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Application of Remote Sensing in Coastal Region – Case Study

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Abstract*— The *coastal sea shore line presents serious problems to land use due to flooding, erosion, pollution, and emerging threat posed by rising sea level due to tidal currents. All these require constant monitoring and preventive measure in order to control economy. There are various methods in practice to monitor the coastal processes via, aerial survey, bathymetric mapping, land use and land cover mapping by remote sensing. In this research paper, the changes in the coastal environment and shoreline behavior in Vasai creek are analyzed by using remotely sensed digital data. Visual interpretation of water quality and study the dispersion of polluted water of sea shore line. The land form features changes were quantified by unsupervised classification technique and which will be vital information for coastal planning for development works. The coastal sea shore line of Vasai creek was observed in year of Jan 1999 and Feb 2001 had undergone some significant change in the area of human settlement, salty land and barren land. There was small increase in the area of human settlement; decrease in salty and barren land was observed. The Pollution influx of Mahim creek and Malad creeks were observed. After studied all results the shoreline of Vasai creek was fairly stable.

***Index Terms*— Remote Sensing DATA, Satellite imagery.**

I. INTRODUCTION

Recent development in field of remote sensing has enabled us to update our knowledge of changing world through comparison of old data with that of new one. These changes may be linear or nonlinear, steady or erratic, moment or long sustaining type. Coastal zone are one of the most dynamic earth interacting process operating in the land sea junction. The world's coastline is about 440000 km long and 66% of the world population lives within a few kilometers of the coastline. However, the coastline stretch presents serious problems to land use due to flooding, erosion, pollution and emerging threat posed by rising sea level. And these require constant monitoring and remedial action in order to preserve mans investment. There are various methods in practice to monitor the coastal process via, aerial survey, bathymetric mapping, land use & land cover mapping etc. the developments in the field of remote sensing by collecting multi temporal data through earth orbiting satellites make it possible to monitor the coastal zone effectively. This approach provides cost effective and accurate solution to various coastal management problems.

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In the present study an attempt have been made to analyze the changes in the coastal environment in Vasai creek, Mumbai using remotely sensed digital satellite data. The shoreline behavior along the creek also analyzed in order to ascertain the stability of the coast,. Water quality assessment using visual interpretation was carried out and dispersion of polluted water in the sea was studied. Satellite images were classified using unsupervised classification technique to form different signature groups which would represent the coastal land form features. Land water delineation contour were drawn on imageries of different dates and were imposed for comparison. Any deviation in the delineation boundary will be easily seen over the imageries and will provide useful information about the erosion or accretion activities taking place along the coastline.

II. METHDOLOGY

A. Types of information extraction from remote sensing

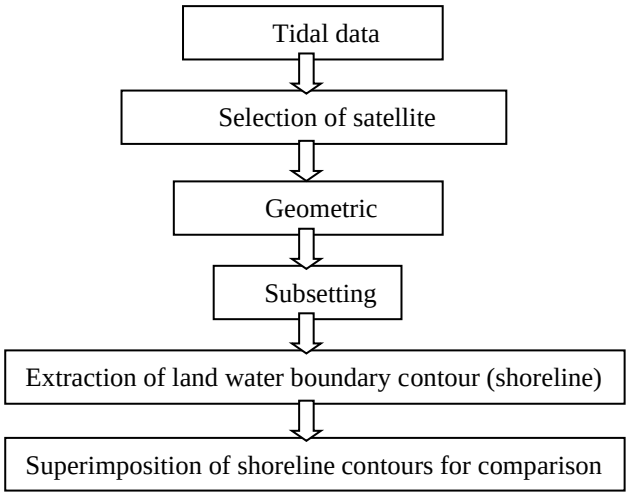
Types	Example
Classification	Land cover, vegetation
Change detection	Land cover change
Extraction of physical quantity	Temperature, elevation
Extraction of indices	Vegetation and turbidity index
Identification of special features	Flooding, erosion, land reclamation

B. Selection of satellite imageries:

The selection of satellite imageries are based on the following factors

1. Revisit capacity of satellite (revisit capacity of IRS-1 B satellite is 22 days and IRC-1C/1D satellite is 11 days)
2. Cloud coverage
3. Picture quality of imageries collected in monsoon
4. Data generation problem faced by national remote sensing agency (NRSA)
5. Tidal data analysis:- The tidal level at the time of satellite pass was obtained by interpolating the tidal levels between flooding and ebbing using sinusoidal interpolating technique.

The following flow chart shows the operation followed for analyzing satellite imageries for shoreline stability studies:



C. Digital image interpretation

The following points were considered at the time of interpretation of image

Geometric correction
Image subseting
Demarcation of land water boundary
Superimposition of shoreline
Unsupervised classification

III. RESULT AND DISCUSSION

A. Study Area:-

For the land use and land cover mapping and shore line stability studies of Vasai creek of thane district, Mumbai has been chosen as study area, which is shown in index map.

