

Morphological Change Analysis of Exposed Ghoramara Island

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Abstract - Ghoramara Island, located in the north of the Sagar Island, is one of the important coastal geomorphological features at the northern portion of the Bay of Bengal. It is a very small island and well known to the oceanographers, geologists and coastal geomorphologists because of its complex dynamic morphological nature. The island is also vulnerable to the tidal effects. The present study has analyzed the erosional as well as the accretional changes in and around the Ghoramara Island using a series of multi-temporal satellite images namely IRS 1C 28/11/99, IRS 1C 27/03/2000, IRS 1D 19/02/2001, IRS P6 20/11/2005 and IRS P6 28/02/2008. The final output reveals that in very recent years, high rate of erosional activities taking place over the study area, due to which the island is gradually being reduced.

Key Words: Accretion, Coastal, Erosion, Geomorphology, Vulnerable

1. INTRODUCTION

The Hugly estuary is a highly dynamic coastal zone. It faces remarkable tidal and cyclonic activities throughout the year. Hence, it requires continuous monitoring and updating of tidal information. Recently, the techniques of remote sensing with its synoptic, repetitive and multispectral coverage helps to monitor the dynamic environment. The study area is located in West Bengal covering parts of South 24 Parganas districts. The latitudinal extent of the study area is from 21°53'30" North to 21°56'20" North and longitudinal extent of the study area is from 88°06'30" East to 88°08'30" East.

Several works have been done earlier on this context. An assessment has been made on landuse dynamics and shoreline changes of Sagar Island using remote sensing techniques [1]. An estimation has been done on the erosional action of the coast of Sagar Island [2]. A research has been performed on space and time related changes of land surface parameters in the Red river of the north basin [3]. Apart from these, an evaluation has been made on the coastal erosion due to wave dynamics operative in Sundarban delta [4]. Moreover, Landsat TM data has been

used in order to design coastal morphological mapping around the Gulf of Khambhat [5].

1.1 Objective

The main objective of the present study is to monitor the recent coastal morphological changes observed in and around the Ghoramara Island using satellite images of successive years [6]. The techniques of geoinformatics are used for the visual interpretation and understanding the recent morphological changes arising out for rapid disappearance of the Ghoramara Island from the every direction.

2. MATERIALS AND METHODS

The morphological condition of the estuary is overviewed from the satellite images covering the Ghoramara Island between the periods 1999 to 2008. The images considered for comparison are IRS 1C 28/11/99, IRS 1C 27/03/2000, IRS 1D 19/02/2001, IRS P6 20/11/2005 and IRS P6 28/02/2008. The following results have been derived through the analysis of the images-

- The overall health of the estuary was good in 1999.
- The Bedford group of Islands are remarkably reduced in size and some of them are totally disappeared.
- Advancement of Bedford channel with nearly complete erosion of Bedford Island is noticeable in 1999.
- Heavy erosional activity has been taken place around Ghoramara Island.

