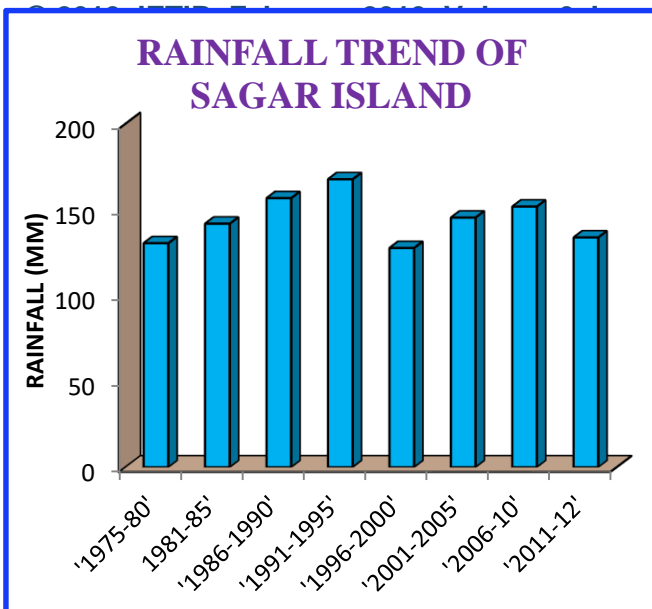


Figure-3; Weather conditions of the study area.

Climate:

This region is located near the tropic of cancer. Generally the climate is hot and humid. The cyclonic weather with high waves and tides which sometimes cause disaster in the region starts from August and extend up to November. Significant amount of rainfall takes place in the late summer and in rainy season. Mean annual rainfall is almost 150-200 cm. Annual temperature ranges from 20⁰c- 30⁰c. During the month of March- September tropical cyclones or depressions form along the coast of Bay of Bengal. In the month between March- May hailstorms caused severe damage to agricultural crops. Over

the last 20 years the intensity and frequency of cyclone have increased. Rainfall does not occur according to its natural nature (monsoonal rainfall). Sometimes heavy rainfalls occur in a particular year or some time there is unreliability of rainfall. In the year 2015 from June-August month excessive rainfall has been occurring and in many places rainfall amount in between last three months (June, July, August) already crossed 270 mm. (Alipore and Kakdwip metrological dept.)

