List of Publications

1. **Tattu Shreestuti**, Bhonde Uday, Desai Nikhil and Shah Dharmendra G. (2008) Change detection study of coastal configuration along the Narmada Estuary at Kaladra village, Bharuch district: A remote sensing approach. *Journal of the Indian Association of Sedimentologists*, 27(2), 127-133. (ISSN: 0970-3268)
2. **Tattu S.**, Shah D. G., Desai N. and Chauhan H. B. (2008) Land use changes in Vagra taluka, Bharuch District - Gujarat: an analysis with the application of Remote Sensing Data. *Indian Cartographer*, 28, 485-489. (ISSN: 0972-8392)
3. ***Khare Shreestuti S.**, Shah Dharmendra G. and Desai Nikhil (2012) Monitoring mangroves and developmental activities on Aliabet, Bharuch District from 1975-2012. *Proceedings of National Seminar on Biodiversity and Conservation of Coastal and Marine Ecosystems of India*, 13th -15th September, 2012, at Department of Biological Sciences, Ramniranjan Jhunjhunwala College, Ghatkopar, Mumbai, pp.1-5. (ISBN: 978-81-925489-0-6)
4. ***Khare Shreestuti S.**, Shah Dharmendra G. and Desai Nikhil (2013) Mapping of mangrove cover of Hansot taluka, Bharuch District. *Proceedings of National Seminar of New Challenges in Remote Sensing Technology with emphasis on Microwave Data*, 5th October, 2013, at Department of Botany, Faculty of Science, The M. S. University of Baroda, Vadodara, pp. 70-73.

*** Surname changed after marriage**

Jour. Indian Association of Sedimentologists, Vol. 27, No. 2 (2008), pp. 127-133

Change Detection Study of Coastal Configuration along the Narmada Estuary at Kaladra Village, Bharuch District : A Remote Sensing Approach

TATTU SHREESTUTI[1], BHONDE UDAY[1], DESAI NIKHIL[1], SHAH DHARMENDRA G.[2]
[1]Department of Geology, Faculty of Science, The M. S. University of Baroda, Vadodara -390002
[2]Department of Botany, Faculty of Science, The M. S. University of Baroda, Vadodara, -390002
Email: shreestuti.tattu@gmail.com

Abstract: The coastal configuration along northern flank of Narmada estuary including Kaladra village of Vagra taluka, Bharuch district has changed in the recent past. The main objective of this study is to evaluate and quantify the changes in coastal configuration of the study area over a period of time by using remotely sensed satellite data. The study area is covered in 1:50,000 scale SOI (Survey of India) toposheet numbers 46C/9, 46C/10, 46C/13 and 46C/14. The High Water Line (HWL) obtained from the toposheet covering the study area is compared with High Tide Line (HTL) obtained from the recent satellite data IRS 1C LISS III image of year 2004 with Polyconic projection and Everest datum. When compared, these two data sets covering a time span of more than 40 years, show severe erosion in the study area along northern part of Narmada estuary. It is estimated based on the SOI sheets and satellite data comparison, that about 100 m encroachment of the High Tide Line (HTL) has occurred in the area towards land. The ground checking of the region revealed high cliffs of about 10 m along with the down cutting in them. A live example of a road being washed away in just past 4 years and shifting of the fishing community towards a new area supports the observations made by comparing the two data sets. Over-riding of coastal environment on fluvial environment in the study area seems to be the result of disturbed sediment budgeting. However, tectonic set up of the area and the geological history of the region does not rule out other factors like tectonic subsidence and influence of higher stream discharge in the area which are responsible for the erosional coast of this part of Gujarat.

Keywords: Narmada Estuary, Kaladra Village, Remote Sensing, Coastal Configuration.

INTRODUCTION

The coastal zone of the world is under increasing stress due to development of industries, trade and commerce, tourism, human population growth and migration, and deteriorating water quality. This region is a very important component for the regulation of climate changes, bio-geochemical cycles and ecosystem. Apart from these, the coastal zone is a rich resource in terms of food, energy and mineral deposits and forms one of important livelihood for a large population (Nayak, 2000). India has a coastline of around 7, 500 km and about 25% of the country's population, live within 60 km zone of the shore line (Rajawat et al., 2004). Coastal environment comprise an integration of different coastal features wherein the shoreline which forms an interface between land and ocean is one of its very important and highly dynamic feature. It regulates changes in landforms of the coastal zone. Coastal processes such as erosion, deposition, flooding due to storm surges and sea level changes modify the shoreline configuration. Due to its very dynamic nature accurate demarcation of shoreline is difficult at times but it is very important from the perspective of coastal zone management. The present investigation around Kaladra village that lies in the Vagra taluka of Bharuch district has been carried out as the study area and its surroundings on the northern flank of Narmada estuary is undergoing severe erosion since last few decades which has indirectly affected the growing industrialization in and around the study area. An attempt has been made in the present study to bring out the quantification of the changes in the coastal configuration using remote sensing data and field observations.

