

Assessing the Changes on the Shoreline Due to Climate Change and Human Activities: A Review of Odisha.

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Abstract- Climate change is a very big term which has been there since the earth was formed. Climate change occurs naturally as well as has risen after the involvement of human activities increased. The impacts of climate change can be seen all over the world. The impacts are observed in all sectors such as agriculture, transport, forestry, coastal etc. Majorly the impacts of climate change are on the agricultural sector and on coastal sector. Coastal life is very important as one third population resides near the coast and our India is surrounded by water so the water body presence is more as compared to the land. Most of the people residing the coast are directly or indirectly relying on coast for their livelihood which also has direct as well as indirect impacts on the marine life. Coastal area is one of the key systems for global sustainability. Coastal regions gained importance because of multiple uses, like high productivity of the ecosystem, highly concentrated population, industrial friendly, waste disposal, tourism, transportation, strategic planning in military and many more. These coasts are always in a dynamic state trying to change, and nature always work for maintaining the equilibrium. Despite all these as mentioned above that Indian coasts are under threat due to multiple stresses like global climate change and human intervention. These stresses are driving vulnerabilities like sea-level rise, coastal erosion, frequent extreme events, and saltwater encroachment. In this scenario, coastal management has become one of the very important issues in last two decades. Thus, coastal vulnerability assessment methods have been developed to identify and manage vulnerable areas over the coast. In the present review, the main focus is on the coastal area is Puri beach and coastline from Sipasurubili and Mohanipur. Proper planning and protection strategies for Indian coast must be taken swiftly by the coastal management and policy makers to safeguard coastal ecosystem and livelihoods. In recent years, there has been much focus on the coastal vulnerability assessments using various kinds of data. Most of the reported studies over Indian coast are based on remote sensing and GIS methods.

Keywords- Climate change, Coast, Vulnerability, Remote sensing, GIS, Geo-referencing

I. INTRODUCTION

Coasts are mandatory to conserve because one third of population is relying on coastal life for their livelihood. Due to rise in the global warming the impacts of climate change on coast are severe. The extreme events have increased after the interference of anthropogenic activities. There was climate change when earth was formed but it was a natural process as soon as the industries came into existence the emissions of different kinds of gases lead to rise in the green house gases which was the key component for the rise in global warming and which gave rise to climate change. Due to climate change the impacts on coast are more as most of the population reside there it have become a common issue that there has been rise in the extreme events like flood, cyclone, tsunami etc. In the year 1999, the Super cyclone, also known as Paradip Cyclone hit Odisha with a speed of 250 kmph. It caused deaths of about 10,000 people and extreme damage in its path and destruction. That cyclone flattened lakhs of houses, uprooted trees and destroyed infrastructure, thousands of livestock were killed, paddy and other crop fields were submerged and hundreds and thousands of people were severely affected by the disaster. Those who were residing on the coast were fully dependent on the marine life for their food and earning but after the cyclone there was nothing left for their livelihood which also affected the economy of the state.

Puri is a district in Odisha which is famous for the Jagganath Mandir that is believed to be one of the char dham yatra. So clearly it can be said that the tourists and visitors will always be there due to ne or other celebration and as the population rate will be higher more will be the pollution which ill give rise to global warming due to which the impacts of climate change will be more severe. The construction and population has increased a lot in the last three decades which also means that the shops on the beach have also increased. There is very less difference between the coast and land. Due to climate change there are several impacts observed such as the change in precipitation leads to floods and droughts which may give rise to different kinds of diseases and affect the human health directly or indirectly. Even the warming of the oceans alters the food chain and the breeding and mating pattern of the

mammals which hampers the marine life. The pollution on beach and coast also has stopped migratory birds, olive ridley turtles to come and breed on coast or beach.

II. REVIEW OF LITERATURE

The purpose of this hydrological and climatological study is to know the impacts of climate change on water level of the ocean. This study was also done to know the variation of the shoreline delineation, rise in sea level and the impacts of climate change on the coast and marine life.

