

# Mapping of Mangrove area of Curtorim Village- South Goa District- Goa- India- Using Remote Sensing and GIS Techniques

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**Abstract :** Human activities like agriculture, aquaculture, navigation and mining in coastal area led to destruction of mangrove habitat. Estuarine regions are densely populated due to its high productivity and prone to rising human pressures causing greater mangrove fragmentation and losses. Lack of spatial quantitative maps on mangroves for the west coast has often crippled restoration programmes. This study has been undertaken to understand mangrove area of Curtorim village (South Goa district) and also help to plan the strategies to monitor and protect such great biodiversity.

An analysis of remotely sensed images of May 2000 and April 2010 gives the clear idea about mangrove area of Curtorim village.

**Key words :** Goa, Curtorim, Remote Sensing and GIS, Mangrove flora, Diversity

## Introduction

Mangroves are trees and shrubs that grow in saline coastal habitats in the tropics and subtropics. They fall into two groups according to their habitats in nature: true mangroves and mangrove associates. True mangroves refer to species that specifically grow in intertidal zones, while mangrove associates are capable of occurring in either littoral or terrestrial habitats. Mangrove formations depend on terrestrial and tidal waters for their nourishment and silt deposits from upland erosion as substrate for support. Mangrove forests perform multiple ecological functions: they produce woody trees, provide habitat and detritus food for fish and shellfish and act as spawning ground for a variety of fishes, prawns and shellfishes. They harbour a variety of valuable fauna, including migratory birds. Remote

sensing is used as a tool for monitoring the changes, especially in forests, as it is inaccessible. It provides relatively accurate information regarding the status of vegetation in the forest and is cost-effective and time saving. Geographic Information System (GIS) and remote sensing tools are being extensively used to understand the changes in mangrove areas, for purposes of planning and management.

Curtorim is located at 15.28°N 74.03°E. It has an average elevation of 38 metres (125 feet). Zuari river flow from this village and meets to Arabian sea. Zuari River occupies approximately 5790 ha of water body, along about 145 km stretch of which 64 km is navigable. The estuarine mouth (Marmugao Bay) is about 6 - 7 km wide, while the upstream region narrows down to 0.5 km (Untawale *et al.*, 1982).



**Fig 1: Distribution of Mangrove flora along Zuari River- Curtorim Village, Goa-India**

**Materials and Methods**

For the above study simple image classification method and some primary data has been used. To record location of mangroves areas images, DGPS (Differential Global Positioning System) has been used. The secondary data like Google Earth image (April-2010, 1 m resolution) and Liss-III (9 May 2000, 23.5 resolution) image were used. Extraction of study area has been done from Google and Liss-III images with the help of Arc GIS software. On Google image visual vector classification has been done with help of ground survey. On the other hand Supervise classification has been done on Liss-III image with the help of ERDAS 9.1 software.

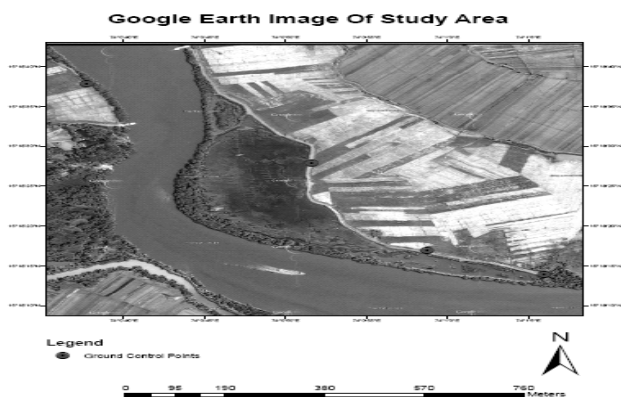
**Results and Discussion**

**Table-1- Sampling Stations**

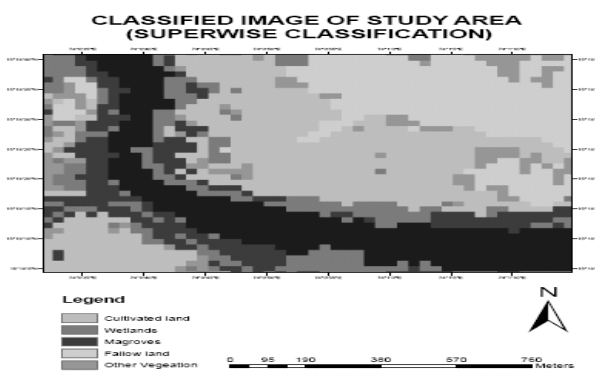
Sampling stations	Latitude	Longitude
Station-I	15°18'27.91658"	74°00'51.58836"
Station-II	15°18'16.90022"	74°00'58.72388"
Station-III	15°18'13.92315"	74°01'05.96435"
Station-IV	15°18'37.77878"	74°00'37.68192"

