Long-term impacts of climate change in Indian Sundarbans: An automatic computation and geospatial approach

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INTRODUCTION

The global coastal region witnessed significant change due to the rising sea level and rapid developmental activities, the growing population along the coastal front regions leading to loss of property and ecosystem, therefore, proper monitoring of the dynamic changes along the coastline is essential for the coastal management and conservation

METHODOLOGY

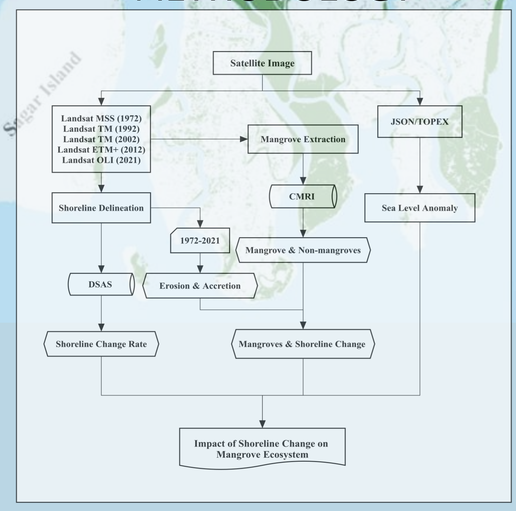

Figure 2 Schematic representation of methodology framework

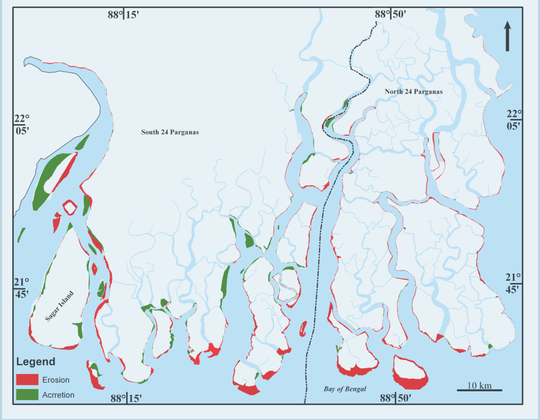

Figure 5 Map shows the erosional and accretional landforms developed by the shoreline change between 1972 and 2021

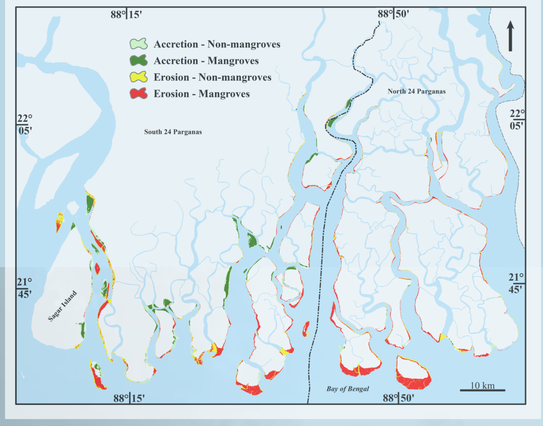

Figure 6 Map shows the erosional and accretional landforms in mangroves and non mangrove coasts.

Table 1 Statistics of erosional and accretional coast in different decade

Shoreline Change Rate		1972-1992	1992-2002	2002-2012	2012-2021
Island	High Erosion	-81.3	-120.24	-163.85	-489.82
	High Accretion	182.73	165.71	282.54	438.64
	Mean	-2.72	-0.4	0.7	-23.75
	SD	21.61	22.5	36.49	66.82
Mainland	High Erosion	-43.81	-78.37	-52.6	-27.5
	High Accretion	90.46	89.72	139.51	101.14
	Mean	0.17	-1.84	4.003	-0.25
	SD	9.61	8.82	15.66	9.75

Table 2 Table Shows area wise distribution of erosional and accretional landforms in mangrove and non mangrove coast between 1972 and 2021 (value in sq km)

		Mainland	Island	Total
Erosion	Mangrove coast	25.06	85.1	110.16
	Non-mangrove coast	37.61	49.36	86.97
	Total	62.67	134.46	197.13
Accretion	Mangrove coast	16.91	25.4	42.31
	Non-mangrove coast	15.41	56.42	71.83
	Total	32.32	81.82	114.14
Net Loss	Mangrove coast	-8.15	-59.7	-67.85
	Non-mangrove coast	-22.2	7.06	-15.14
	Total	-30.35	-52.64	-82.99