Graphical coverage	**E 72^0 48' to E 72^0 54' Longitude and 19^0 18' to 19^0 21' latitude**
River	Ulhas River
Pollution studies	Mahim creek and Malad creek

B. Analysis of Satellite Imageries

The imageries used in this study are listed in the following table 1.

Table 1 List of satellite data

Satellite	**Sensor**	**Date**	**Spatial resolution (m)**	**Tidal level (m)**
IRS -1D	LISS- III	23-1-1999	23.8	1.25
IRS -1C	LISS- III	28-2-2001	23.8	0.62

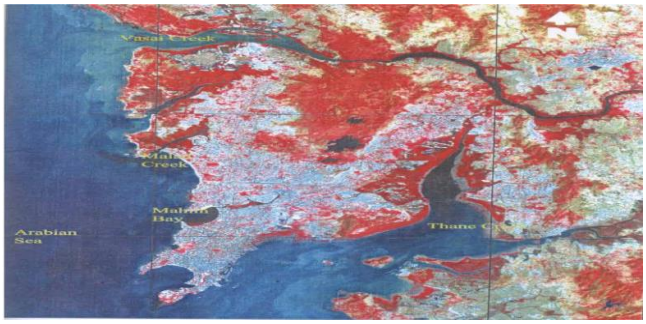


Figure: 1 Satellite Imagery of Mumbai and surroundings as on 28-2-2001

C. Unsupervised classification

Unsupervised classification of imagery for year 1999 and 2001 are shown in fig 2 and 3. Seven classes have been generated from both the imageries. The geographical area covered by each class was computed by knowing the spatial resolution distance.

Table 2 Results of unsupervised classification of year 1999 and 2001 imageries for land use /land cover mapping

Class name	**Area covered in 1999 (Sq.Km)**	**Area covered in 2001 (Sq.Km)**	**Change area (Sq.Km)**	**% change**
Mud flat	40.53	36.59	-3.94	9.7
Water	41.96	43.23	1.27	3
Thick vegetation	36.38	34.45	-1.93	5.3
Sparse vegetation	17.79	25.27	7.48	42
Salty land	21.50	18.65	-2.85	13.2
Barren land	13.28	10.15	-3.13	23.5
Settlement	6.32	8.73	2.40	38.1

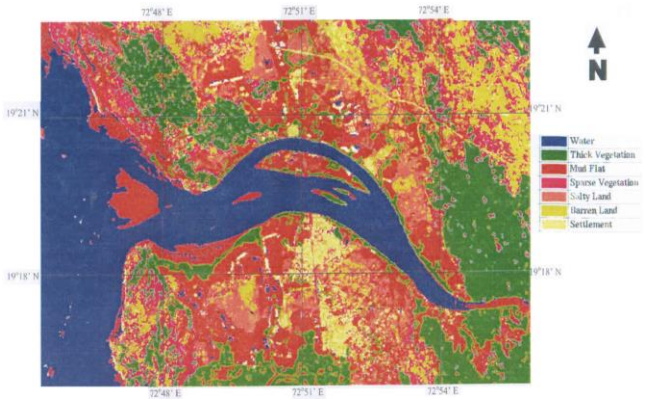


Figure : 2 Unsupervised classification of Satellite imagery of Vasai Creek as on 23-1-1999

Figure: 3 Unsupervised classification of Satellite imagery of Vasai Creek as on 28-2-2001

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D. Stability of shore line assessment

In order to access the stability of the shore line contour lines were drawn in the water land delineation boundary of both the imageries. Fig 4 shows the comparison of superimposed boundary contours of both the imageries. The cyan line indicates the shoreline corresponding to 2001 and yellow line corresponding to 1999. In overall observation, the shoreline shows a stable behavior. The small deviation seen here are due to the tidal difference between the two imageries.

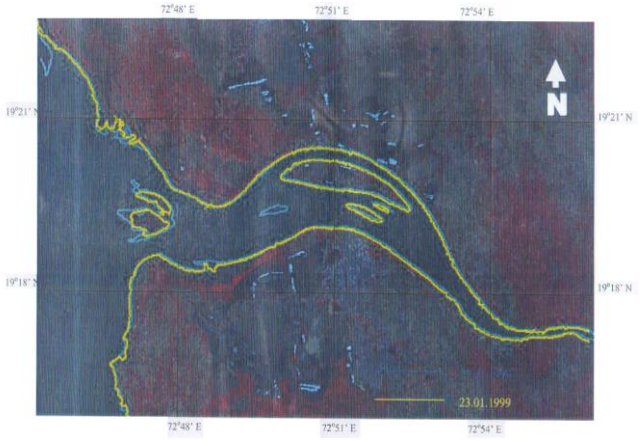

Figure: 4 Superimposed shorelines of 1999 & 2001 Imageries of Vasai Creek

E. Pollution dispersion analysis

Polluted water influx in the Mahim bay and Malad creek, Mumbai was observed from satellite imageries fig 5 and fig 6. The color difference between the clear water and the polluted water easily brings out how the polluted water gets dispersed in to the sea. It is also possible to trace the location from where the polluted water get originated.