**Table-2 The Diversity of true mangroves and mangrove associate in selected sampling station at Curtorim village**

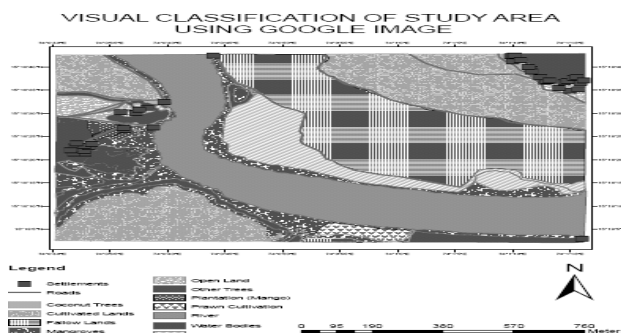
Sr. No.	Botanical Name	Family Name	Life Form	Stn. -I	Stn. -II	Stn. -III	Stn. -IV
1.	<i>Acanthus ilicifolius</i>	Acanthaceae	S	+	+	+	+
2.	<i>Avicennia officinalis</i>	Avicenniaceae	T	+	+	+	-
3.	<i>Sonneratia caseolaris</i>	Sonneratiaceae	T	-	+	+	+
4.	<i>Kandelia candel</i>	Rhizophoraceae	T	+	+	+	+
5.	<i>Rhizophora mucronata</i>	Rhizophoraceae	T	-	+	-	-
6.	<i>Acrostichum aureum</i>	Pteridaceae	S	-	-	+	-



**Figure1- Ground Control Points in Study Area**



**Figure 2- Supervise Classification of IRS Image**



**Figure 3- Classified Image of Google Earth**

Supervise classification has been done with 89% accuracy and we got the area under mangroves is around 190 sq. Km. While visual classification on Goole image gives area under mangrove vegetation is around 195 sq. Km. This difference has occur due to difference in spatial resolution of both the images.

However the sampling stations which are located on images shows following mangrove flora (Table-2)

**Station-I**

The selected station is an island along the Zuari river- Curtorim village. The area is dominated by *Kandelia candel* and along the border *Acanthus ilicifolius*, *Avicennia officinalis* were also recorded during survey.

**Station-II**

Five mangrove species were recorded in this area namely *Acanthus ilicifolius*, *Avicennia officinali*, *Sonneratia caseolaris*, *Kandelia candel*, and *Rhizophora mucronata*. Here the first three species are dominant and others are rare.

**Station-III**

At a distance of 1km-from stn.-II four true mangroves species called *Acanthus ilicifolius*, *Avicennia officinalis*, *Sonneratia caseolaris* and *Kandelia candel* were recorded along with one mangrove associate i.e. *Acrostichum aureum*.

#### Station-IV

This station is on other site of river bank and species like *Acanthus ilicifolius*, *Sonneratia caseolaris* and *Kandelia candel* are present here. On this site all three species of true mangroves are dominant.

#### Conclusion

As we know that mangroves grow in saline habitat but in this study area presence of *Sonneratia caseolaris* indicates that the water of this estuary is less saline.

Villagers use forest as resources for their livelihoods. This area has no protection. There is need to develop local support to protect this area and to restrict the human interference. The present information would form a useful tool for further studies and monitoring of these coastal ecosystems. The present study can help in formulating strategic plans to afforest mangroves.

