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A review paper on 'Remote sensing studies in coastal zone management: A new perspective

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Abstract

The coastal zone represents varied and highly productive ecosystems. These ecosystems are under pressure on account of increased anthropogenic activity on the coast. It is necessary to protect these coastal ecosystems to ensure sustainable development. In most of the studies shorelines are manually digitized from satellite images and calculate the changes using remote sensing technology. GIS and RS technology has been recognized as one of the most dominant tool for quantifying the shoreline changes on temporal scales as it provides the information in digital form. ICMAM-PD has implemented a national project for monitoring the shoreline changes for entire Indian coast using satellite imageries to maintain a long-term database in GIS environment.

Keywords: Remote sensing studies, coastal zone management

Introduction

Coastal zone is a unique environment where land, sea and atmosphere interact and interplay continuously influencing a strip of spatial zone. It is endowed with a very wide range of sensitive habitats. 1. Biomorphological features:-Coral reefs, Mangroves, Sea grasses, Back Waters, coastal wetlands, Salt marshes, etc, 2.Geomorphological features:-Sand dunes, Mudflats, Beaches, Estuaries, Lagoons, etc

Coastal Zone Management

These zones are highly under pressure like, anthropogenic activities- Increase in population and Industrial developments, Natural activities- Erosion, Deposition, Periodic storms, Flooding and sea level changes. The coastal zone of world is under increasing stress due to development of industries, trade and commerce, tourism and resultant human population growth and migration, and deteriorating water quality. This region is of very high biological productivity and thus an important component of the global life system. Coastal ecosystems harbour wealth of species and genetic diversity, store and cycle nutrients, filter pollutants and help to protect shorelines from erosion and storms. Marine ecosystems play a vital role in regulating climate and they are a major carbon sink and oxygen source. The industrial development of coast has resulted in degradation of coastal ecosystems and diminishing the living resources of Exclusive Economic Zone (EEZ) in form of coastal and marine biodiversity and productivity. More than half population lives within 60 km of the coast and would rise to almost three quarters by 2020 (Anon, 1992). Episodic events, such as cyclones, floods, pose serious threat to human life and property in the coastal zone. Human activities also induce certain changes or accelerate the process of change.

Coastal Regulation Zone

The increasing pressure on the coastal zone due to concentration of population, development of industries, discharge of waste effluents and municipal sewage and spurt in recreational activities, has adversely affected the coastal environment. The population of coastal districts is increasing all over the coastal areas in the world. In India, the population on coastal regions is likely to increase to from 15 per cent at present to almost 40 per cent in next decade. In view of this, coastal stretches of bays, estuaries, backwaters, seas, creeks, which are influenced by tidal action up to 500 m from High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL has been declared as the Coastal Regulation Zone