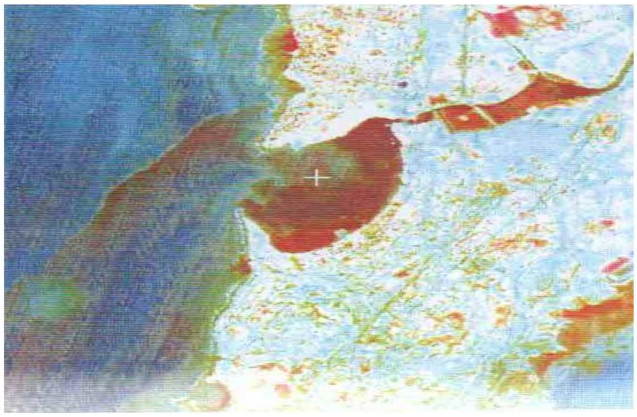

Figure: 5 Pollution dispersion patterns from satellite imagery (Mahim bay)

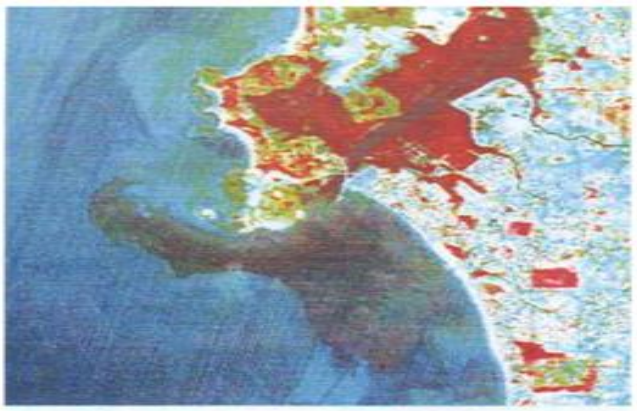

Figure: 6 Pollution dispersion patterns from satellite imagery (Malad creek)

IV. CONCLUSION

1. The area of water covered region has increased by 3% from 1999 to 2001. This result was because of the difference in tidal level between both the imageries.
2. The area covered by mud flat has decreased and is also because of difference in tidal level.
3. There is reduction in thick vegetation while increase in sparse vegetation is observed. This may be due to the seasonal difference by one month between two imageries.
4. The area covered by settlement has increase by 2.41%, while area covered by barren land and salty land has reduced. This indicates that human activities / development works are on this locality
5. The shoreline of Vasai creek was fairly stable
6. Pollution influx at Mahim creek and Malad creek were observed.
7. The coastal environment can be easily be monitored using remote sensing satellite data.

REFERENCES

1. Banner A.V. Al, 1981, "Multi Temporal Analysis of LANDSAT Data for Forest Cut Over Mapping- A Trail Of Two Procedures, Proc. of the Seventh Canadian Symposium on Remote Sensing held in Winnipeg in 1981,pp, 233-240.
2. Byrne G.F., Et Al., 1980, Monitoring land cover change by principal component analysis of multi temporal LANDSAT Data, Remote Sensing of Environment, 10 Pp, 175-184.
3. Huly Yildirim, 1995, Temporal change detection by principal component analysis on satellite imagery.IEEE,2/95,pp.1227-1229.
4. Nelson R.F., 1983, Detecting forest canopy change due to insect activity using LANDSAT MSS, Photographic and Remote Sensing, 49,pp, 1303-1314.
5. Nayak S.R. et.Al, 1985, Coastal morphology: a case study of Gulf of Khambat, International Journal Of Remote Sensing. Vol 6, pp 559-567.
6. Singh A, 1986, Change detection in tropical forest environment of North Eastern India using LADNSAT , In Remote Sensing and Tropical land management, Edited by M. J. Eden & J. T. Parry, (London John Wiley & Sons),Pp. 56, 1995
7. IAF, space for education, Health Care & Environment Monitoring, special plenary session, International Astronautically Federation, 46th Congress, Oslo, Norwey,Pp.56, 1995.
8. NRSA, Manual of nationwide land use/ land cover mapping using satellite imagery Part1, Pp. 58, 1989.
9. L Rao, K.M, Remote sensing for land use planning, International Journal of Remote Sensing, Vol 16, No. 1, 53-60, 1995.

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)

10. Change detection of wasteland using remote sensing and GIS, an interim report, CSRE IIT , BOMABAY, 1996.
11. Gazetteer of India, Maharashtra State, Thane District, Published by Gazetteer Department, Government Of Maharashtra, Bombay 1982.
12. Lillesand T.M. Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley & Sons Inc. Publication, 1986.
13. Manual of procedure for wasteland mapping using remote sensing techniques, National Remote Sensing Agency, Department of Space, Government of India, Hydrabad,1986.
14. Chandramohan P, Kumar M. Nayak B.U. And Anand N.M. " Wave atlas for the Indian coast, ocean engineering division, National Institute of Oceanography, Dona Paula, Goa. 1990.
15. Vaa Zuidam, R.A., Aerial photo interpretation in terrian analysis and geomorphological mapping, 1995

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