DETECTION OF COASTAL GEOMORPHOLOGICAL CHANGES FOR EFFECTIVE COASTAL MANAGEMENT USING REMOTE SENSING & GIS

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ABSTRACT

The present study deals with the Geomorphological changes Detection study in Pulicat Lagoon. The study involves identifying the geomorphologic changes occurred due to the natural disasters and man made activities using 2008, 2010, 2013 satellite Images by adopting Remote Sensing Technologies and GIS tools. The study area is located in Nellore district of Andhra Pradesh, India located between longitude 80° 3′3″ to 80° 18′6″ and 13 °28′ 32″ to 13° 57′6″ latitude. The study area is covered under the Survey of India (SOI) toposheet no 66C/1,2,3,5,6 and 7 with scale 1:50000 and Multi-Spectral imageries from IRS-P6,LISS III,IV data of 2008, 2010 and 2013 Geocoded Satellite data are acquired as primary and secondary data for analysis. Visual Interpretation techniques are used to identify the Geomorphology classes from 2008, 2010 satellite imageries, ground truthing and post interpretation of the satellite image for preparation of 2013 Geomorphology map in this different classes like Creek, Flood Plain, Coastal Plain Moderate, Buried Pedi plain etc. are identified. These spatial data maps generate statistical values of geomorphological classes, from this data analysis was carried out to find out the changes in the Geomorphology classes of 2008 to 2010 and 2010 to 2013. These type of model studies are very useful to identify the coastal geomorphological changes, its impact on coastal environment and in preparing the action plans to protect the coastal environmental.

Keywords: Geomorphology, Coastal environment, Remote Sensing, GIS

1. INTRODUCTION

Major part of the study area is under Pulicat Lagoon. In Periplus of the Erythraean Sea written by anonymous mariner listed Podouke (Pulicat) as one of the three ports on the east coast of India in 1st century. Ptolomeys list of ports on this coast included Podouke emporion in 2nd century. Arabs who were expelled from mecca migrated to the shores of this lake in the 13th century. In 1515 a church was built and was dedicated to Nossa Senhora Dus Prazeres which is now in dilapidated condition. Dutch people drifted to this lagoon on the opposite side of the mouth of the lake as their ships got stuck on the shores and during the Dutch rule Pulicat was known by the name Pallaicatta. Protected by the Archaeological Survey of India (ASI), Pulicat today bears testimony to this fact with the Dutch Fort in ruins, dating back to 1609, a Dutch Church, Dutch Cemetery with 22 protected tombs (1631 to 1655) and a Dutch Cemetery with 76 tombs and mausoleums.

Many villages located around the lake periphery and on the islands opted fishing as their main occupation. With some truly brackish water and a few freshwater species the lake has rich fish diversity, mostly marine species. The lake is a nursery for several species of fish. One third of the settlements in the lake area are in Andhra Pradesh and the balance in Tamil Nadu. Approximately 6,000 fishermen in Andhra Pradesh and 6,370 fishermen in Tamil Nadu live on fulltime fishery in the lake. Economic benefits from the lagoon include seafood exports of white and Tiger prawns, jellyfish, finfish and live lagoon green crabs are also. A total of 168 fish species are reported till date. Endangered Green sea turtles are found on the beaches. Apart from prawns salt is also produced from the lagoon. Acknowledging the importance of protecting the diversified environment with in the lagoon, the present study aims at utilizing the advanced technology of Remote sensing and GIS for Geomorphological characteristics changes and its impact on environment.

2. DESCRIPTION OF STUDY AREA

Pulicat lagoon is the second largest brackish-water lagoon on the Coromandel Coast of southeastern India and spreads over an area of 460 sq km. The present study area is located in Nellore district of Andhra Pradesh. The spatial coordinates of location are lat 13 °28′ 32″ to 13° 57′6″, long 80° 3′3″ to 80° 18′6″. Vakadu, Chittamur, Doravarisatram, Sullurpet, Tada mandals are covered in the study area. The lagoon is separated from the adjoining Bay of Bengal by an inland spit called Sriharikota Island.

