

# **REMOTE SENSING AND GIS APPLICATION IN BRACKISH AQUACULTURE IN NORTHERN PART OF ANDHRA PRADESH FROM SRIKAKULAM TO WEST GODAVARI**

R.Sivakumar<sup>1\*</sup>, Mrs.A.M. Kiruthika<sup>2\*</sup>, Dr. S. Suresh Babu<sup>3\*</sup>

<sup>1\*</sup> *II M. Tech (Remote Sensing),*  
<sup>2\*</sup> *Project guide,* <sup>3\*</sup> *Head of the Department, Dept of Civil Engineering,*  
*Adhiyamaan College of Engineering, Hosur*  
*Anna University, Coimbatore*

## **ABSTRACT:**

**Aquaculture development over the past 50 years has been facilitated largely by the application of science and the introduction of new technologies. Selection of potential and suitable site is the first and foremost step for successful brackish water aquaculture. Adequate engineering and water quality parameters (such as pH, alkalinity, dissolved oxygen, total ammonia, unionized ammonia, nitrate, total nitrogen, phosphorus, BOD, COD and electrical conductivity), soil quality and topography are the most important parameters of a good site. LANDSAT ETM + 60m resolution imagery as revealed the various land forms as well as land use, land cover features in a part of srikakulam, vizianagaram, Visakhapatnam, east Godavari, west Godavari delta coastal belt. The land use/land cover as indicated that the aquaculture has phenomenally increased by 9,293.5 ha during the 9 year period at the same time, the crop land which occupied about 29,104 ha in 2001 has been reduced to 14,153.9 ha by 2010 mainly due to encroachment of aquaculture. The 5 districts of along coastal area lands which are designated as 'aquaculture ponds' are grouped in 2perioditic classes based on the intensity of conversion.**

## **INTRODUCTION:**

Commercial aquaculture has gained global attention not only due to its role and strengthening the economy of a country but also due to sudden collapse of the industries in some countries. The aquaculture bloom along the east coast region of India in 2001-2010(2), has transformed the landscape and environmental conditions in recent years. The coastal belt of Godavari delta is one such area where aquaculture activity is spreading a rapid pace into barren dry mudflats, mangrove and also fertile crop lands. Conversion of agriculture and mangrove areas for aquaculture leads to salination of surface water resource and agricultural land, besides causing pollution and disease. Hence it is desirable to monitor the trends in aqua culture. So that effective measures can be taken to spread of aquaculture into productive agricultural land. The modern techniques of remote sensing and geographic information system are discussed (1) for various other issues to aquaculture useful tools for analyzing the trends in land use/land cover through the time. In this paper, An attempt is made to study the extent change in land use practices due to the aquaculture boom in the srikakulam, vizianagaram, Visakhapatnam, east Godavari, west Godavari coastal belt, particularly to

highlight “aqua culture” hotspots at village level.

## **STUDY AREA:**

The srikakulam, vizianagaram, Visakhapatnam, east Godavari, west Godavari, Godavari delta region has witnessed a large scale aquaculture development during the recent years along its 460 km long coastal belt as evident from the satellite imagery of the area in the year(1994) (1). While the aqua culture has encroached onto to the mangrove swamp zone in the north eastern part of the delta, its spreads is mainly into the agricultural land in the southwestern parts(4). Most of the Aquaculture farmers are cultivating fishes like vannamei, tiger fish, prawn, crab, etc., In order to achieve the stated objective if identifying the ‘aquaculture hotspots’ at the village levels, the northern part of the coastal belt where the aquaculture is encroaching predominantly onto the crop land is selected for the study (3). The study area consists of the 5 districts constituting here revenue mandals namely srikakulam, vizianagaram, Visakhapatnam, east Godavari, west Godavari in district of Andhrapradesh spread over an area of about 89426 km<sup>2</sup>.



### DATA USED:

In the present study various types of data have been used. It includes different satellite data (Land sat TM, SRTM), thematic maps, field-measured data and other relevant published information etc. The thematic maps on land-use, land capability associations and watershed were used for the study.