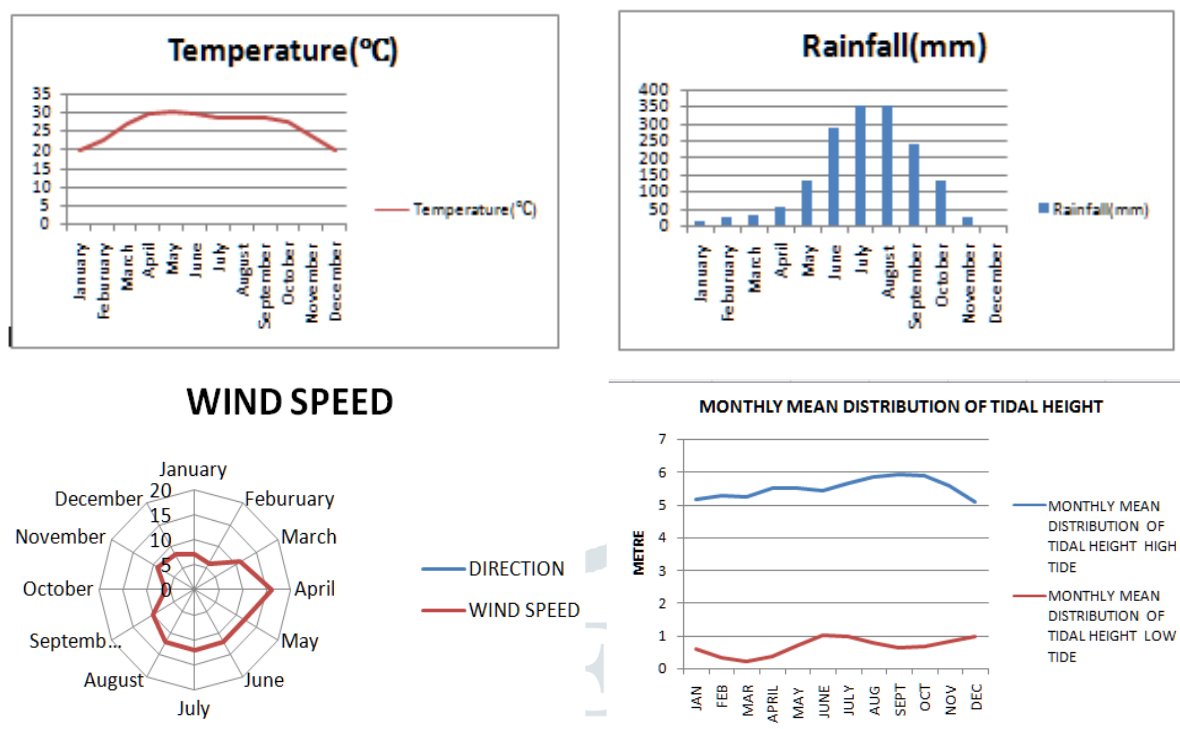


Figure-4; Temperature, Rainfall, Wind speed and Monthly mean distribution of Tidal height of the study area.

HUMIDITY AND CYCLONES

In this area humidity ranges between 70% - 80%. It is exposed to storm and cyclones. Cyclones, tidal waves and storms are very common at the adjacent villages of the area. When these cyclones in the form of monsoon depression, with high tides, they cause havoc damage in the coastal villagers like Namkhana, Patharpratima, Sagar and Kakdwip blocks. The mangrove forests cover serve as breaks water against the tidal waves and ocean waves also. Because they prevent inundation of agricultural land, loss of life and property. The villages of Namkhana and Patharpratima are more exposed to storms and cyclones due to the lack of forest cover and as a result of embankment breaching and salinization of agricultural lands leading to crops failures. Cyclones are formed during the pre monsoon and post monsoon periods. Monsoon period is associated with depressions; it sometimes turns into Cyclonic storms.

Wind :- High wind velocity causes damage to the mangroves during the months from March to September. It exposed the estuarine plants and animals to the strong wind. The speed generally ranges from 3 km per hour in October to a maximum of 12 km per hour during June. During Cyclonic period it is almost 50 km per hour to 120 km per hour.

Tidal waves :- The tidal waves sweep over the area twice a day. The tidal current changes its direction every 6 hours. The maximum rise and fall tides occur in the month of March to April. In the wide river month area in which the length of the river is very high, the velocity of the current usually varies from 3 km/hr near the sea surface to 6 km an hour up in the forest. The speed increases further inland on account of the rivers. The average rise and fall near the sea surface is about 2.2m, further up it is 3m. Where the tide has little or no stream to contend 5-6 m is common incident.

Tidal Amplitude :- Tidal amplitude in the Southern part of the island is very high reaching almost up to 7m. Because of the high tidal fluctuation and high tidal amplitude, most of the mangrove forest in Namkhana and Patharpratima is very frequently inundated with the tidal water. During the low tide period when the tidal water recedes, most of the vegetated mangrove forest floor is exposed to air. The resulting dynamic condition favoured the most suitable ecological niche for the growth and spread of diverse group of mangrove species in the Patharpratima and Namkhana block.

Soil :-The deltaic alluviums of the region are transported by the rivers which are flowing from the Himalaya and Chhotanagpur plateau region to this area and finally mixed with tidal sediments of the Sundarban unit. The sediments which are carried by tidal waves play important role for the formation of Sundarban alluvial soil. Sand, silt, clay and organic matter collectively form the soil of Sundarban. The soil is composed of 5% sand 90% silt and 5% clay.