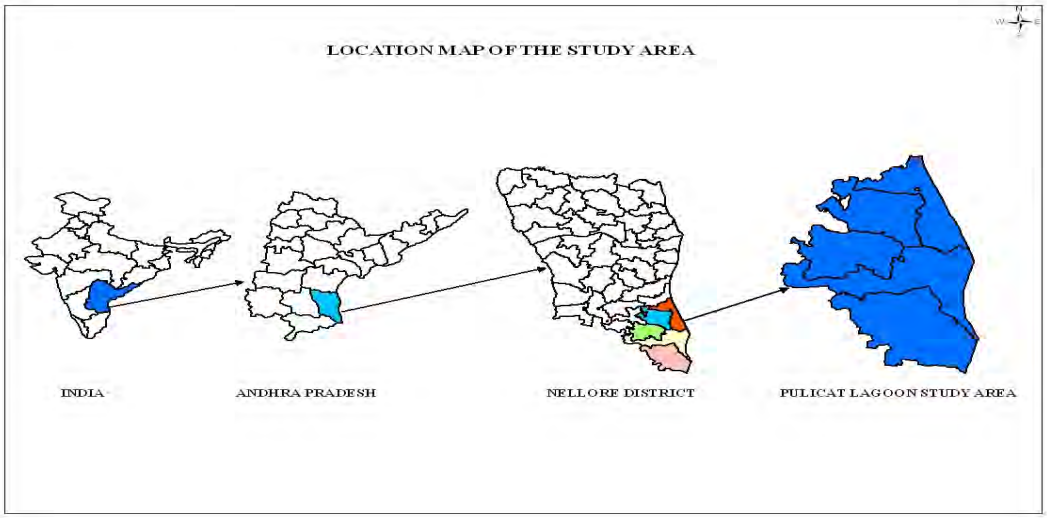

Figure 1: Location map of study area

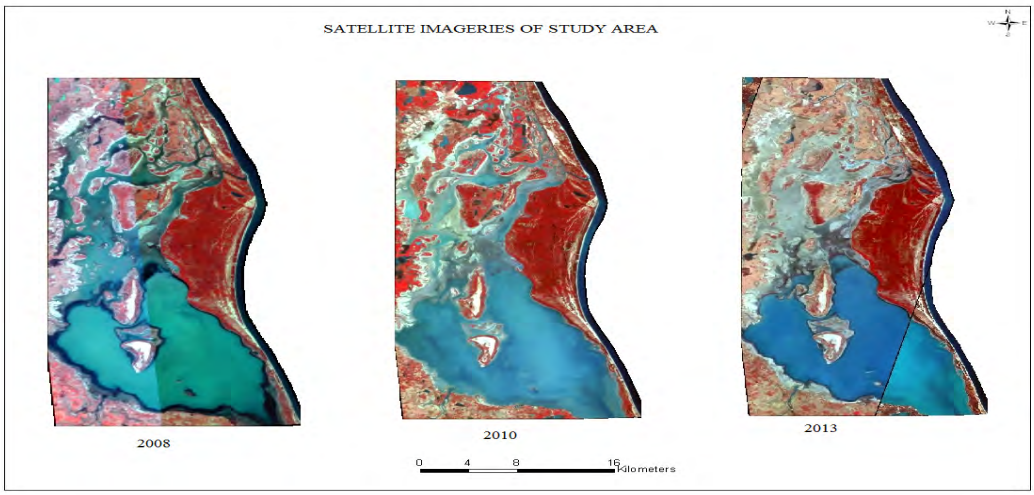

Figure 2: Satellite Images of study area

2.2 OBJECTIVES OF THE STUDY

1. Create spatial digital database consisting of Geomorphology of 2008, 2010 and 2013 using the Survey of India toposheet no 66C/1,2,3,5,6 and 7 with scale 1:50000 and Multi-Spectral imageries from IRS-P6, LISS III, IV Satellite data

2. To study the coastal Geomorphology changes in study area for effective management of coastal environment for future development.

3.METHODOLOGY

1. Source data like satellite data and SOI toposheets are collected. The satellite data of IRS-P6, LISS III, IV 2008, 2010 and 2013 years data was geometrically corrected and enhanced using SOI toposheets of 66C/1, 2, 3, 5, 6 and 7 with scale 1:50000 and ERADAS software satellite imagery are printed in FCC.
2. Preparation of themes of 2008, 2010 and 2013 years Geomorphology map was done by using Visual Interpretation Techniques.