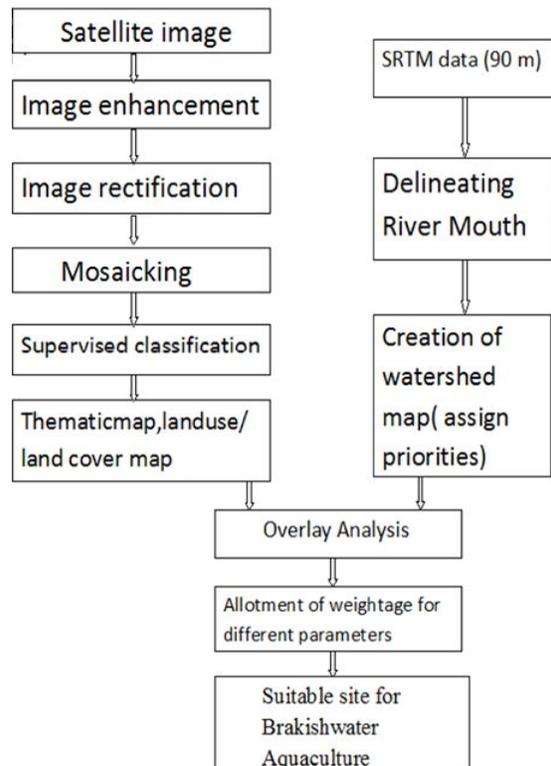
### SOFTWARE USED:

- ERDAS IMAGINE 9.1
- GLOBAL MAPPER
- ARC GIS

Most of the area under intensive agriculture with many crop combinations supported by a dense network of irrigation canals on the ground water resources. The dominant crop in this region is paddy followed by tobacco, sugar cane and vegetable crops. Coconut plantations are also prevalent in this region (2). Coastal sandy areas are covered with casuarina plantations.

The general climate of the area is tropical monsoonal type with an average annual rainfall of about 996mm, about 73% of which occurs during the south west monsoon (June to September) while the retreating monsoon season (October to November) accounts for the rest of the rainfall (5). October is the rainiest month. Mean monthly temperature ranges from 21° to 41°C. As the study area adjoins the Bay of Bengal, the sea breeze renders the climate moderate to some extent.

### METHODOLOGY

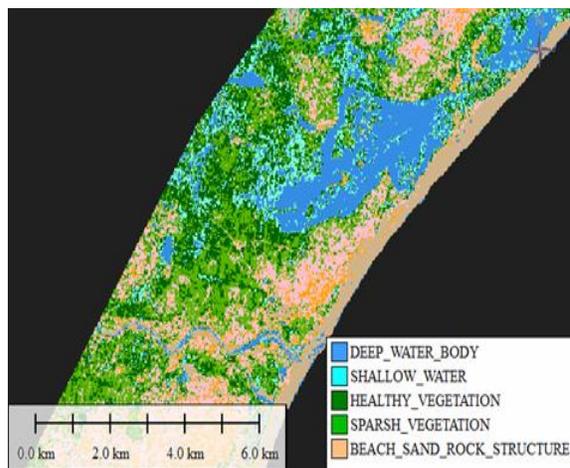


**LANDSAT ETM+60m** resolution (path 103/row 061) digitally processed and the various geomorphologicland use/ land cover features where interrupted, flats, all screen digitizing was made to map aquaculture ponds based on the geometric boundaries.

Further aquaculture villages were identified and are grouped in to four priority classes, based on the magnitude of conversion of agriculture land in to aqua culture pond at each village (8).

#### **LAND USE LAND COVER MAP:**

Land use refers to the land which is occupied by human beings for various activities and land cover refers to the land covered by natural resources like forest, water resources etc. land use land cover map was prepared for North Andhra Pradesh using LANDSAT thematic mapper images.



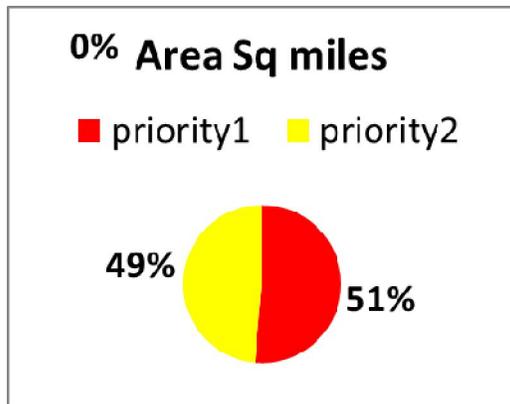
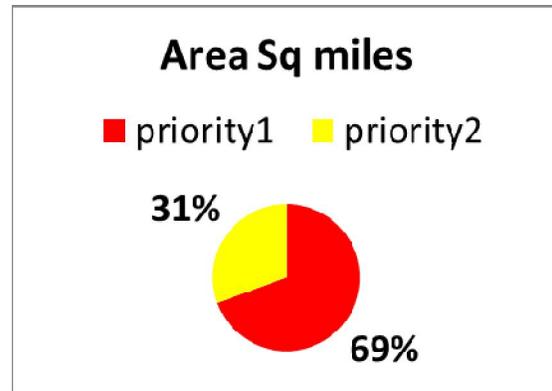
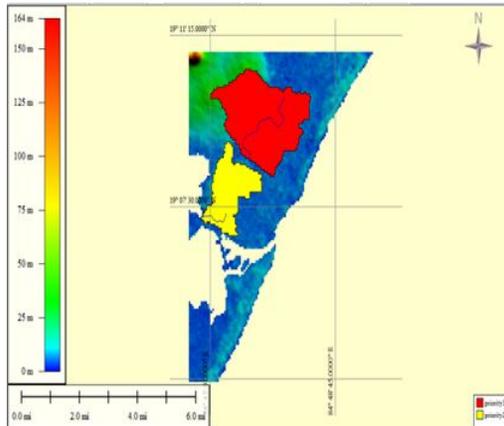
#### **WATERSHED MAP FOR VARIOUS RIVERS**