STUDYAREA

The present study of change detection in coastal configuration is carried out in the estuarine part of Narmada River, between latitude 21°37' to 21°40' N and long.72°30' to 72°46' E (Fig.1). It lies on the Jambusar-Broach block of the Cambay rift basin, bounded by the ENE–WSW seismically active Narmada– Son Fault (NSF). Total length of studied segment is of about 20 km wherein the most effects are seen at Kaladra which preliminary observations representing a small

Land use changes in Vagra taluka, Bharuch District - Gujarat: An analysis with the application of Remote Sensing Data

Tattu S., Shah D.G.*, Desai N., Chauhan H.B.**
Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat
*For correspondence E-mail: shahdhamu@rediffmail.com
**Sci \ Eng SF, MECD, MESG, RESA, Space Applications Centre, Ahmedabad.

Abstract:

Coastal areas are highly dynamic and are the most vulnerable for land use changes in this rapid industrialization and urbanization epoch. Information of land use and land cover changes is a basic requirement for developing sustainable and efficient management strategies for any area. Evaluation of land use and land cover changes over time can leads us toward the trend of anthropogenic and natural activities. Vagra Taluka situated in Bharuch district of the Gujarat state, has a fairly large coastal area. With its economic development, population growth and urbanization, it has experienced a dramatic land use changes over the past 39 years. The main objective of this paper is to evaluate and quantify land use changes in Vagra taluka from 1965 to 2004 using remote sensing technique. The historic land use map was derived from topographic maps of Survey of India of 1965and land use map of 2004 was generated through the visual interpretation of IRS-1 C LISS III images, supported by ground verification.

The area has undergone industrialization in a big way. The area under industrial set up has gone up from 7.91 ha to 1243.3 ha. The extent of industrialization can also be gauged from the fact that, while in 1965 there was a single jetty, in 2004 the area has 6 jetties covering an area of 60.81 ha. Gandhar one of the major oil producing sites in western India also falls within the taluka. This increase in the industrial area has compensated by agriculture and forest. These categories have decrease in area by 59993.42 ha to 51517.37 ha and 526.85ha to 266.93 ha respectively during the time period. In addition to this, the development of saltpans and industrial infrastructure development has made a great impact on the land use pattern. Development at this alarming rate can disrupt the ecological balance of this region. Proper land management practices would be require to maintain balance between coastal ecology and economic developmental activities. Remote sensing data can be used as reliable and scientific input for developing the coast in sustainable and integrated manner.

Introduction:

Land is the most important natural resource, which embodies soil, water, and associated flora and fauna involving the total ecosystem. It is a key and finite resource for most human activities including agriculture, forestry, industry, settlement, recreation and water catchment's and storage and hence it has been tightly coupled with economic growth. But due to rapid industrialization it creates a pressure on the land system and may lead to the number of changes .The use of land is highly dynamic and undergoes significant changes according to the changing socioeconomic pattern and natural environment (Raju and Kumar, 2006). But, since long this natural resource is being degraded.

Land use describes how a parcel of land is utilized, where as land cover describes the materials that are present on the surface (Sabins, 2000). Land use and Land cover changes are closely linked with the issue of sustainability of socio-economic development. These land use/ land cover changes are a major driver of global changes through its interaction with climate, ecosystem processes, biogeochemical cycles, biodiversity and human activities (Fisher, 2006). Hence, for the judicious use of the resources in a sustainable manner knowledge of extent of land utilization is essential.

GIS and RS techniques have been widely applied to study land use/land cover changes (Rao et al., 1996; Yagoub et al., 2006; Sabins, 2000; Jenson, 2005). The great merit of recording land use on map is that each parcel of land can be precisely located and the areal relationship of different uses can be analyzed in a way that is not possible with a variety of statistical data (Raju and Kumar, 2006).