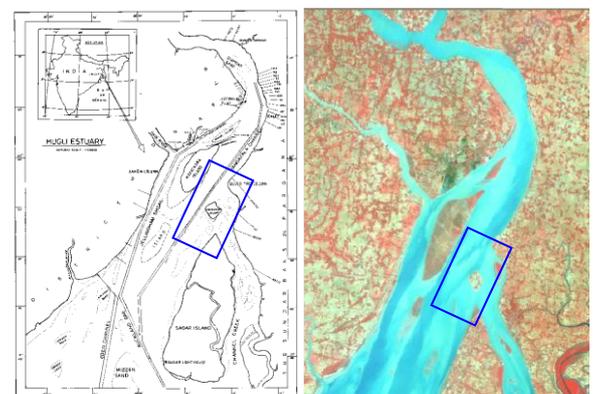


Fig -1: Location of the study area

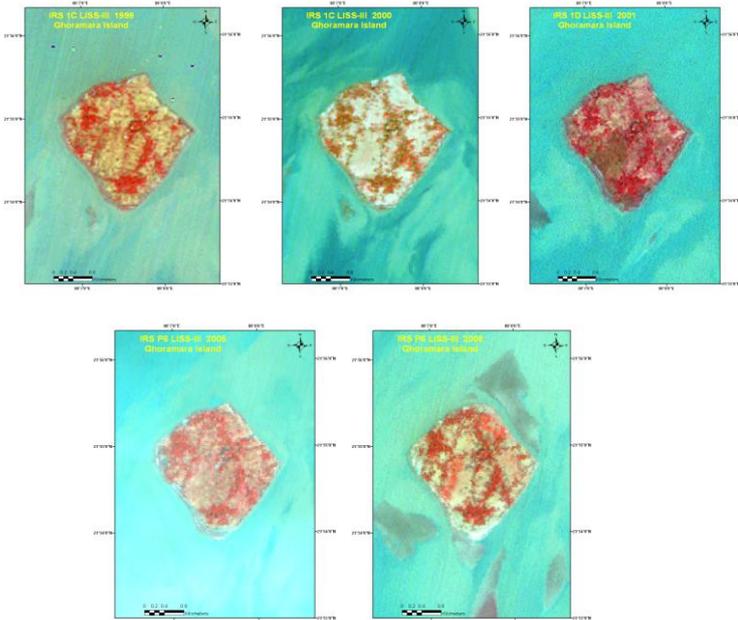


Fig -2: Multi-temporal data of the Study Area

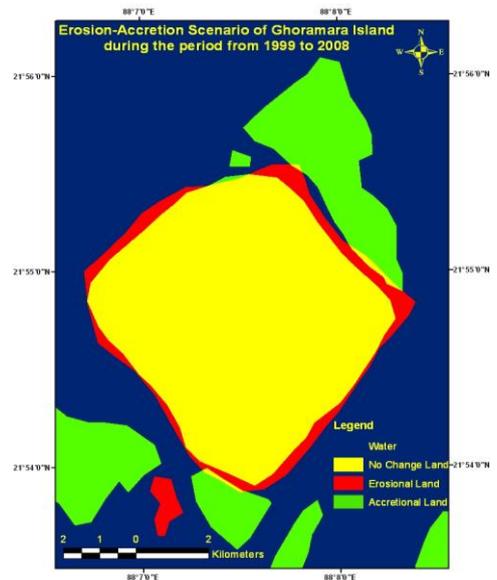


Fig -4: Overall erosion-accretion scenario of the study area during the full time-period

Table -1: Area of Ghoramara Island in Different Years

Year	Ghoramara Island Area(sq km)
1999	5.42
2000	5.15
2001	5.10
2005	4.64
2008	4.82

Table -2: Tidal Information synchronous with satellite passes

Serial Number	Date	Name of the satellite product with details	Time of pass	Tide in metre At Gangra Station
1.	28-Nov-1999	IRS 1C LISS-III	10.30 AM	2.5
2.	27-Mar-2000	IRS 1C LISS-III	10.30 AM	1.5
3.	19-Feb-2001	IRS 1D LISS-III	10.30 AM	3.2
4.	20-Nov-2005	IRS P6 LISS-III	10.30 AM	3.95
5.	28-Feb-2008	IRS P6 LISS-III	10.30 AM	2.93

