

Environmental Appraisal of an Eroded Island, the Ghoramara: Hugli Estuary, West Bengal.

Debasmrity Mukherjee

Department of Geography, Asutosh College, Kolkata, West Bengal, India
Corresponding Author: Debasmrity Mukherjee

Abstract: Ghoramara island is located at 150km South of Kolkata in the Sundarban delta region. The area is covered by island in the Bay of Bengal around 4.8sq. km and the total shoreline is of 8.5 km. Once this island was a part of Sagar Island, that got detached from Sagar in 1904. Presently, this island got attention due to severe erosion and reduction in size. This has rendered thousands of people homeless and become environmental refugees. The sparsely populated island is suffering from coastal erosion mainly. The causes of erosion are so many. Natural and Anthropogenic causes leads to total aerial reduction of the island. In the present study, it is an attempt to make the assessment of erosion and accretion process through time series analysis and GIS technique. Multi resolution and Multi temporal data have been used to understand the landuse and erosion pattern of the island of past decades (1980-2017). The rate of changes in shoreline position have been estimated using statistical regression and egression co-efficient method. Land use – Land cover map has been prepared. A study of remedial measure to protect the island using a engineering technology is reported in this paper.

Keywords: Bay of Bengal, Environmental refugee, Regression coefficient, Shoreline change rate

Date of Submission: 25-03-2019

Date of acceptance: 09-04-2019

I. INTRODUCTION

The Hugli estuary geomorphologically, hydro-logically is very much dynamic in character, Sundarban delta was former a part of both India and Bangladesh. Major part of these deltaic systems is found in Bangladesh and a smaller part is found in India. The Hugli estuary is funnel shaped in nature, and terrestrial marine factor has produced sensitive ecosystem. The shoreline interface between land and sea is changing since few decades. Long term – short term changes of shoreline caused by hydro dynamic behavior. The part of shoreline changes is one of the major concerned issues of coastal scientist, engineer and geomorphologists.

Ghoramara island is located in the North of Sagar island, which is one of the important coastal geomorphologic features at the northern coast of Bay of Bengal. Sagar is the largest island of Sundarban and it is situated at the mouth of Hugli estuary and divide it into two channels ---- Western channel is Hugli and Eastern is Muri-ganga. Presently the sensitive deltaic system is gradually getting degraded may be due to global environmental change and anthropogenic activities. Ghoramara and Sagar were used to be a single island till 1903, but in 1904 it got separated from Sagar and stabilized as a separate island. The island is extended between 21 89' 50"N – 21 92' 62" and 88 11' 75"E = 88 14' 25"E and covers an area of 4.8 sq.km. The survey of India, Toposheet NO 79 C/2(1:50,000) corresponding the Latitude and Longitude extension. The major villages of this island include Khasimara, Baishnabpara, Baghpara, Raipara, Mandirtala, Chunpuri and Khasimara char. Khasimara, Laxmi Narayanpur and Khasimara char have already been lost. The population of the island was, ca. 5000(census report 1991), but this number has been decreasing rapidly. The major occupation of the inhabitants is agriculture and fishing. The island experiences a tropical warm and humid climate and prone to south – west monsoonal rainfall. Due to the position of Hugli estuary, it experiences semi – diurnal tide and flood. Flood – tide appears short duration for 3 – 4 hours and ebb – tide remains for more than showers, so the island experience the stronger flood tide for shorten duration.

II. PROBLEM OF THE STUDY AREA

The island is under sever threat of erosion in the North - West, while it is marginally growing through accretion in the South – West. The rate of erosion is much higher than the accretion. The rise of sea level is acted as natural process for erosion and global warming treated another important factor for the erosion. The island has already lost 75% of its land area during the past 30 years. The inhabitants have already lost the major villages----Baishnabpara, Lohachara, Khasimara and Khasinara char. The people who lost their home due to sea

level rise, erosion were moved to Kakdwip, Sagar island and where these uprooted people became environmental refugees facing identity crisis.