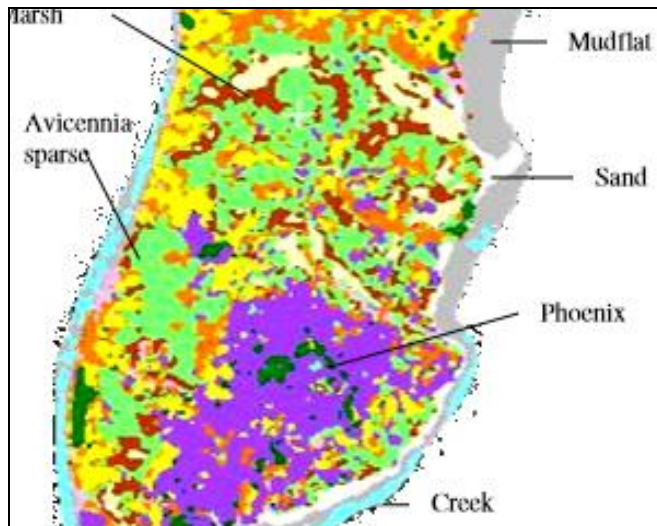


Fig 1: Biomorphological features

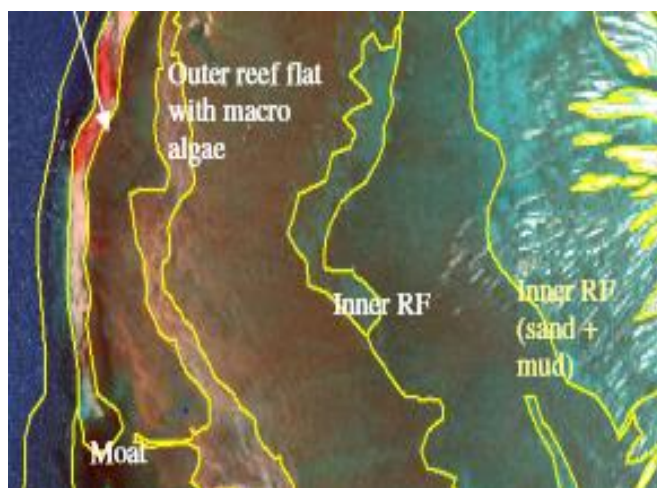


Fig 2: Geomorphological features

(CRZ). In world, many areas are being eroded and threaten the life and property of local population. The economic and human costs of the coastal erosion are growing as more people migrate towards coast. Healthy coastal ecosystems cannot completely protect coast from impacts of storms and floods, but they do play an important role in stabilizing shorelines and buffering coastal development from impact of storm. One of the major requirements of planning coastal protection work is to understand coastal processes of erosion, deposition, and sediment-transport, flooding and sea level changes, which continuously modify the shoreline. In order to ensure sustainable development, it necessary to develop accurate, up-to-date and comprehensive scientific databases on habitats, protected areas, water quality, environmental indicators and carry out periodic assessment of the health of the system. The modern scientific tools of remote sensing, GIS and GPS are extremely valuable in development of databases and to analyses them in the integrated manner and derive management action plans. Availability of repetitive, synoptic and multi-spectral data from various satellite platforms, viz. IRS, LANDSAT, SPOT, have helped to generate information on varied aspects of the coastal and marine environment. Ocean color data from OCANSAT I, OCM, SeaWiFS, MODIS, provide information on biological aspects useful for fisheries and coastal ecosystems.

Applications of Remote Sensing- Coastal land use /land cover mapping Wetland mapping, Shoreline changes, point pollution along the coastal areas. Status of coastal ecosystem, Marine water quality, Marine environment & climate change, Coastal aquaculture & fisheries and Coastal Hazards and state and central Govt. agencies also require data to monitor and evaluate the Urbanization in coastal areas, Effluents and pollution of Coastal areas, Coastal Shore line changes, Coastal developments and Coastal hazards and also required data to protect and conservation of Natural habitats like Coral reefs, Mangroves, Sea grasses, Back Waters, coastal wetlands, Salt marshes, Sand dunes, Mudflats, Beaches, Estuaries, Lagoons, etc,

Remote sensing technology in coastal zone management

The GIS and Remote sensing technology has been recognized as one of the most dominant tool for quantifying the shoreline changes on temporal scales as it provides the information in digital form (Nayak *et al.*, 2009) [2]. The major advantages of GIS are that it allows identifying the spatial relationships between features and temporal changes within an area over time. Remote sensing satellites images have been effectively used for monitoring shoreline changes of different locations.

Studies have been carried out using the data provided by these satellites in assessing the pattern and level of utilization of natural resources. Satellite imageries are useful tools for detecting the coastal morphology changes. RS data can be used to evaluate the coastal processes like erosion/accretion and shoreline changes. Geographic Information System is designed to work with data referenced by spatial/geographical coordinates.

Conclusion

Remote sensing techniques can be utilized as a general aid in the field of coastal zone management. It is more efficient than ground-based techniques. Satellite based remote sensing techniques provide comprehensive, reliable and up to date information at a minimal cost and time. The Tools like Remote Sensing, Global Information System, Global Position System are extremely valuable in development and analyse of Data in the integrated manner, Remote Sensing and GIS data information could play an important role in the formulation of policies along the coast this technology helps in not only coastal resource management but also for protection and conservation in the long run. Advances in remote sensing will enable quicker and more focused emergency responses. More accurate map production will leads to best navigation system in Offshore and On shore exploration. LiDAR, Multibeam Echosounder and a number of techniques are recently improved in this field for marine habitat exploration.

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