Problem of soil salinity: -

Soil salinity is one of the measure problems for the development of agriculture in the deltaic island and plains of Hugly-Sptamukhi estuarine deltaic complex. Patharpratima block consist of thirteen islands criss crossed by several rivers and its southern part facing the Bay of Bengal. Tidal water affects the salinity of soil due to tidal inflow. Embankment breaching causes saline water incursion into agricultural land. For example during Aila cyclone in 2009 many villages of Patharpratima block (Maheshpur, Sikarpur, Indraprastha, Ramganga, DakshinKashi Nagar, Achintanagar, PurbaSripatinagar, Sitampur, Govindopurabad, BrojoBallavpur, Buraburir tot, Uttar surendraganj) affected by high salinity in soil. On the other hand in Sagar block Shibpur, Chemaguri, Beguakhali, Bamankhali, Sumatinagar and Dhablat villages agricultural land highly affected by saline water. Some villages of Kakdwip and Namkhana block also affected by high salinity. At Beguakhali. sample collected from different places and soil content amount was more than 5000ppm (Ppm=1gm in 10 lac gram). At Dhablat village soil salinity was more than 6000ppm. The ph value of soil ranges between 6.0 - 8.5. Before Aila cyclone the amount of soil salinity was comparatively lesser. During the pre- monsoon period soil salinity becomes very high and at the time of rainy season due to heavy rainfall amount of soil salinity decreases due to the erosion of the top soil and downward movement of salt in the form of solution. The amount of soil salinity become so high that three consecutive years after Aila cyclone cultivation was almost impossible in maximum villages of the all the block of the Sundarban.

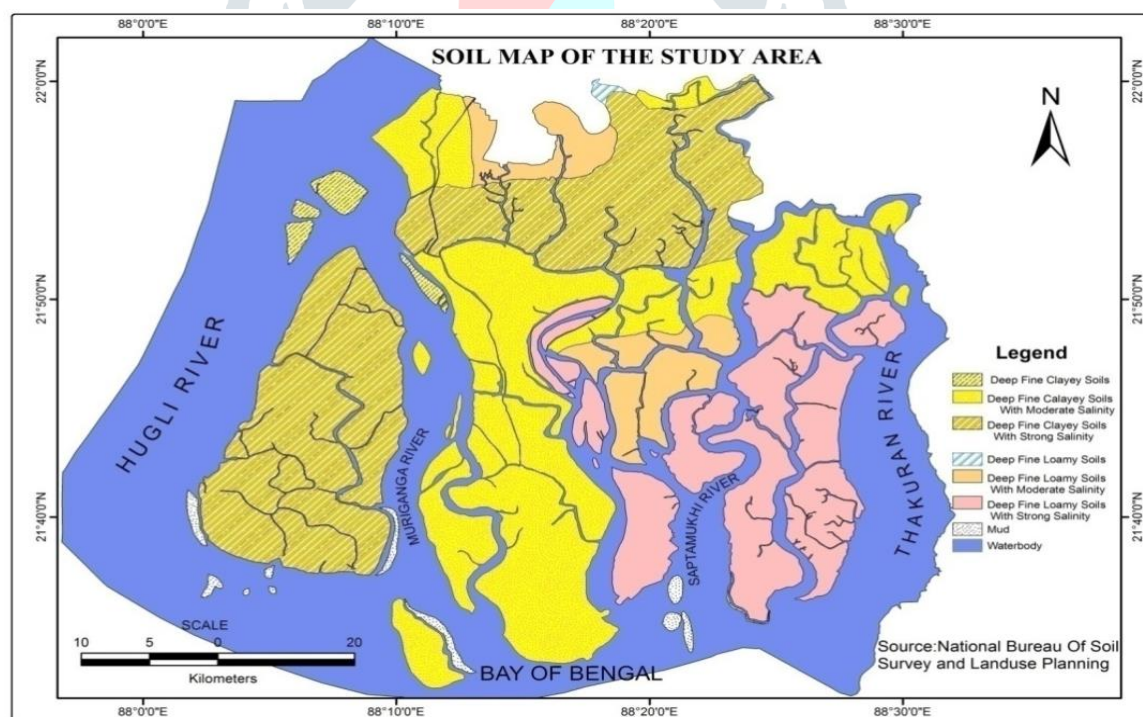


Figure-3; Soil Map of the study area.