Environmental degradation due to natural and anthropogenic activities, erosion and accretion are the major responsible issues for the permanent loss of habitants. This problem has a remarkable sociological impact on the inhabitants of the island, thus, the question of stability occupies the major role.

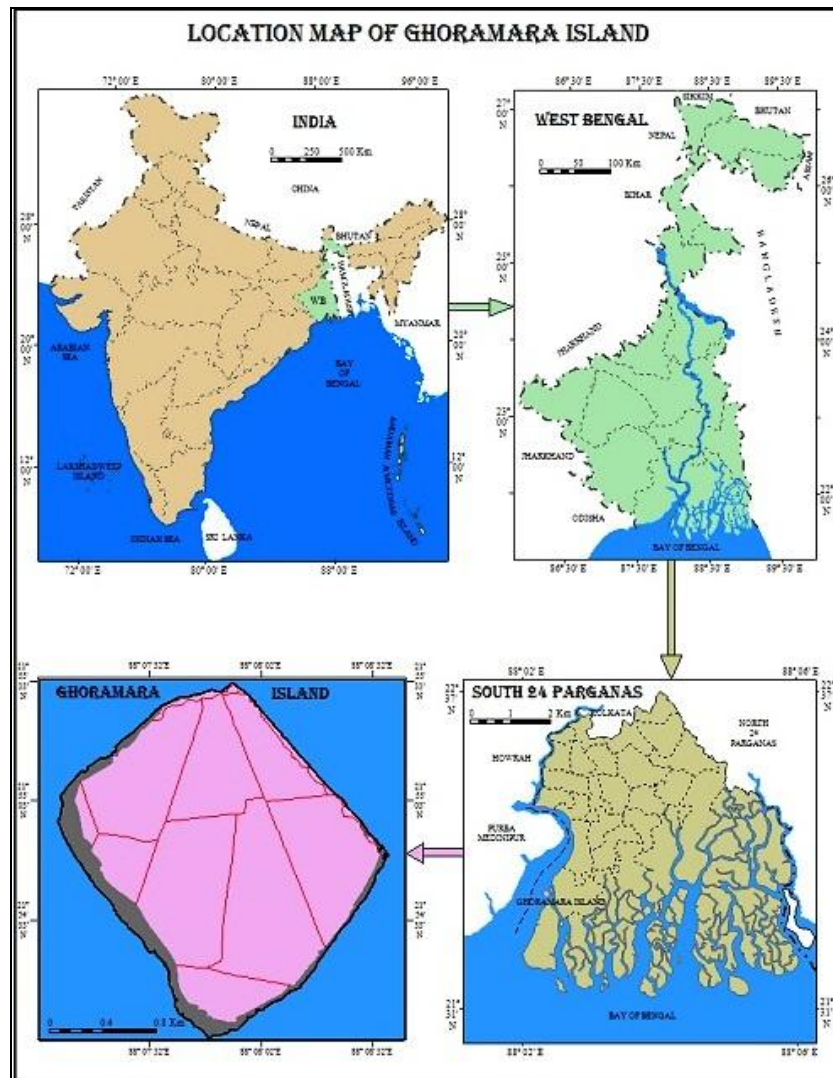


fig.1

III. OBJECTIVES OF THE STUDY

The objectives of this paper are as follows :-

- 1.To evaluate the impacts of erosion on physical environment, economic and social environment.
2. To assess the status of the erosion and deposition through time series analysis.
- 3.structural and nonstructural measures to combat the hazards.
- 4.To emphasize people's perception of the study area in drawing up effective management plan for the island

IV. METHODOLOGY

Methodology incorporate Pre-field, field and post field Study.Prefield includes literature survey, studying old maps, topographical sheet(79C/2) and downloading recent satellite image IRS-1D (LISS-III) image of the area etc. The field study involves direct field measurement and observation of environmental problems, GPS survey, questionnaire survey. Post Field Study involves combining and correlating all the measurements and observations of the field study. Preparation of figures and diagrams and interpretation .