3. Field visits were carried out to check the delineated units of the prepared Geomorphology maps and also collection of secondary data related to coastal land forms and field observation classes are incorporated in to the final Geomorphology maps.
4. All the maps prepared were converted into soft copy by digitization. Graphics reparation, editing, composition of layout was done using Arc Info and Arc view software.
5. Comparison of 2008, 2010 and 2013 final geomorphology maps was done to identify the changes of classes, finding the statistical variations.

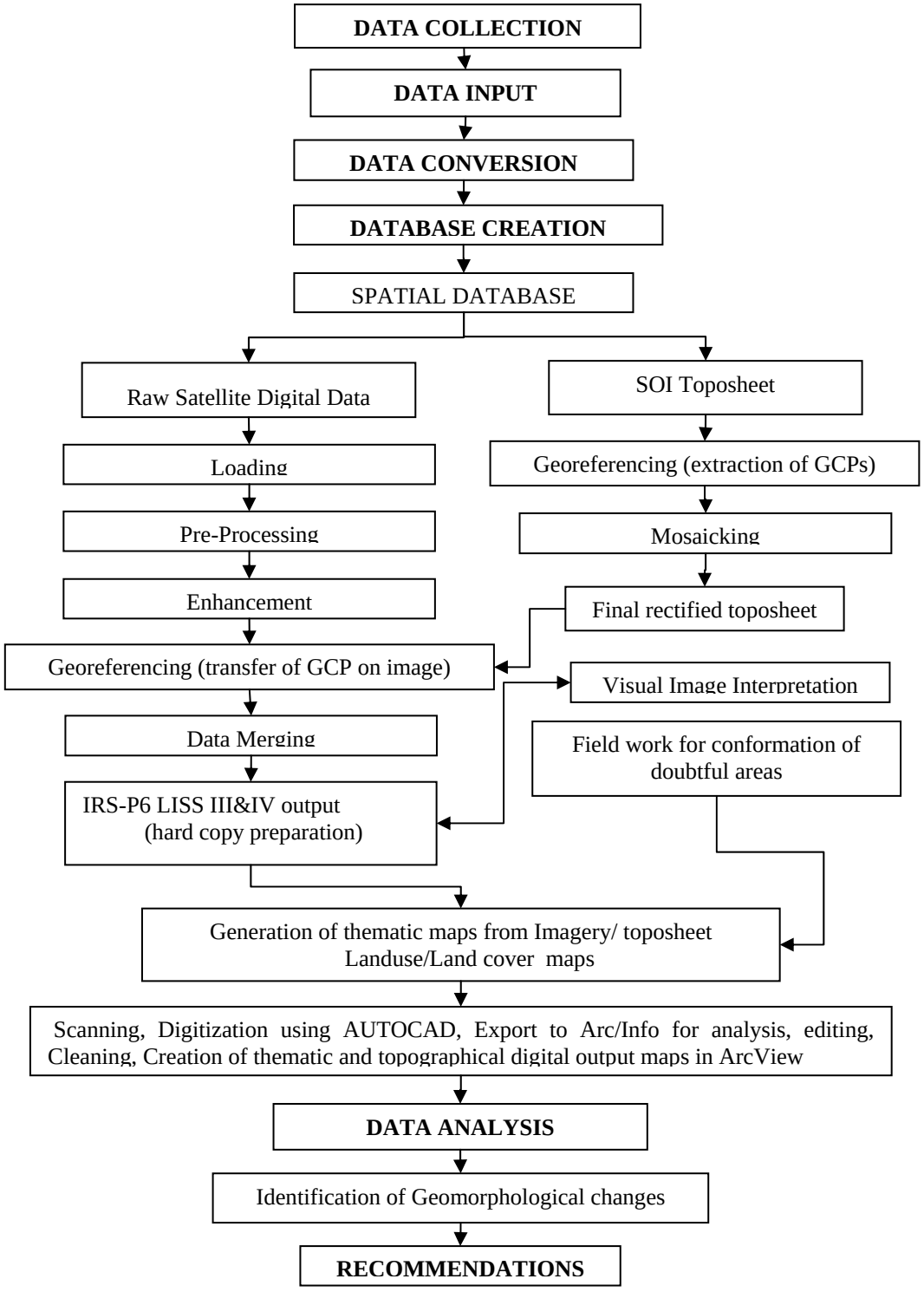

Figure 3: Flow chart showing the methodology adopted for the present study

5. RESULTS AND DISCUSSION

Geomorphology is the study of landforms and the processes that shape them. Landforms evolve in response to a combination of natural and anthropogenic processes. The landscape is built up through tectonic uplift and volcanism. Denudation occurs by erosion and mass wasting, which produces sediment that is transported and deposited elsewhere within the landscape or off the coast. Landscapes are also lowered by subsidence, either due to tectonics or physical changes in underlying sedimentary deposits. These processes are each influenced differently by climate, ecology, and human activity. The linkage between the physiographic units and geomorphic units are necessary to relate the, landforms and soils. Geomorphologists seek to understand why landscapes look the way they do to understand landform history and dynamics, and predict future changes through a combination of field observation, physical experiment, and numerical modelling. Practical applications of geomorphology include measuring the effects of climate change, hazard assessments including landslide prediction and mitigation, river control and restoration, coastal protection, and assessing the presence of water on Mars.