Study area:

Bharuch District is located in the south central Gujarat and constitutes a marginal strip of the southern Gujarat alluvial plain. The alluvial plain is a product of the age-long processes of erosion and deposition carried out by the major rivers of southern and

BIODIVERSITY AND CONSERVATION OF COASTAL AND MARINE ECOSYSTEMS OF INDIA (2012)

MONITORING MANGROVES AND DEVELOPMENTAL ACTIVITIES ON ALIABET, BHARUCH DISTRICT FROM 1975-2012

Khare Shreestuti S.[#*], Shah Dharmendra G.[#], Desai Nikhil[+]
[#] Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat
[+] Department of Geology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat
Corresponding author [#] shreestutitattu14@gmail.com

ABSTRACT
Aliabet was an island representing a long linear sandy river mouth bar in Narmada River. Over a period of time this land mass has shown substantial changes in terms of its configuration and vegetation. The main objective of this study is to evaluate the changes in mangrove cover and developmental activities along an island over a period of time by using remotely sensed satellite data. The area is covered in 1:50,000 scale SOI(Survey of India) toposheets numbers 46C/10, 46C/11 and 46C/14.The changes were studied based on the comparison of data retrieved from the toposheets (Base line information) and satellite data of different time scale such as1978, 1987,1997, 2004 and 2012. The recent satellite image was georeferenced with help of GCP points collected at the time of field. The other images were georeferenced with referenced image and then subjected to analysis. The analysis was done using visual interpretation technique in which the mangrove vegetation and industries were marked for different year. The comparison of the satellite data of the different time scale shows substantial changes in the configuration, vegetation cover and development of an area. Aliabet which was earlier an island in the Narmada estuary has got merged with the main land. The major portion of it is mudflat which shows both erosional and depositional features on the northern and southern flank respectively. This change in the geomorphology has led to considerable change in the overall vegetation especially in the mangrove which is going to play a very important role in improving slope stability, consolidating sediments and to protect the shoreline. The mangroves vegetation has decreased drastically compare to the area retrieved from the toposheets and year 1997. The developmental activity mainly includes the development of industries such as saltpan, aquaculture ponds and oil based industries. Till year 1995 Aliabet was not encroached by any industries but in 1997 saltpans were developed at the northern side of Ambheta village. Later on in year 2002 oil excavation started and in recent past aquaculture industries have come up in the area. This development had indirectly leaded the development of the road network and thus the area is easily approachable which was not possible earlier because of the muddy substratum and dense creek network. Thus, changing configuration, decreasing mangrove cover and increasing industries in the area are of great concern for the environmentalist in order to protect the coastal environment.

Key words: Mangroves, Remote sensing, Aliabet,

INTRODUCTION

Mangroves are a group of highly evolved halophytes occupying the intertidal zone in estuaries, lagoons and coastal mudflats along tropical and sub tropical coastlines. They are considered to be one of the most productive and biodiverse wetlands on earth (Mitsch and Gosselink, 1993; Odum *et al.,* 1982). But, till about 1960s, mangroves were largely viewed as "economically unproductive areas" and were therefore destroyed for reclaiming land for various economic activities (Hirway and Goswami, 2004). However, mangroves play a crucial role in the balancing coastal ecosystem. They are "protector of shoreline" and play an important role in reducing the coastal erosion. They act as breeding and nursery ground for a number of commercially important marine organisms such as crabs, shrimps and fish species. Mangroves trees are very well known site for the collection of honey and tannin. They also provide fodder, wood for the construction of houses, boats and even as fuel and in this way mangrove give livelihood to the coastal community. Thus, although they are of great economic and ecological values, their importance was not appreciated till December, 2004. The attack of Indian Ocean Tsunami on 26th December, 2004 have raised the value of mangrove substantially as "bioshield" (Kar and Kar, 2005 and Kathiresan and Rajendran, 2005) and hence, their conservation and plantation activities have been increased over south east Asia (Feagin *et al.*,2010). The increase in the awareness and plantation activities can be retrieved from the report of Forest Survey of India 2011, which suggests that in India mangrove cover has been increased to 4662.56 sq km over a period of time (Anon, 2011). The report has also mentioned about the rise of 12 sq km in mangrove cover of Gujarat state. But the massive development along the coast has put a tremendous pressure on the coastal ecosystem. This has threatened not only to mangrove but also to coral reef, algal beds, estuaries and mud flats which are important constituents of the coastal ecosystem (Nayak, 2000). In the present investigation one such location is selected which faces substantial change in its configurational, vegetational and developmental aspects. The present paper focuses on the monitoring mangroves

ISBN 978-81-925489-0-6

Proceedings of National Seminar of *'New Challenges in Remote Sensing Technology with emphasis on Microwave Data'*

MAPPING OF MANGROVE COVER OF HANSOT TALUKA, BHARUCH DISTRICT

Khare Shreestuti S.[#*], Shah Dharmendra G.[#], Desai Nikhil[+]

[#] Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara

[+] Department of Geology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara

Corresponding author [*] Email: shreestutitattu14@gmail.com

ABSTRACT

Mangroves are specialized group of plants growing along the coastal area. The mangroves possess high economical and ecological importance. But, worldwide mangrove cover shows a decreasing trend. Hence, it is an urgent need to map, monitor and conserve this coastal vegetation. In the present study mangrove cover of Hansot taluka of Bharuch district has been mapped with remote sensing technology. This technique is proved to be most effective for the mapping, monitoring and bringing out changes in coastal life forms such as algae, mangrove, coral reef, mudflats etc. The satellite image of year 2011 is used to fulfill the objective. The image was georefrenced and the data analysis was accomplished by visually interpretation followed by onscreen digitization. The map was prepared giving idea of mangrove cover and different density cover. The map shows a substantial mangrove cover and is present throughout the coastaline of Hansot taluka. The total mangrove cover estimated from the image is 1941.29ha which is quite good number. But, it is necessary to monitor the mangrove cover of this area continuously, as there are many upcoming industries in this area and especially in the coastal mudflats region which is a matter of concern as they may affect the mangrove adversely.