V. PROBABLE CAUSES OF EVOLUTION OF GHORAMARA ISLAND

From literature review and field observation helped to identify several factors behind the causes of evolution of Ghoramara as a separate entity in Hugli Estuary. The reasons are-

1. A continuous widening of the Baratala branch of the estuary
2. The destructive action of a tropical cyclone is mostly felt on the right of its track (northern hemisphere) and shore that face perpendicularly.
3. Mangrove clearing project and deforestation at the British colonial period may be another cause of the evolution of the Ghoramara island as a separate entity from Sagar island.

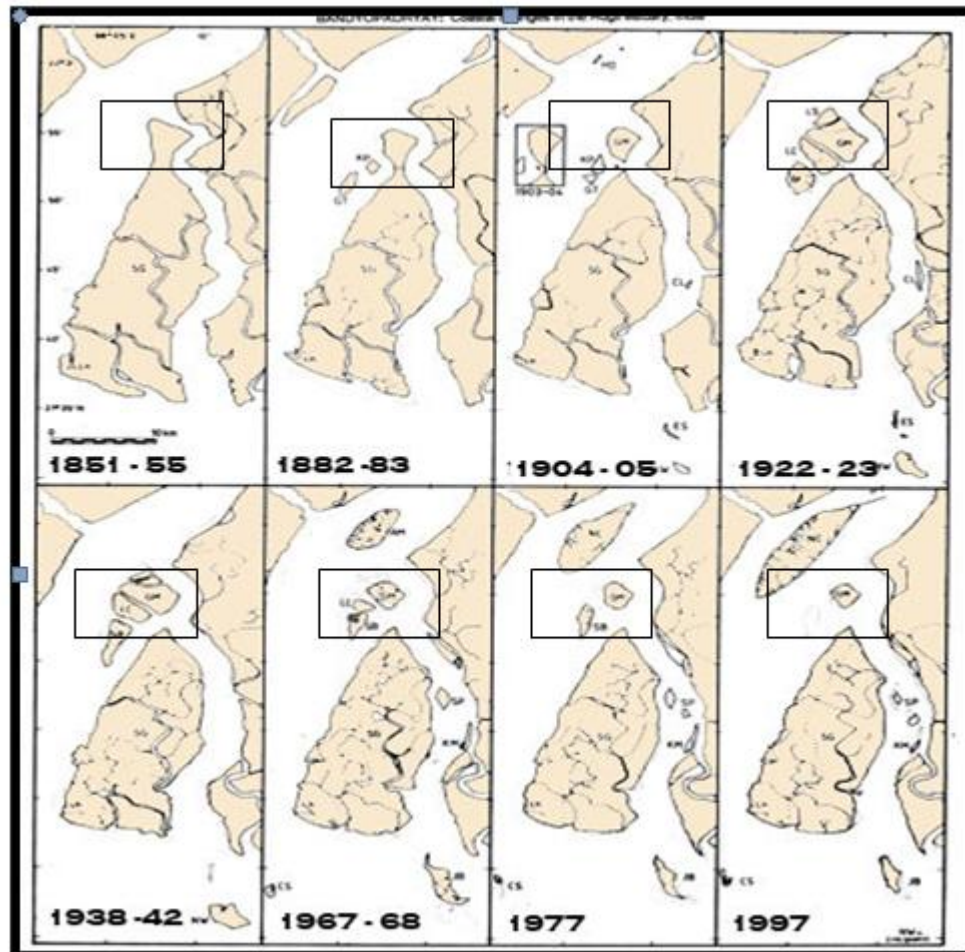


Fig.2 Source: Evolution of Sagar Island: Landforms and Environmental Management. Sunando Bandyopadhyay

VI. CHANGES IN THE GHORAMARA ISLAND

According to local resident, the word Ghoramara means “where the horse was killed”. Previously, it was known as “mud point”. Historically, it is known that, British cleared the forest of mud point and made residents, after building a fort and the light house, they wanted to convey the message to their ships loaded with valuables and just in order to save them from the hands of pirates. The word Ghoramara first named after the accident took place on the island by killing the officer Herrington.