A large number of definitions of climate change are widely in use. Climate change in IPCC usage refers to change in the state of the climate that can be identified by the changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate change over time, whether due to natural variability or as a result of human activity.

Another recent and widely used definition by United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

Climate change refers to any change in climate conditions for any period of time, resulting either from the natural causes, or by human action. Recently, climate change has been directly linked to the intensification of emissions of greenhouse gases on the terrestrial atmosphere. (IPCC, 2007)

The two major reasons that lead towards the climate change, due to its prolonged impacts are natural activities and anthropogenic activities. Volcano eruptions, methane emission due to earthquakes and many more are few examples of natural activities. Whereas urbanization, industrialization are some of the examples of anthropogenic activities which plays a major role in enhancing the climate change.

The impacts of climate change are likely to worsen problems that coastal areas already face. Confronting existing challenges that affect the man-made infrastructure and coastal ecosystems are shoreline erosion, coastal flooding, and water pollution, which is already a concern in many areas. Addressing the additional stress of climate change may require new approaches to managing land, water, waste, and ecosystem.

A. APPLICATION OF REMOTE SENSING IN COASTAL STUDY

With the help of remote sensing and GIS a lot of data and information can be acquired for that place which cannot be done by field visits. All kinds of maps are available on the internet and with the help of RS and GIS and Georeferencing a lot of information can be obtained using the satellite data.

In India, Satellite based information has been used for generating inventory on coastal habitats, landforms, coastal land use and shoreline condition, condition assessment of protected areas, exploration of marine fisheries, mitigation of coastal disasters and understanding of sediment dynamics. GIS has been used for the integrating satellite based information for identifying aquaculture sites, coastal regulation and environmentally sensitive zones.

B. COASTAL CONSERVATION

In world, many areas are being eroded, threatening the life and property of local population. The economical and human costs of the coastal erosion are growing as more people migrate towards coast. Healthy coastal ecosystem cannot completely protect coast from impacts of storm 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 process of erosion, deposition and sediment transport, flooding, sea-level-changes, which continuously modify the shoreline. The historical and functional approaches to study shoreline changes along with

various landforms help in deciphering the coastal process of erosion, deposition, and sediment-transport, flooding and sea level changes, which continuously modify the shoreline. The historical and functional approaches to study shoreline changes along with various landforms help in deciphering the coastal process operating in an area (Shaikh, *et al.*, 1989, Nayak, 2000).

C. MONITORING COASTAL LAND-USE/LAND COVER CHANGES (LULCC) AND STATUS OF COASTAL ECOSYSTEM

Coastal land forms are unique and dynamic in nature and are vulnerable to the excessive anthropogenic pressure. Monitoring coastal Land Use/ Land Cover is important for making coastal zone management plan. The following tasks are required to be performed for this work;

- Mapping Land use Land-cover changes in coastal zone and identifying hotspots of land cover changes.
- Studying changes in coastal habitats
- Studying the relationship between anthropogenic pressure, LUCC and its impacts on the vital coastal habitats (coral reefs and mangroves)
- Predicting the changes in coastal habitats/identify hotspots due to LUCC
- In addition, other data utilized for this study are:
- Climatic, physical and biological parameters collected in the CZIS component
- Socio-economic data (past and present)
- Past land-use land-cover data from past revenue maps

III. STUDY AREA- A REVIEW OF CHANGES OBSERVED IN THE AREA OF INTEREST

Puri is present in the Odisha state and it is in the part of eastern India. It is located on east coast of India on Bay of Bengal. Puri is 60 km (37 mi) south of the state capital of Bhubneshwar. It is also known as Sri Jagannath Dhama. Earlier when roads did not exist, people used to walk or travel by animal drawn vehicles or carriages along beaten tracks to reach Puri. Puri is well known connected by rail, road, and air services. The nearest airport is Biju Pattnaik International Airport, Bhubneshwar. The nearest railway station is Puri Railway station which is 2 km away from Puri beach. The total area of Puri covers 16.3 km². The population density according to the census 2011 was 201,026. The language spoken is Odia. The climate of Puri is "Aw" (Tropical Savanna Climate)