Watershed maps were prepared for major rivers of Andhra Pradesh using global mapper and ERDAS software.

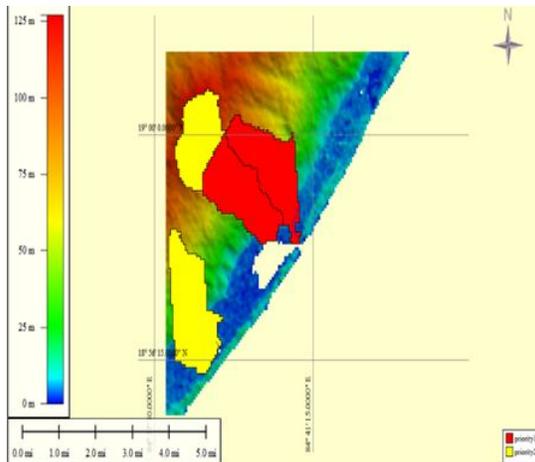
In the GIS analysis of the land use, land cover data sets of 2001 and 2010. Similar change matrices were also prepared separately for all the villages indicating the nature of changes in various land use land cover categories in each villages between 2001 and 2010 (9). Of all categories, the reduction in the extent of agriculture land and increase in the aquaculture are quiet significant in the study area

On the whole, the agriculture to aquaculture conversion is considered as a better indicator of the land degradation in the area rather than the overall increase in the extent of the aquaculture (10) which would be due to conversion of barren mudflats as well.

**MACHILI RIVER**



**GODAVARI RIVER**



**RESULTS AND DISCUSSION:**

The study area is more or less, a low-lying coastal plane devoid of any major relief. From the year less studies, it is clear that the regional owes its origin to fluvio-marine process. This study has identified several areas suitable for shrimp farming. From the identified area, highly suitable and moderately suitable area are mapped based on priority (highly suitable – priority 01, whereas moderately suitable – priority 02). The results of this study were confirmed by the fact that many farms already exist in those areas, which were classified as suitable for brackish water aquaculture.

From the watershed map, not all the creek are suitable for brackish aquaculture only some few of them are suitable. Because of low elevation where sea level rise submerges the ponds and high saline water intrusion. Because the priority 2 has most preferable in nature. By this, it is recommended to undergo shrimp culture

by pumping methods, because it is slightly elevated area. The watershed map of Vaghotanriver are best suitable for aquaculture and also it has priority 1.

Sl.no	District	Area under prawn culture (ha)
1	Srikakulam	140
2	Visakhapatnam	256
3	East Godavari	300.35
4	West Godavari	540.20

Based on the tonal variation, linearity of the features and vegetative associations, coupled with field evidences, the various land forms in the region have been identified from the satellite imagery. The major geomorphic features identified in the region are sandy beach ridges, dry paleo mudflats, present mudflats, tidal inlets/creeks, tidal pan and fluvial plain(8).

Land use describes how a parcel of land is used such as for agriculture, settlements or industry, where as land cover refers to the material such as vegetation, rocks or water bodies hat are [present on the surface. While both these terms are found to be used interchangeably, the term land use is more commonly to the human activity on the earth's surface. The enormous population pressure, economic potential and the entrepreneurial attitude of majority of the farmers in the Godavari delta region

have sufficiently transformed the land use land cover pattern of the area, especially during the recent years. Owing to the fertile soils, availability of irrigation water through canals and or the ground water, the area supports intensive agriculture throughout the two main cropping seasons called as 'sarva' (kharif) and 'dalva' (rabi)(6). In both these crop seasons, the dominant crop grown in paddy. Besides these other important crops like sugarcane, banana, turmeric, and horticulture are also grown. The land use land cover features that have been identified in the study area are built up land, agriculture land, coastal plantation, aquaculture, dry palaeo at mudflats, mudflats, sandy area, water load area, tidal channel/creek and canal/drain.