This island is very much prone to south west monsoonal rainfall occurring in May to September and during November to December by North East monsoon. Due to its location is Hooghly estuary I experience semidiurnal tide and ebb tide remains for 8 to 9 hrs. This island once used to be a part of Sagar island but from 1851 onwards it got detached and appeared as separate island in 1903 – 1904 (after Bandyopadhyay, S. 1997: coastal erosion and its management in Sagar island, South 24 parganas, West Bengal: Indian journal of Art Science, Vol. 24, NOs 3 – 4, p. 51 – 69, 1997).

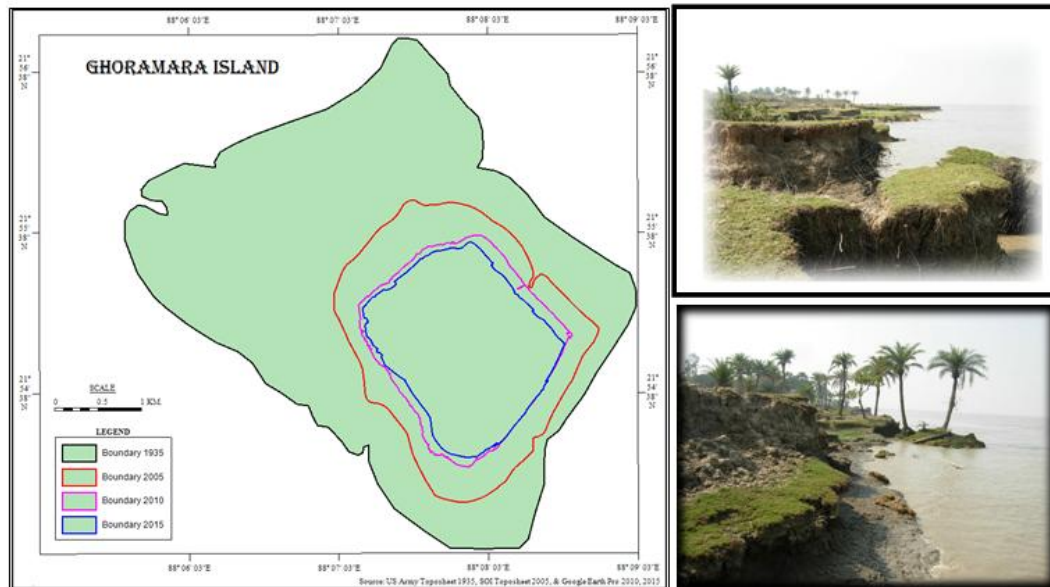


fig.3

A time series analysis over 80 years has been performed on the basis of satellite image and survey of India topographical sheets and US Army maps along with Google Image

Table no.1

Year	Island Area	Area in sq km	
		Erosion	Accretion
1935	18.59	0	0
2005	6.63	0.33	0
2010	3.98	0.21	0.01
2015	3.45	0.29	0.013

First high tide line was demarcated on the US Army map(1935) then SOI toposheet was digitized to get the second shoreline. The changes of shoreline(2010,2015) in different year were obtained from the down loaded satellite images of different dates and different years. The area of the island was measured from the traditional method of plain meter and graphical sheet. The actual loss of land on the North western part and the gain of the land in the South Eastern parts over 80 years were calculated from the shore line interpolation map.(fig.3).The rate of erosion is 0.20 km/ yr. Extensive erosion on the western part is the result of ships run very close to the western region and Southern part of the island ship cause the active erosion and breaking the island at different part. climatic condition, tidal upsurge accelerate the rate of erosion, and considerable deposition occurs on the South Eastern part which appears lateral shifts of the island.