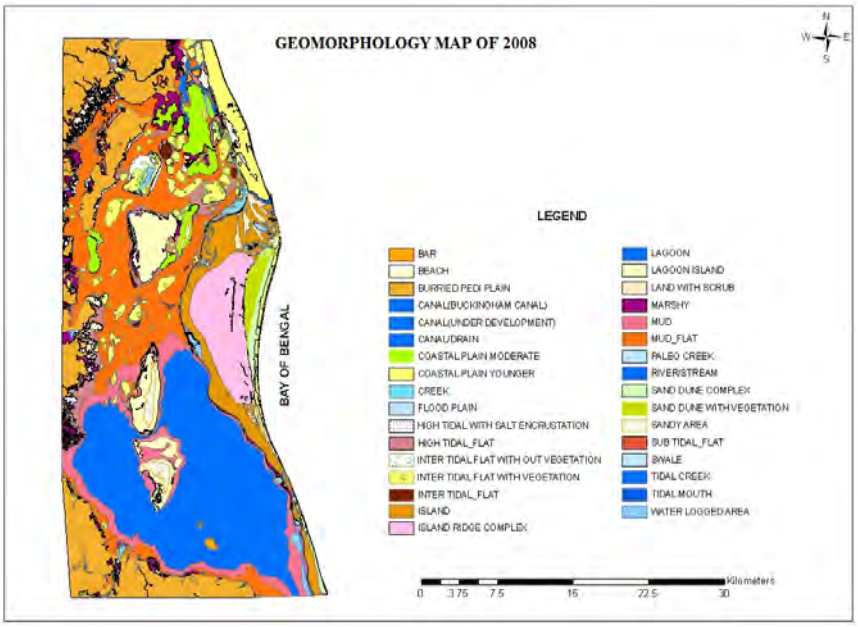

Figure 4: Geomorphology map (2008) of study area

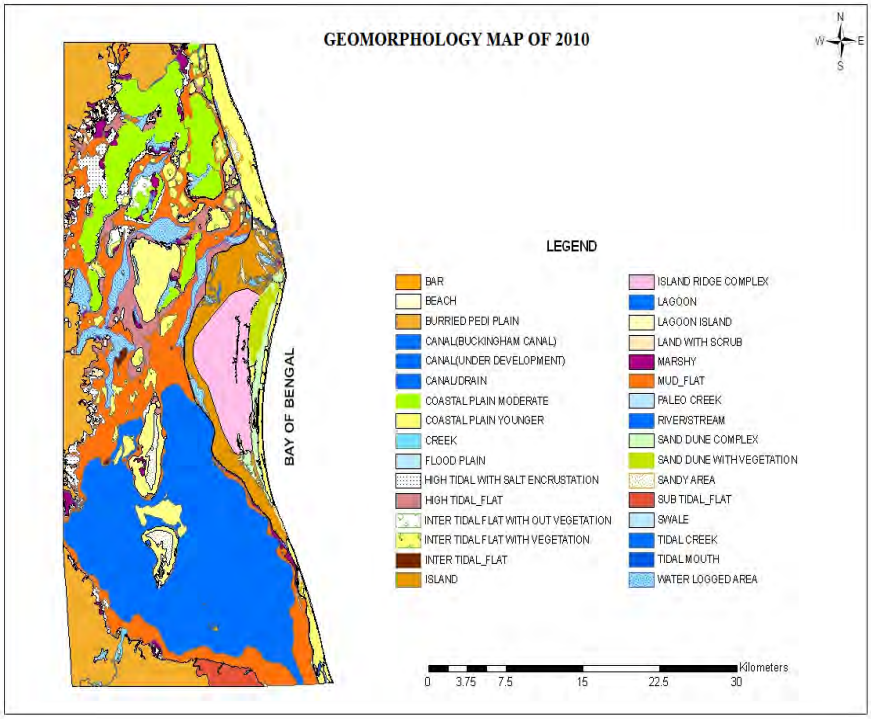

Figure 5: Geomorphology map(2010) of study area

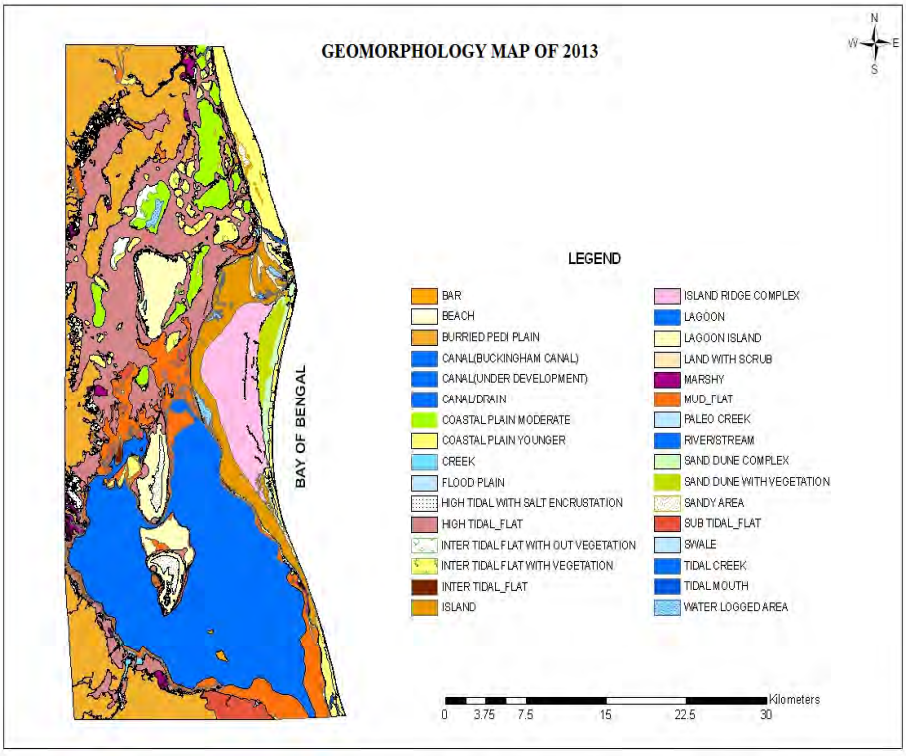

Figure 6: Geomorphology map(2013) of study area

Geomorphology Class	2008	2010	2013
BAR	118	20	66.85
Beach	716	440	330.86
Buried Pedi plain	17038	13635	14078.26
Canal	112	247	167.30
Canal under development	19	24	21.46
Drain	223	116	189.37
Coastal Plain Moderate	5940	4190	3866.66
Coastal Plain Moderate Younger	5943	3934	4315.99
Creek	681	423	363.40
Flood Plain	36	0	0
High Tidal With Salt Encrustation	4120	4081	1389.35
High Tidal Flat	5934	4127	19614.59
Inter Tidal Flat with out Vegetation	788	386	434.60
Inter Tidal Flat with Vegetation	5960	3312	2893.59
Inter Tidal Flat	373	155	111.09
Island	5918	4799	4854.94
Island Ridge complex	5968	5131	5445.24
Lagoon	2936	27571	26069.14
Lagoon Island	4900	4409	4615.42
Land with Scrub	1015	813	948.68