Land farms control human landuse activities of any region. Even in this monotonous plane area under the present study, the control land forms over the land use activities is clearly evident. The predominant paddy crop in the palaeo mudflat zones in the area is a glaring example of this phenomenon. The marine clay substratum and brackish soil – water conditions do not favour the growth of vegetation here. However, with the availability of canal irrigation, paddy is grown in this area as the soil salinity is not allowed to affect the crop under the flood irrigation. As such land forms, namely

dried up palaeomudflats are suitable flood irrigated paddy crop(7). The study reveals that most of the aquaculture activities in the area are confined to the mudflat regions. The availability of brackish water through tidal creeks as well from the ground water sources in this area facilitates aquaculture growth. Realizing this, palaeo mudflats zones, which are traditionally under paddy crop are also being converted in to aquaculture in the recent years.

Similarly, the presence of settlements on the beach ridges is also an example of control of geomorphology over land use landcover. Almost 92% of the settlement in the study area located over the beach ridges, which with their relatively elevated ground, offer protection from frequent floods in this low lying coastal region. The major settlements of the study area namely Srikulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari and others are situated on the elevated beach ridges. Furthermore plantations like coconut, casuarinas, and cashew are mostly confined to beach ridge zone. Since the sandy soil and ground water availability are favorable.

#### **CONCLUSION:**

Aquaculture is increasing at a rapid pace in the coastal tracts of Godavari delta, has evident from the satellite imagery of 2001

and 2010. Extraction of data on aerial extents of different land use and land cover features of the study area through GIS analysis as held in identifying what are called 'aquaculture' ponds the villages in which the cropland is being extensively converted in to aquaculture ponds. The study also highlights the importance of Remote Sensing and GIS techniques in identifying this type of environmental degradation due to unplanned human activities even at village level.

#### **REFERENCES:**

- 1) Anderson, J.R., Hartzel, E.T., Roach, J.T. and Witmer, R.E. (1976). A land use and land cover classification system for use with remote sensor data
- 2) U.S.G.S. Prof. Paper no.466, pp 1-26 Gupta, M.C., Krishnarajan, V.P. and Shailesh Nayak, (2001). Brackish water aquaculture site selection in coastal tract of Cannore (Kerala) using remote sensing and GIS techniques.
- 3) Hema Malini, B., Sarma, V.V.L.N., Murali Krishna, G., Naqvi, S.A.S and Nageswara Rao, (2002) Impact of human and land use practices on the occurrences of droughts- a case study of Godavari delta region, *J. Applied Hydrology*, 15 (2&3) 26-31.

- 4) Sarma, V.V.L.N., Murali Krishnan, G., Hemamalini, B. and Nageswara Rao, K. (2001) Land use and land cover change detection through remote sensing and its climatic implications in the Godavari delta region, *J. Ind. Soc. Remote Sensing*, 29 (1&2):85-91
- 5) Holdahl (1991) An interferometric SAR studies of subsidence in Houston, Texas
- 6) Alagarwami, K. (1994). Environmental Assessment and Management of Aquaculture Development. Country Report, FAO/NACA Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development.
- 7) Durairaj S (1996). Current Status of Coastal Aquaculture in Tamil Nadu, Proceeding of National Conference on Sustainable Aquaculture, held at Centre for Water Resources & Ocean Management, Anna University, Madras from April 5-6, 1995, pp. 24-28.
- 8) Macintosh, D. J. and Phillips, M. J. (1992). Environmental issues in Shrimp Farming. In: H. de Saram and T. Singh (Eds.) Shrimp 92, Hongkong. Proc. Of the 3rd Global Conference on 'The Shrimp Industry', Hongkong, September 14-16, 1992. INFOFISH, Kuala Lumpur, Malaysia.
- 9) Ahmad, E., 1972. Coastal geomorphology of India. Orient Longman, New Delhi, 222p.
- 10) Krishnamoorthy, R., 1995. Remote sensing mangrove forest in Tamil Nadu coast, India. Ph.D. thesis, Anna University, 202p.