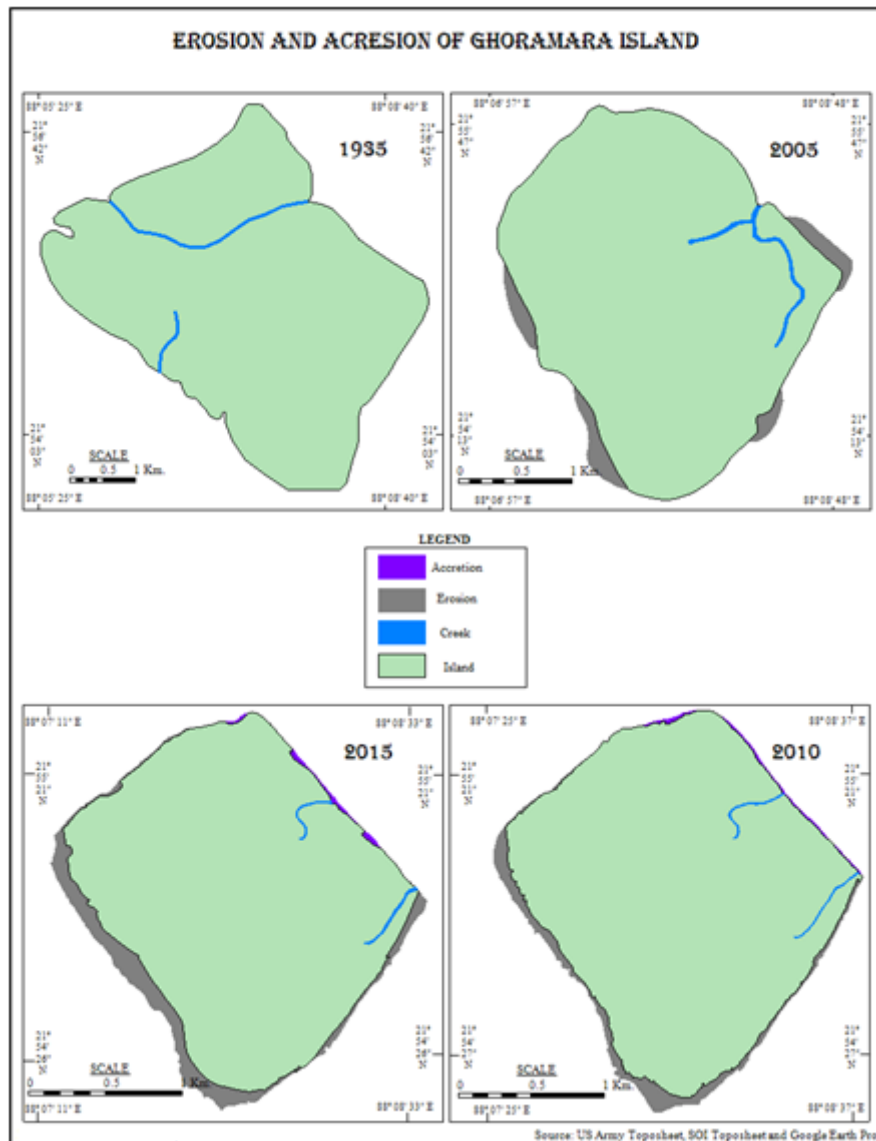


Fig.4

The diagram (fig.4) showing the Erosion and accretion part of Ghoramara throughout several years. Corresponding datasheet (table.1)ent the erosion and vulnerability .Ghoramara experiences tropical cyclone, storm surge, high waves generated by ships and its unconsolidated bank materials are the major causes behind the erosion. Due to very dynamic and complex hydro-geomorphologic character of Hugli estuary, the island is very much prone erosion. Rhombic shaped island, Ghoramara covers the area 8.18 sq.km in 1967 – 68. Mudflats is at the northern, eastern and western parts of the islands were observed. The mudflat of the western part was wider then the eastern part. Mudflat and sandflats are basically indicating an inter tidal zone. At low tide it is possible to see the mudflats that present Ghoramara’s eroded past. Conifers, Bamboo, palms plantations were covered in the island. These features was observed from the topographical sheet in 1968.