Estuarine Environment

Hugli Estuary:-

On the basis of salt water intrusion and diverse tidal change within different sections of the channel the Hugli river can be subdivided into different estuary reaches. Six major regions have been demarcated in

the Hugli estuary. These regions are River section (above Hugli pt.), Estuary head (from Hugli pt. To Diamond Harbour), Upper reaches (Diamond Harbour to Haldia port), Middle reaches (Haldia port to Kaukhali), Lower reaches (Kaukhali to Lower Long Sand) and estuary mouth (extends up to sand head). Due to the presence of many islands in Hugli river it has been divided into many channels (Haldia channel, Rangafalla channel, Gabtala channel and Hugli main channel). Sagar Island is the largest island in Hugli river. In case of Sagar Island estuarine flood plain, tidal flat, marshy land, tidal creek, island margin or estuary bank and the coastal section are the major sub-environmental parameters. Jambu and Chuksar Island are open to sea environment. Island configuration is constantly changing in Hugli estuary. Islands of the inland section of Hugli estuary for example Ghoramara, Nayachar, Bedford, Sikarpur, Kumarmari lying beyond the influence of wind generated waves represent rather sheltered environment. Tidal flat shoals of sand, banks and mud are significant in this section. These islands are gradually eroding its bank. Tidal current is the major agent of bank erosion here. Loha Chara Island already eroded by tidal current.

Mean tidal range at the head of the estuary is 5.8 metre. It decreases gradually upward portion. The width of the estuary also decreases upward in order to balance the increase tidal range with its increase velocity. The estuary is 50 km wide at its mouth, 32 km wide at south Sagar, 12 km wide at Haldia and 5 km wide at Diamond Harbour. The trumpet shaped Hugli estuary and its macro-tidal setting created a zone of environment for erosion and deposition. Till now these are taking place actively.

Estuarine characters of the Hugli River :-

At present tidal section of the Hugli river extends up to 300 km from its mouth to its upstream (From Sagar Island to Nabadwip). The off shore bathymetry from Sagar south to Sand head is strongly influenced by Hugli water flow and sediment discharge in the freshet period. Tidal water of the Bay of Bengal dominates over the shallow offshore portions and the estuarine portions of the Hugli river in dry season. The water flow characters of the Hugli river shows that the head of the water flow is almost nil till the month of June. It reaches a peak in September and again falls into a minimum flow in December.

As the width of the estuary decreasing upstream it caused the concentration tidal energy into the channel section. Finally the tidal range at the middle part of the estuary becomes very high. The tidal range at the middle part of the estuary 5.5 metre at Kolkata, at Diamond Harbour it is 6 metre and at Garden Reach it is 5.2 metre. It comes down to only 1 metre. At 60 km up stream of Kolkata. Tidal energy is very high at the middle part of the estuary causes the breaching of embankment. We can see the reversal direction of movement of salt water and fresh water flow along the Hugli river. It is probably due to the bend of the land margin at the estuary bank (Sengupta et al (1989) estimated the spatial and seasonal variations of water salinity in the Hugli estuary. As the river bed is becoming shallower the tide keeps the water well mixed from surface to bottom portion of the river. As fresh water dominates over the river Hugli in the peak Monsoon period salted water hardly reach beyond Haldia at this time.

On the basis of salinity range, sediment distribution, topographic factor and volume of water involved in the Hugli estuary it can be classified into following categories : a) Estuary head b) Upper reaches c) Middle reaches d) Lower reaches and e) Estuary mouth.

