Impact of Shoreline Shifting on Social and Environmental Aspects Using Remote Sensing & GIS Techniques

(A Study of Tajpur and Berakhana Mouza in Digha, West Bengal)

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Abstract

The study examined the impact of changing High Water Line (HWL) on Socio- Environmental aspects in the context of CRZ Notification 2011. For this, a comparative study of changing High Water Line through space and time using cadastral map, LISS-III, IV Satellite images and Toposheet with ground truth verification, generation of land use/ land cover map with change detection, and Integration of socio economic data & spatial data under GIS platform have been performed. For obtaining a comparison of present day physical and cultural features of the study area satellite image and ground truth verification data with old Toposheet, cadastral survey and thereby analysis through remote sensing & GIS have been pressed into service. The study reveals migration of beach front dune towards inland, changing High Water Line, remobilized sand covering the cultivable land making them uncultivable, and conversion of cultivable land into wetland causing socio-economic imbalance in the area. Situation demand an alternative source of income by the land owner. Hoteliers are coming forward with hotel projects, promoting the tourism in the area. Such changes in this coastal stretch of CRZ III category, however, pose environmental threat which ultimately raising question of existence of CRZ notification.

Key-Words: *Remote Sensing & GIS, Coastal tract, High Water Line Shifting, Shoreline Change, CRZ (Coastal Regulation Zone).*

Introduction

The Coastal zone is a broad transitional area between the land and sea. The high water line is a boundary line between land and sea. Because of its dynamic natures, the shore line with high water line changes gradually (Chakrabarti &Chakraborti 1977). This change is provided by sequence of coastal process which is stormed cyclone coastal process sea level rise and seismic events involving a specific range of space and time cumulatively affects and over all change in High Water Line (HWL) geometry. Accurate determination of high water line change rate is important for development planning, hazard zoning, and erosion accretion studies of the coastal belt (Niyogi, 1970).

The study area

The study area is located between latitude: $21^0$38'20"N to $21^0$40'00"N and longitude: 87^0 36'40"E to $87^0$38'20"E in the Tajpur and Berakhana Mouza of Ramnagar-I block, Purba Medinipur District, West Bengal, India This area is a part of the coastal plain estuary with the Jaldha creek and Pichaboni Rivers are flowing through the area .It mainly consists of sandy beaches, mud flat-costal dune inlet. The beach is under the action of waves, Tide, and long shore drift and also in some cases it is shaped by rip currents (Paul, 2002). The back shore zone is reworked by wind and storm surges or high waves. The result shows accelerated rate of erosion on the beach and unprotected eastern side is severely threatened by coastal dune retreat.

Objectives are to-

- find out the impact of changing High water line on socio-environmental aspects of the study area in space-time perspective,
- propose a development strategy in the context of CRZ notification.

Methodology

The changes of HWL shifting of the study area at cadastral level is done by using satellite image of

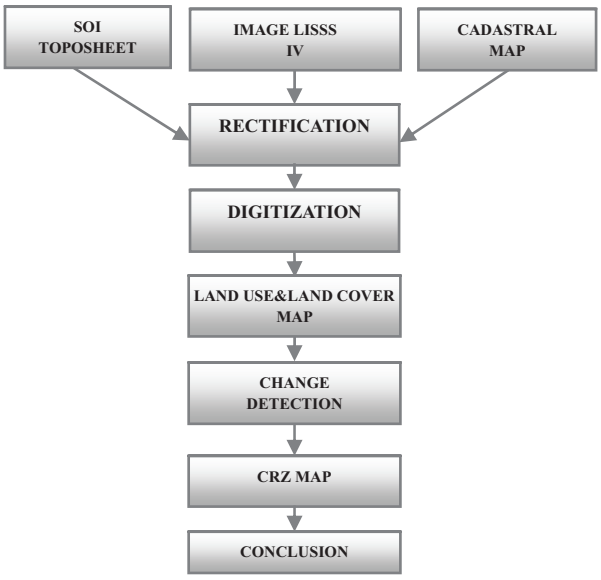

Fig. 1 Methodological steps

LISS –IV,Jan-08 and Oct-08,cadastral map of 1957and as a base map SOI Toposheet of 1972. After geo-referencing of this satellite image with cadastral map, the high water line of study area is prepared (see Fig.1).

Economic activity: The salt pan present in the study area is basically man made economic activity (Fig.2).

Geomorphic features

Creek: A Saline Creek is the portion of a stream that is affected by the flow of ocean tides. Thus, this portion of the stream has variable salinity and electrical conductivity over the tidal cycle. Due to the temporal variability of water quality parameters within the tidally influenced zone, there are unique biota associated with tidal creeks. Creeks may often dry to a muddy channel with little or no flow at low tide, but often with

Fig. 2 Field photo of Salt Pan

Fig. 3 Field photo of Jaldha Creek

significant depth of water at high tide. Saline creeks are found dispersed all along the Indian coast (Chakrabarti 1995). Most of the creeks in the country are reported from the south eastern part of the coast and the predominant vegetation is mangroves. One of such creek is Jaldha creek is found in the study area (Fig. 3). High fishing activity in the study area is covered under Alampur fisheries project.

Result and Discussion

A land use/land cover map was prepared by visual interpretation of the Geo-referenced image. Depending upon present condition of the area according to field verification and the satellite imagery vulnerable points or area was marked. Vulnerability is found to be more in the eastern part of the study area. So single crop land in the high vulnerable eastern part and gradually shifting towards double crop in low vulnerable.