From the field visit and date from satellite images clearly showing that western mudflat was eroded in 2005. High and low water lines, vegetation pattern did not change. Submerged bar emerged between Ghoramara and Kakdwip island in the Baratala river but in 2005, vegetation cover reduced a trend of movement of islands towards South east was observed. Erosion was much more pronounced on the entire bank of North west After 2009, the storm effect of Aila, destructive wind direction severally affected the island having the impact an water, agricultural production and erosion at faster rate. From 1999-2010, the Ghoramara island was gradually eroded with alarming rate. In between 2006-2010 some depositional land were also formed in the Northern and Southern direction of island.

An island called Nayachar evolved to the North west of Ghoramara showed a continuous growth during the same period. It is said that Nayachar island offers a natural shield of protection of the North western side of Ghoramara from the direct ebb tidal force of the Haldi river. A protecting wall, constructed by Kolkata

Port Trust in 1990 (Sanyal, etal1995), This wall have been constructed to divert the main flow in the main eastern channel of the river Hooghly towards the western channel of river Hooghly . The growth of Nayachar itself may be attributed to the protecting wall. The southerly flowing river Hooghly has a transverse slope towards the east due to sediment deposition on the western bank as observed from 1999 satellite imagery, which indicated the main flow dose not work to enrich Haldia port rather it goes towards eastern channel of river Hugli, that is why a gradual shifts of the river Hugli towards the East indicated the main flow touches the North Eastern shoreline of island.

VII. SOCIO-ECONOMIC CONDITION OF ISLANDERS

To analyse the overall scenerio of Island aquestionnaire survey was conducted.From direct field observation these information was gathered for socio economic status.The issues are-

- ❑ Demographic Characteristics: 43% people are schedule Cast, Muslims are 6.6% and rest are general.
- ❑ Educational Status: Maximum level of standard education here is up to the Secondary level.. Literacy rate is higher for females than males.
- ❑ Occupational Structure: people engage in agriculture ,fishing, tailoring , but maximum are unemployed due to lose of agricultural land
- ❑ Changes in occupation in marginal areas: Most of the people migrated from Midnapore, Diamond Harbor Kakkdwip so they changed their occupation at the marginal areas.

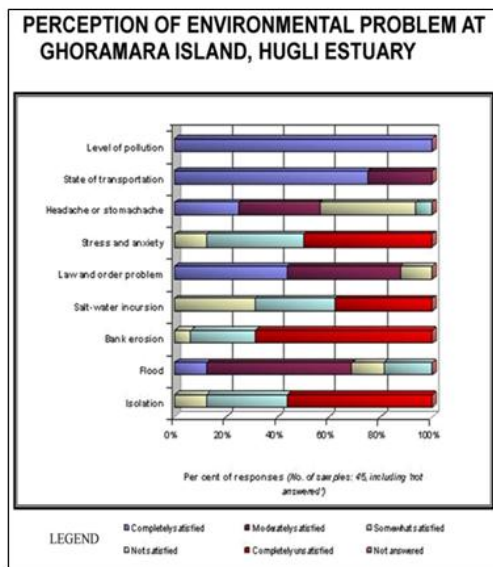


fig.5.