Estuary Head :-

This is the area where fresh water enters the estuary. This portion of Hugli River dominated by river currents. Very little amount of salt penetrates in this zone. In this portion water salinity is low. Sediments are finer in nature. Sediment movement takes place in this sectioning the downstream.

Upper Reaches :-

This is the place of salt water and fresh water mixing place. This portion extends from Diamond Harbour to Haldia. Here highest tidal range recorded near Diamond Harbour (6 mt.). Mud deposition can be seen in this section. Naya char and Balari bar have developed in this section. Here salinity ranges from 2.1/00 to 9.1/00.

Middle Reaches :-

In this section of Hugli estuary tidal flat, islands, linear sand bar, deeper channel ,shoal can be seen. It extends from Haldia to Kaukhali. Here river Hugli divided into three channels such as Hugli, Gabtala and Muriganga or Baratarariver. Salinity ranges from 10.5 to 14.7 /00 . Tidal range at Gangrais 5.5 mt.

Lower Reaches :-

Here the speed of the current is very faster because of the width of the channel. The channel width is almost 50 km. In the channel bank, channel floor and at the margin of the islands sand deposits are predominates. This section of the Hugli estuary is open to marine influence. During high tide salt water enters the Hugli river. Deltaic islands like Sagar Island, Chuksar, Jambu are dominated by sand flat, sea beach, sand dune and tidal flats. Salinity ranges from 15.5 to 30 /00. Tidal range varies from 5.2 to 5.5 mt. The lower reaches of Hugli estuary extends from Kaukhali or Gabtala Point. Lower Long Sand (33 km downstream to Kaukhalipoint).

Estuary mouth:-

This portion of the Bay of Bengal strongly controls the tide and salinity of this area. Strong tidal current have a significant role for the formation of irregular bathymetry of in this area.

Saptamukhi Estuary:-

The Saptamukhi river is flowing along North and South 24 Parganas. The northern portion of this river is at Nischindipur. Jhikrakhal, Banstalakhall and finally Ghughudanga khal collectively give birth to river Saptamukhi. In its channel bed a number of shoal feature developed. One such big shoal operates the river from Ghughudanga bill creek. From north to south the Banstala–Ghughudanga Gang Saptamukhi west gully formed continuous arm. At the mouth of this estuary Lothian Island Reserve forest is located. The major branches of the west are Kalnaginikhal, Ghughudanga Gang, Patiboniariver, Edward creek,Chandanpirikhal and Bagkhali River around the Fresergaunge Island.

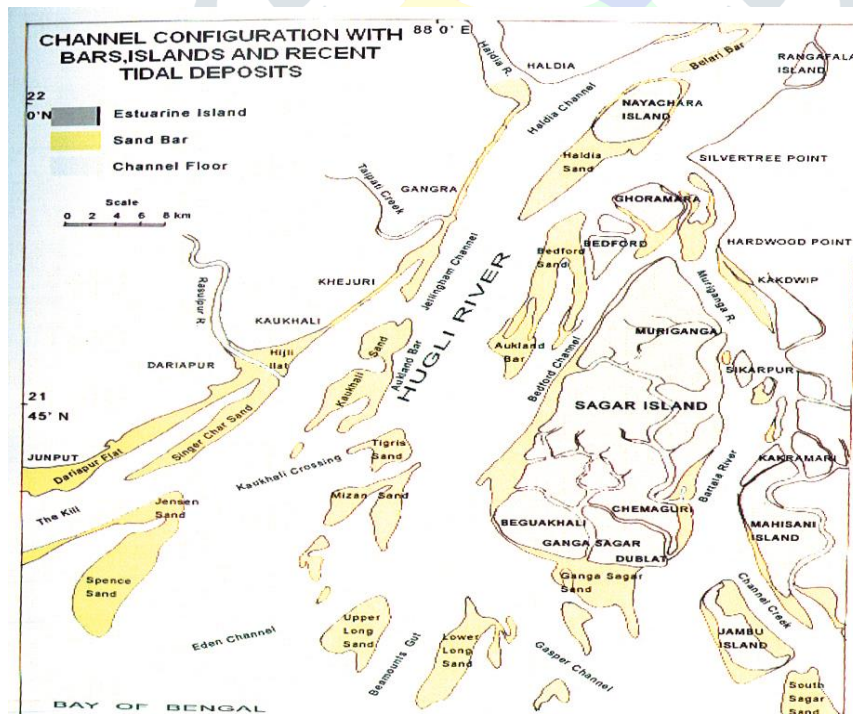


Figure -4; Coastal geomorphology and environment.