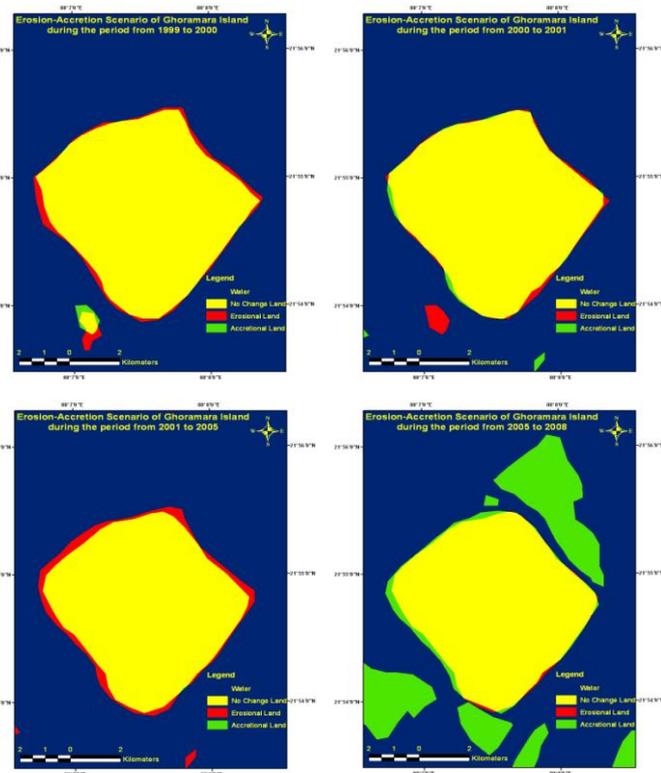


Fig -3: Erosion-Accretion scenario of Ghoramara Island during the different time-periods

Table -3: Erosion-Accretion area of Ghoramara Island during the different time-periods

Period	Ghoramara Island (Area in sq. km.)		
	Common Area	Area of Erosion	Area of Accretion
1999-2000	5.15	0.26	0.0006
2000-2001	5.05	0.11	0.0505
2001-2005	4.64	0.46	0.0010
2005-2008	4.61	0.03	0.2047
1999-2008	4.81	0.61	0.0088

3. RESULTS AND DISCUSSIONS

From 1999 to 2005 the Ghoramara Island was gradually eroded with an alarming rate. But after 2005 some depositional land are also formed in the northern and southern direction of Island. But, one thing should be kept in mind that during 2005 to 2008 the water level is decreased from 3.95m to 2.93 m. Hence, it may be considered that some of the extra land may also be found due tidal activity. It shows a very dynamic and complex hydro-geomorphologic character of Hugli Estuary region [7]. It appears that during post dredging scenario, in absence of any river regulative measure, the area around Ghoramara have undergone fast changes due to the imbalance created by the stressed flow and the system as a reaction developed resistive forces enabling the morphological changes occurring in those areas. The above interpretations, analyses and inferences are drawn on the basis of satellite data interpretation. Apart from detailed Numerical and Hydraulic Model studies, hydrological analyses with detailed hydrographic survey will be required for the formulation of the comprehensive river training scheme [8].

Table-1 shows the change of the entire study area from 1999 to 2008. In 1999 the area of the Ghoramara Island was almost 5.42 sq km which become 5.15 sq km in 2000. At that time-period the rate of erosion was faster than the later years. From 2000 to 2001 the erosional activity was comparatively lesser and only 0.05 sq km area was reduced from the total landmass. But, after 2001, again the rate of erosion was much higher and area of the island becomes 4.64 sq km in 2005. Lastly, the area was 4.82 sq km in 2008.

Table-2 reveals the tidal information synchronous with satellite passes throughout the time-period. These information for Ghoramara Island has been derived from

Gangra station which is the nearest tidal station of the island. In 2005 high tide was recorded 3.95 m. Hence, some land area may be invisible due to the submergence by tidal effect.

Table-3 depicts the relative comparison between the common area and also the area under erosion and deposition during the different successive time-spans. It is very much clear from the table that the overall area under deposition is only 0.0088 sq km in comparison to the 0.61 sq km of area under erosion. 4.81 sq km area was common during this period.

3. CONCLUSIONS

Ghoramara Island is a very special island according to the coastal morphological point of view. It was situated along with the islands of Korapara and Gabtala at the very beginning of the 20th century. Newly formed two Islands namely Lohachara and Bedford were developed instead of the Korapara and Gabtala Islands in 1922-23. At that time heavy depositional activities had been taken place in the area. After that, in 1967-68 Suparbhangra Island was created in the place of Bedford Island. In the recent years the depositional work was shifted towards the north-west of the Ghoramara Island. The Lohachara and Suparbhangra Islands were completely wiped out due to high rate of erosion. Infact in the study area, erosional activity is stronger than accretion. If this type of geomorphological activities will be continued, this Ghoramara Island may also be disappeared wholly or partially. It is a very significant evidence to determine the complex morphological and tidal nature of the area.

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