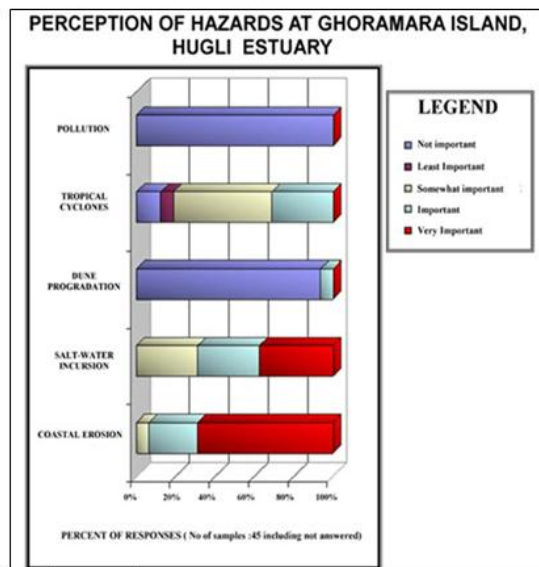


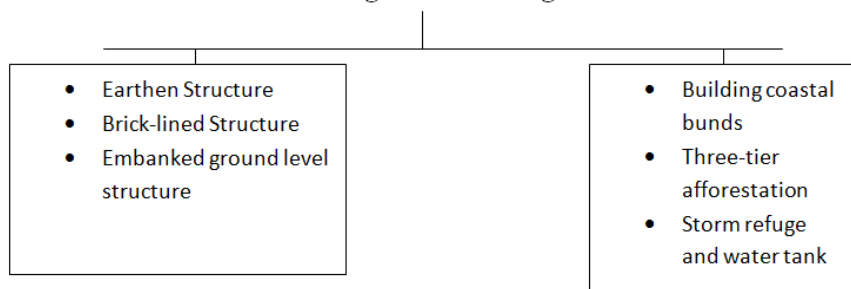
fig.6.

From these cartographic representation it is clear that Salt water intrusion and tropical cyclones are the main environmental hazard of the Island.

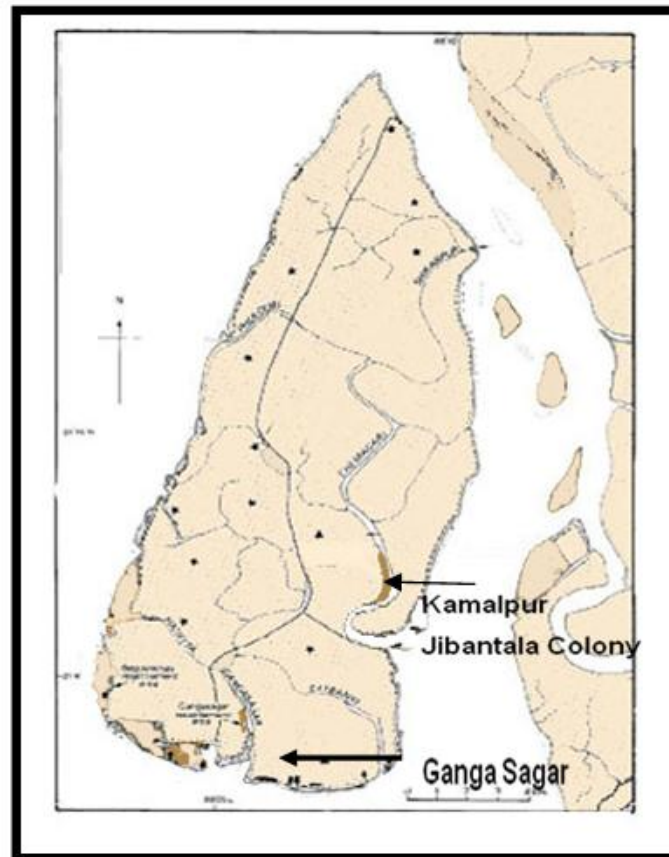
VIII. MANAGEMENT

In order to combat the situation and stress local people along with NGO's were built some structure to protect bank erosion.The strategies are as follows-

Management Strategies



The most alarming problem is identity crisis of the environmental refugee who has become homeless in due course of time. The victims of erosion permanently lost their habitat due to natural and anthropogenic activities. Initially, the island having 10,000 population, more than 7000 people became homeless due to the erosion of Khasimara, Khasimara char, Baishnabpara, Lohachara. This environmental refugees were shifted to resettlement colony Phuldubi, in the year 1964. After that Kamalpur Jibantala re settlement colony started in 1972. During the questionnaire survey it was revealed that they had not got any kind of governmental help during the massacre. They are mainly



engaged in small household industry, fishing. Males are engaged in ferry service and females are engaged in stitching.