Accreted and eroded land of the study area is calculated after considering cadastral map, Toposheet and image by using ArcGIS 9.3 software. So it can be said that the Tajpur and Berakhana Mouza of RamnagarI Block is under the erosional regime of the coastal tract.

Shoreline shift: From the Fig. 4 it is clearly observed that HWL shifted 250mt towards the land after considering HWL of cadastral map of 1957 and HWL of IRS LISS-IV Image 2008. The HWL is shifting towards land by 250mt is also confirmed by the ground truth verification. The beach is under the action of waves, tide and long shore drift and also in some cases it is shaped by rip currents. The back shore zone is reworked by

wind and storm surges or high waves. The result shows an accelerated rate of erosion on the beach and eastern side is severely threatened by coastal dune retreat.

Classification of Coastal Regulation Zone

For regulating development activities, the coastal stretches within 500 meters of High Tide Line on landward side are classified into four categories:CRZ-I, CRZ-II, CRZ-III and CRZ-IV, the study area falling mainly in CRZ-III zone.

CRZ-III

The area of Ramanagar Block, part of Tajpur and Berakhana Mouza upto 200 meters from the High Tide Line is to be earmarked as No Development Zone. No construction shall be permitted within this zone except for repairs of existing.

Authorized structures not exceeding existing FSI, existing plinth area and existing density, and for permissible activities under the notification including facilities essential for such activities. An authority designated by the State Government/Union Territory

Administration may permit construction of facilities for water supply, drainage and sewerage for requirements of local inhabitants.

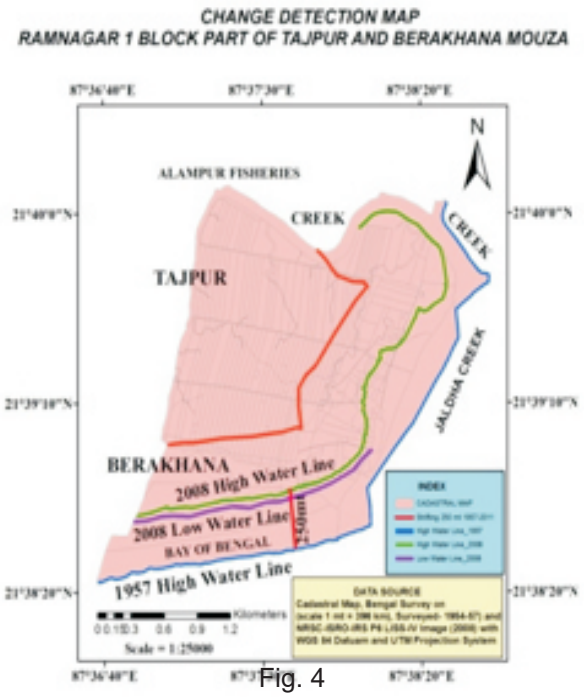

Fig. 4

However, the following uses may be permissible in this zone agriculture, horticulture, gardens, pastures, parks, play fields, forestry and salt manufacture from sea water.

Development of vacant plots between 200 and 500 meters of High Tide Line in designated areas of CRZ-III with prior approval of Ministry of Environment and Forests (MEF) permitted for construction of hotels/beach resorts for temporary occupation of tourists/visitors subject to the conditions as stipulated in the guidelines at Annexure-II.

Construction/reconstruction of dwelling units between 200 and 500 meters of the High Tide Line permitted so long it is within the ambit of traditional rights and customary uses such as existing fishing villages and gathers. Building permission for such construction/ reconstruction will be subject to the conditions that the total number of dwelling units shall not be more than twice the number of existing units; total covered area on all floors shall not exceed 33 percent of the plot size; the overall height of construction shall not exceed 9 meters and construction shall not be more than two floors ground floor plus one floor. Construction is allowed for permissible activities under the notification including facilities essential for such activities. An authority designated by State Government/Union Territory Administration may permit construction of public rain shelters, community toilets, water supply, drainage, sewerage, roads and bridges. The said authority may also permit construction of schools and dispensaries, for local inhabitants of the area, for those Panchayets the major part of which falls within CRZ if no other area is available for construction of such facilities.

Reconstruction/alterations of an existing authorized building permitted subject to (i) to (iii) above

Potential impacts of the study area: (i) loss of private land, (ii) displacement of encroachers and squatters on government land, (iii) loss of

livelihood/livelihood sources for fishing community Conflict on the species selected, (iv) impacts on coastal geomorphology and Impacts due to use of non biodegradable materials, and (v) impacts due to natural disasters till maturity and Impacts on the stability of the beaches in neighboring areas.

Mitigation measure of the study area comprises of-

- compensation for land at replacement value and other R&R Assistance as per the entitlement framework.
- assistance to squatters / encroachers as per the policy and ensuring community participation and oversight.
- loss of access/restricted access to the coast due to project activities for the community and Land donation.
- impact on the present species composition and biodiversity of the area.

Conclusion

From the study it is cleared that the HWL shifted towards land by 250mt. Due this shift land erosion and biodiversity loss occurs. This leads to the loss of livelihood activity as well as land in the study area. So the CRZ notification is highly violated in the study area.

- Necessary steps may be taken up by the Environment and Forest Depts, to restore the converted cultivates land.
- Environment and Forest Dept. may take necessary action to acquire such cultivable land with remobilized sand to convert it into forest land.
- monitoring and mitigation and management steps in the study area must be taken due to changing scenario of High Water Line Shifting. It also includes the transparency and acceptance of proposed mitigation plan among the local people. Although there is violation of CRZ notification in some part of the study area but the livelihood activity of the local people must be taken care of before any punitive measure. The economic development and improvement of social security of the local people must be considered before any developmental activity.

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