#### References

- Agadi, V. V.; Bhosle, N. B. and Untawale, A. G 1978, Metal Concentrations in Some Seaweed of Goa (India); *Botanica Marina*; **21**(4): 247-250.
- Andhra Pradesh Remote Sensing Application Centre (APRSAC) 1999. Environmental management and monitoring of shrimp culture project, East Godavari District, Andhra Pradesh – land use/land cover. Hyderabad, India.
- Banerjee, L.K., Sastry, A.R.K. & Nayar, M.P. 1989. *Mangroves in India: Identification Manual*. Botanical Survey of India, Calcutta.
- Bhardwaj, R. K. 2007, Application of GIS Technology for Coastal Zone Management: A Hydrographer Perspective; [In: Management of Coastal Resources: An Introduction; (Ed.): Ranade, P. S.]; the Icafi University Press, Hyderabad; pp. 168-181.
- Brakel W.H. 1984. Seasonal dynamics of suspended sediment plumes from Tano and Sabaki rivers, Kenya; analysis of coastal imagery. *Remote Sensing Envnt.* 18: 165–173.
- Chakrabarti, P. 1995 Coastal Zone Management in Hooghly Estuary – An Operational Approach; *Indian Journal of Earth Sciences*; **22**(3): 125-134.
- Chapman, V.J. 1975. *Mangrove Vegetation*. J.Crammer Fl-9490, Vaduz, pp.425. Hajra, P.K. and Sanjappa, M. 1996 (eds.): Fascicle 22, *Fascicles of Flora of India*. Botanical Survey of India, Calcutta.
- De Souza, R. J. S. 2006, Remote Sensing and GIS Tools for Integrated Coastal Zone Management – Goa State; a Ph. D. Thesis Submitted to Goa University.
- Duke N.C., 1992, Mangrove Floristics and Biogeography; [In: Coastal and Estuarine Studies: Tropical Mangrove Ecosystems; (Eds.): Robertson, A. I. and Alongi, D.M.]; American Geophysical Union, Washington D. C.; 63-100
- Jagtap, T. G. 1983, Metal Distribution in *Halophila beccarii* (Aschers) and Surrounding Environment along the Central West Coast of India; *Mahasagar Bulletin of the National Institute of Oceanography*; **16**(4): 429-434.
- Kathiresan, K. & B.L. Bingham, Biology of Mangroves and Mangrove Ecosystems, *Advances in Marine Biology*, 40.
- Klemas V. and Bartlett D.S. 1975. Coastal zone classification from satellite imagery. *Photogramm. Eng. Rem. Sens.* 41:499–513.
- Kothari, M.J. & Rao, K.M. 2002. Mangroves of Goa, Botanical Survey of India, Kolkatta.
- Naskar, K. & Mandal, R. 1999. Ecology and Biodiversity of Indian Mangroves. Daya Publishing House, New Delhi.
- Rao, A. and Suresh, P.V. 2001. *Coastal Ecosystems of the Karnataka State, India. I. Mangroves*. Karnataka Association for the Advancement of Science, Bangalore.
- Swaminathan, M.S. 2005. Mangroves reduce tidal waves. The Rediff Interview, Jan, 17.
- Ramsey E.W. and Jensen J.R. 1996. Remote sensing of mangrove wetlands: relating canopy spectra to site-specific data. *Photogramm. Eng. Rem. Sens.* 62: 939–948.
- Ranga Rao V., Reddy B.S.R., Raman A.V. and Ramana Murthy A.V. 2003. Oceanographic features of the Bay – Mangrove waterways of Coringa, East coast of India. *Proc. AP Akademi Sci.* 7: 135–142.
- Reddy B.S.R. and Prasad K.V.S.R. 1982. The sand spit near Kakinada – further studies. *Indian J Ear. Sci.* 9: 167–173.
- Selvam V., Ravichandran K.K., Gnanappazham L. and Navamuniyammal M. 2003. Assessment of community based restoration of Pichavaram mangrove wetland using remote sensing data. *Curr. Sci.* 85: 794–798.
- Sery F., Ducrot D., Mougine E. and Fromard F. 1995. Mapping on mangrove forest of French Guyana using multisource data. In Proceedings of the IGARSS '95, IEEE 95CH35770, Florence, Italy, 10–14 July 1995 2: 1122–1124.
- Silapathong Ch. and Blasco F. 1992. The application of geographic information systems to mangrove forest management: Khlung, Thailand. *Asian Pac. Rem. Sens. J.* 5: 97–104.
- Terchunian A., Klemas V. and Asegovia M. 1986. Mangrove mapping in Ecuador: the impact of shrimp pond construction. *Environ. Manage.* 10: 345–350.
- Untawale, A. G. 2006, Change of Coastal Land Use, its Impact, and Management Options; [In: Multiple Dimensions of Global Environmental Change; (Ed.): Sonak, S.]; TERI, New Delhi; pp. 23-43