The shallow subsurface layers and the layered structures developed along the coastal plains have got potential natural resources like groundwater, radioactive and non-radioactive heavy minerals and irrigable clay mixed soil. At same time due to natural calamities and anthropogenic interventions, these valuable shallow subsurface resources have been disturbed by erosion, pollution, sea water intrusion or salt water mixing in the coastal zones and degraded. Several research works have proved the carcinogenic radiation levels in groundwater tapped from these potential aquifers using Ground Penetrating Radar (GPR) and Geoinformatics technology. Coastal vulnerability can be stated as vulnerability of coastal landforms to hazards caused by flooding, inundation, wave action, littoral currents, tsunami and cyclone, which are common in Odisha coast (Srinivasa Kumar, 2010)

The research work of the shoreline delineation was divided into two components such as Remote Sensing and GIS based works and Field Surveys and related Laboratory works. Some suitable locations have been chosen for the work of GPR survey. The geomorphic units present in the coastal districts are categorized based on the origin of the landform and the associated processes of the specific geomorphic units. The revolutionary techniques such as Remote Sensing and GIS provide not only the platform for basic and in-depth researches, but also enables researchers to compare information about an area by incorporating Geophysical data such as GPR survey data and Litho-log data and groundwater quality. The GPR profiles also gave a better understanding about the subsurface layers, structural features, saline water interfaces and the geological properties of the study area. (Smita *et al.*, November 2018)

The eroded shoreline near Swargdwar in Puri swallowed by tidal waves has left the district administration and locals worried. This has affected the livelihood of many shopkeepers who line up on the beach with their make-shift outlets. Though erosion is a natural occurrence near shores, a 200 feet erosion spotted recently near the Chaitanya square to Swargdwar coastline. Following the erosion the district administrator has 'red flagged' many spots restricting the entry of tourists. A similar erosion had

taken place near Swargdwar in August 2016 following which a team of experts from IIT Madras had come for inspection of the shoreline. The experts attributed the erosion to the formation of current in the sea to non-release of water into rivers. (Odishatv.in, August,2018)

A. GIS IN THE STUDY OF LAND USE / LAND COVER

According to Zhou Y., (2004), Geographical Information System (GIS) has two important applications for its characteristic. On the one hand, GIS provides much data for the land use / land cover research. In land use / land cover change detection, land cover data and other GIS data can be used to make the detection. On the other hand, GIS provides many methods in the land use / land cover research. Many GIS methods from the simple spatial analysis such as algebra and overlay to complex GIS integrated models are adopted in the land use / land cover change detection, driving factors and impacts analysis. The GIS land use and land cover data can also be used to carry out various analysis such as image differencing, vegetation index differencing, selective principal components analysis, direct multi-date classification, post-classification analysis and so on (Coppin *et al.*, 2004; Mas J. F., 1999).

IV. CONCLUSION

The above studies states that climate change the impacts are increasing day by day affecting the population and coastal life directly or indirectly which leads to destruction of some habitats as well as migration and shifting of the people residing on the beach. If proper administration done than only we can conserve the coastal ecosystem and the people or else due to the rise in global warming and population on the coast the extreme events will also rise in future. By using Remote Sensing, GIS we can get information of upcoming events and according to that some future climate models can be prepared so that if any situation arises in future, the solution will already be ready and should be followed. The people should be made aware of the recent changes. The vegetation cover should be increased as it was decreased from the last past decades as the settlement has increased. The beach and coast should be less polluted so that the turtles or migratory birds or the coastal chain is not disturbed. Awareness about the climate change should be provided to the people. Public participation as well as administration participation together can be done to lesser down the effects of climate change, so that the impacts of climate change on each sector would decrease.

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