Earthen embankments were built to control the erosion. A bio engineering technique has been proposed to deal with a problematic situation but everything was in vain.

IX. CONCLUSION

Ghoramara island is special in character according to the coastal geomorphologists. The total study reveals that from 1968-2000, Ghoramara island lost 3 villages and the area gained was less than the erosion. The island system in river Hugli was stable when the availability of freshwater influence is high. But the

problem started when the imbalance in water budget followed by reduction of fresh water influence due to upliftment building of Farakka Barrage somewhere improve the influence of fresh water seasonally. The littoral material carried by tidal and ocean currents from off shore and accumulate during high tide, which lead to the shifting of island towards south east. Sea level rise also an important factor for erosion and submergence of the island. If the movement of island is taking place like this way, then the island will merge with the mainland of Sagar within 25 years. Government and other authorities should provide proper management for this issue. Erosion may be stopped and channel sedimentation may be eliminated if the depth of the channel can be maintained, the tidal frouce com not directly hit the bank of the island and erosion of the island may be stopped. Otherwise, erosion process on the North western port of the island if continues at the present rate then the North western port of the island will be vanished within next 50 years.

REFERENCES

- [1]. Biswas A., Jana A. and Sharma S.P., Delineation of groundwater potential zones using satellite remote sensing and geographic information system techniques: A case study from ganjam district, Orissa, Res. J. Recent Sci, 1(9),59– 66 (2012)
- [2]. Ghosh T., Bhandari G. and Hazra S., Assessment of landuse/landcover dynamics and shoreline changes of Sagar island through Remote sensing, 22nd Asian Conference on Remote sensing, Singapore, 2, 848–852 (2001)
- [3]. Gopinath G., Critical coastal issues of Sagar Island, east coast of India, Env. Monitor. Assest., 160, 555–561 (2010)
- [4]. Ghosh T., Bhandari G. and Hazra S., Application of a bio engineering technique to protect Ghoramara island (Bay of Bengal) from severe erosion, J. Coast. Cons., 9, 171–178 (2003)
- [5]. Maiti S. and Bhattacharya A.K., Shoreline change analysis and its application to prediction: a remote sensing and statistics based approach, Mar. Geol., 257, 11–23 (2009)
- [6]. Mallik T.K., Samsuddin M., Prakash T.N., Vasudevan V. and Machado T., Beach erosion and accretion—An example from Kerala, Southwest coast of India, Env. Geol. Water Sci., 10(2), 105–110 (1987)
- [7]. Mukherjee K.N., History of settlement in the Sundarbans, Indian J. Land. Sys. Ecol. Stud., 6, 1–19 (1983)
- [8]. Lee J.S. and Jurkevich I., Coastline detection and tracing in SAR images, IEEE Trans. Geo. Rem. Sen, 28(4), 662–668 (1990)
- [9]. Paul A.K., Textbook of Coastal geomorphology and environment: Sunderban coastal plain, Kanthi coastal plain and Subarnarekha Delta plain, ACB publications, Kolkata, 1–61 (2002)

IOSR Journal Of Humanities And Social Science (IOSR-JHSS) is UGC approved Journal with Sl. No. 5070, Journal no. 49323.

Debasmitry Mukherjee. "Environmental Appraisal of an Eroded Island, the Ghoramara: Hugli Estuary, West Bengal." IOSR Journal of Humanities and Social Science (IOSR-JHSS). vol. 24 no. 04, 2019, pp. 58-65