STUDY AREA

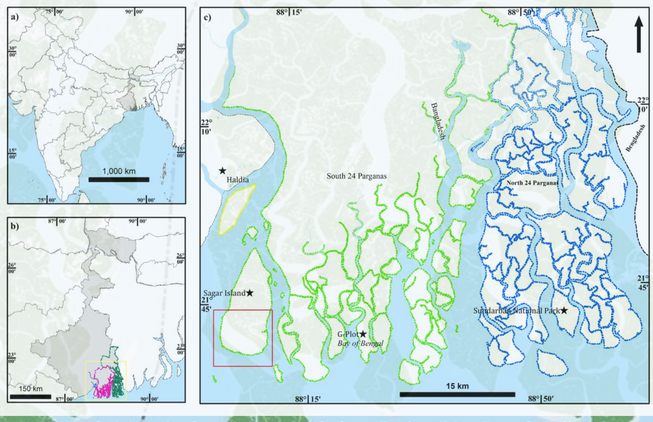

Figure 1 administrative boundary of Sundarbans Region (West Bengal, India). Green and Blue colour line indicates the coastline where the shoreline change analysis is performed

RESULTS

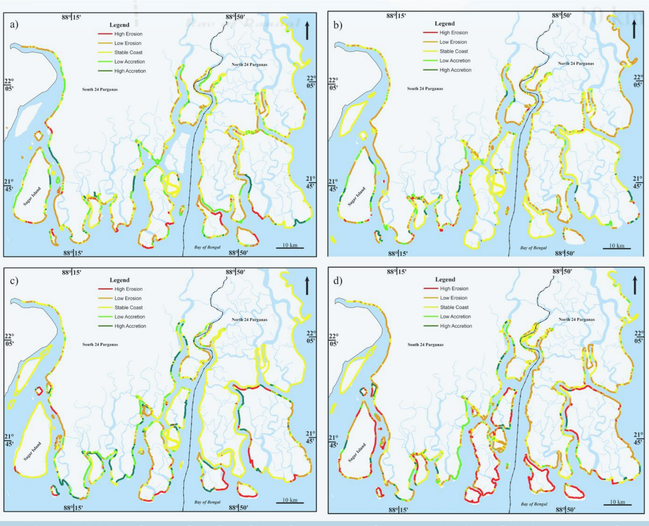

Figure 3 Map shows the shoreline change rate between 1972 and 2021 estimated using EPR statistical tool. a) Shoreline change rate between 1972 – 1992, b) Shoreline change rate between 1992 – 2002, c) Shoreline change rate between 2002 – 2012, and d) Shoreline change rate between 2012 – 2021.

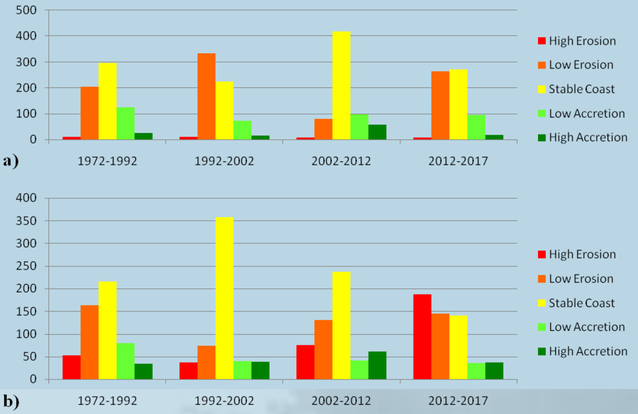

Figure 4 Graph shows the shoreline change rate between 1972 and 2021 estimated using EPR statistical tool. a) Island, b) Mainland

CONCLUSION

The historical shoreline change shows that erosion is more dominated in the study area during 1972 to 2021, around 83 sq km area is eroded during the 45 years of period. The highest rate of erosion is observed in the ocean front coasts. Bay of Bengal is funnel shaped bay and has the characteristics such as, shallow water with low lying flatten terrain, highest rate of sea level rise and sea surface temperature may be influenced in the erosion process

The average rate of shoreline between 1972 and 2021 is estimated at 0.64 m/y and -2.65 m/y in mainland and island coastlines respectively. Remote sensing data and technology proves its ability to monitor the dynamic change of the coastline with its reliable and cost effective approach.