Source: - Paul A.K. Coastal geomorphology and environment page– 94.

Actually Saptamukhi River is flowing 10 to 12 km eastward from the River Hugli. There are seven re entry points of tidal channels along the lower course of Saptamukhi. Three major shoals are formed into the islands of mangrove swamp. Dia group of islands, Prentice and Lothian Islands are extended from North to South. Actually Saptamukhi tidal pass is divided into two separate channels on both sides of Lothian Island. The maximum depth of the channel is 11 metre on the western margin of Lothian Island. The western bank margin under cutting process by tidal force is very active. Linear shoals are growing sea ward to the south of Lothian Island. Surface accretion of silts is rapid at the margins between two islands. Concave banks are under cut cliffed by tidal current and wave dash activity at the mouth. The salinity of water varies from 13.7 to 22.4 ppt. At present salinity amount has increased than earlier.

Thakuran Eestuary:-

The Thakuran or Jamira river actually originated from the branch river vidyadhari. River Piyali made a loop named Kultala gang. From this gang Thakuran river originated. Thakuran River is very wide near sea. The major branches of this river are Kadar khalikhal, Damdama khal, the Moni River, the Pakchora, the Pakirali and Ross creek. With Thakuran River there are many link channels on the eastern and western side near the sea face. The river bank is protected by earthen embankment from tidal action. Both younger and older mud flats have developed on both sides of the channel under different inundation level of tide water flow. Along the bank margin mangrove plants developed. Along its course meanders developed.

Shoals, bars and islands emerged on the beds of Thakuran River near Raidighi. Mangrove swamps and mud flats can be seen. The premature flood plain banks are colonized by mangroves. It is liable to be flooded during high tides near sea face. The eastern flood plain bank is divided into many large islands by the dissection of tidal creeks. In its upper and middle course the depth of the river bed is only 1 to 3 metre. But its depth increased up to 16 metre at the sea face near Kalas Island. The rate of siltation is very high in this river. The salinity of the water varies from 16.6 ppt to 26.9 ppt.

Major Findings:

The Sundarban Islands remains a subside delta with vertical up building process. The Islands height varies to 2.6 to 5 mtrs. The Hugly, Matla, Esturine experiences higher rate of fresh water discharge. Both fresh water Swamps and brackish Swamps are distributed over the areas of inner estuaries and low alluvial planes. Coastal process with tides, waves, current, and work of rivers are responsible for development of this region. This region is surrounded by rivers, creeks and rivulets. The southern part of this region the delta building process is till now very active. Regular tidal inflow and outflow occurs. Embankment breaching is very common along all the study area. We can find that there is very diversity among the plant and animal species. Hot and humid climate prevails in this area. The soil is very saline in nature, that's why agricultural activities are interrupted here. Due to high salinity in soil and in river and sea water mangrove plants face problems to survive.

Conclusion:

The increased population in the low lying coastal plains of the West Bengal and direct impact of human activities, natural delta building process as well as coastal ecosystem are influenced. Land reclamation by mangrove degradation for agricultural purpose, disruption of the natural flow of the rivers for the construction of embankment, huge resource exploitation from the forest, rivers and estuaries have an adverse impact on the environment. At present global warming with sea level rise, increase salinity in river and sea water, coastal erosion, shoreline shift, recreational activities and many other factors make his area most hazards prone and vulnerable for the existence of coastal community.

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