KEY WORDS: Mangrove, Remote sensing, Density, Hansot taluka

INTRODUCTION

Mangroves are a group of highly evolved halophytes occupying the intertidal zone in estuaries, lagoons and coastal mudflats along tropical and sub tropical coastlines. They are considered to be one of the most productive and biodiverse wetlands on earth (Mitsch & Gosselink 1993; Odum *et al.* 1982). But, till 1960s, mangroves were largely viewed as "economically unproductive areas" and were therefore destroyed for reclaiming land for various economic activities (Hirway and Goswami, 2004). However, their ecological and economical importance was appreciated after an attack of Indian Ocean tsunami on 26th December, 2004. In this natural calamity, mangroves have acted as a natural "bioshield" and reduce the damaged caused by waves of tsunami. Since then, considerable efforts have been made for the monitoring and conserving mangroves especially in the South-East Asia (Feagin et al., 2010).

In the coastal area there is a competition for the availability of space. Unfortunately, along with mangroves, others stockholders are also interested in this region for the development of industries as well as for the urbanization. As a result of which the mangroves, coral reef, algal beds, estuaries and mud flats which are important constituents of the coastal ecosystem have become threatened throughout the world (Nayak, 2000). Hence, it is necessary to continuously map and monitor the various components of coastal ecosystem in order to protect them and subsequently the human lives and property.

In the present investigation, the mangroves were mapped using the remote sensing techniques for Hansot taluka, of Bharuch district, Gujarat state. Hansot taluka is located in Bharuch district in the south central Gujarat, India and constitutes a marginal strip of the southern Gujarat alluvial plain. It falls between 21° 35' 00 N to 21° 40' 00 N latitude and 72°37' 00 E to 72° 56' 00 E longitude with a total geographical area of 39861.4 ha (Anon., 1991) and has 46 villages (Figure.1). The area is delimited on the western side by Gulf of Khambhat and on southern side by Kim river and on eastern and northern side by Ankleshwar taluka. The annual rainfall received in this region was 1327.40 mm during the year 2010 (Anon., 2010) while the temperature ranged from 16° C to 45° C. Geomorphologically, the area is characterized by vast mud flats and a narrow strip of sandy beach on the western side where as on the northern side, relatively narrow belt of mudflat is present. The mudflats are dissected by small and large creeks all along the coastline and are covered with the coastal vegetation.

MATERIAL AND METHODS

To map and monitor mangroves considerable amount of data needs to be collected. There are two different ways of acquiring these data which includes the conventional method and remote sensing technique. The conventional method requires a lot of time, effort and funds, and at the end of the day gives information of only a small area where as, optical remote sensing with its synoptic, multispectral and repetitive coverage, proved to be very useful in the study of mapping mangrove areas (Nayak, 1994). In case of inaccessible region, this technique is perhaps the only method of obtaining the required data on a cost and time effective basis (Rao et al., 1996). In the last few years a considerable work has been carried out in mapping and assessing mangrove ecologies along the coastal regions of the world using the remote sensing techniques (Hardisky et al., 1986; Hurd et al., 1992; Scavia et al., 1995; Green et al., 1996; Perez et al., 2002; Tattu et al., 2008; Bhatt et al., 2009; Giri et al., 2011 and Ponnambalam et al., 2012, Khare et al., 2012).

Remote sensing technique consists of three steps: data acquiring, data analysis and data representation. The data acquiring includes the acquiring satellite image from the data delivering agency. For this study, the satellite image was downloaded from the U.S.Geological Survey (USGS), Global visualization viewer (Glovis) site. As, the main objective of the study is to map the mangrove cover the satellite image of Landsat 5, with TM sensor and spectral resolution of 7 bands and spatial resolution of 30m was selected. Based on the availability of the satellite data and low tide condition, the image acquired on the 30th January, 2011 was downloaded.

Organized by: *Faculty of Science, The M. S. University of Baroda, Vadodara, IEEE GRSS (Gujarat Chapter), ISG & IWSA (Vadodara Chapter), 5th October 2013*