Marshy	3251	1611	1014.87
Marshy swamp	0	969	971.05
Mud	5813	0	0
Mud Flat	18988	16640	8570.46
Paleo Creek	58	13	25.75
River/Stream	70	79	41.73
Sand Dune Complex	1696	1424	1094.55
Sand Dune with Vegetation	762	672	883.37
Sandy Area	2808	1166	1204.80
Sub tidal flat	9	24	535.17
Swale	53	103	87.94
Tidal Creek	504	104	95.01
Tidal Mouth	71	53	72.10
Water logged Area	2157	4307	604.41
Total Area	104978	104978	104978
	AREA IN HECTARES		

Table 1:Geomorphology classes in area wise(2008,2010,2013)

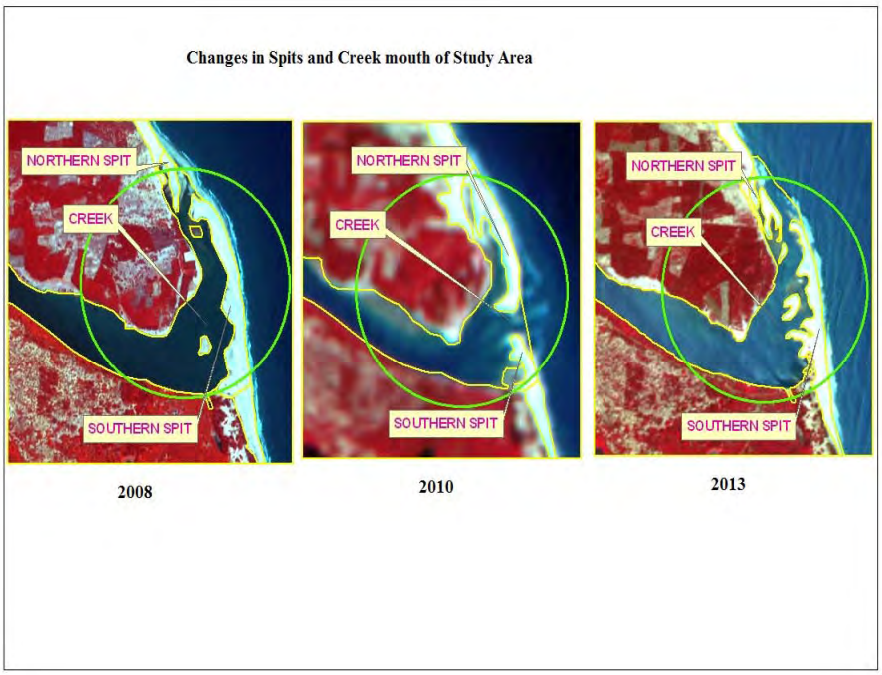

Figure 7: Changes in Split and Creek mouth

Based on the above analysis the changes in the Geomorphology classes like bar, canal (under development), flood plain, palaeo creek, river/stream, tidal mouth, and tidal creek are observed in the present study area are negligible. Major changes occurred in beach, buried pediplain, canal (Buckingham canal), canal/drain, coastal plain, creek, high tidal with salt encrustation, high tidal flat, inter tidal flat without vegetation, inter tidal flat with vegetation, inter tidal flat, island, island ridge complex, lagoon, lagoon island, land with scrub, marshy, marshy swamp, mud, mud flat, sand dune complex, sand dune with vegetation, sandy area, sub tidal flat, swale, water logged area classes.

5 Conclusions

The present study involved identification of changes caused by the tsunami effects in the northern and southern spits length and mouth width of the creek. It is observed that these spits were highly altered due to the impact of Tsunami waves and also to a little extent by the effect of prevailing long shore currents. This methodology can be employed anywhere else in the coastal study to understand the changes in land use/ land cover and geomorphic land forms within a lagoon environment with the help of spatial and attribute database prepared in the present study and can be used for further up gradation.

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