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Tsunami flood damages assessment in Cuddalore district using remote sensing technology

C. Pandiammal[1], J. Senthil[2*] and P. H. Anand[2]

[1]Department of Geography, Govt. Arts College (A), Karur, Tamil Nadu, India
[2]Department of Geography, Govt. Arts College (A), Kumbakonam, Tamil Nadu, India

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ABSTRACT

This study is an attempt to identify the damages area of cuddalore district due to tsunami. Remote sensing technology has been applied in the study of structural damages in the coastal belt of the district. East coast is worstly affected due to Tsunami of 26th December 2004 and several changes along the coast happened In this study, the main focus was to generate damage mapping to measure the extent of the area prone to Tsunami. IRS-P6 LISS III data dated 17 April 2004 and 19 March 2005 with a resolution of 23.5 meters are processed to obtain the pre- and post-tsunami conditions along the coastal zone.

Key words: Remote Sensing, Tsunami, IRS

INTRODUCTION

Cuddalore district is one of the districts in Tamilnadu, which is severely affected by Tsunami at 26th December 2004. There are severe damages to the life and property throughout the district. The seawater inundation levels of 200m to 3000m are noted at different villages of the district. The worst affected habitation is Devanampattinam, Akaraigori, Sonankuppam, Ariyagosti, Koththattai, Gunduuppalavadi and Killai where the maximum inundation level is approximately 3000m. This is due to the presence of mouth of Gadilam River at this region. The location of the villages namely Sonakuppam and Akkarigori situated in the midst of the river mouth of Gadilam and Uppanar River. Devanampattinam, Koththattai and Ariyagosti are severely affected although there is no river mouth because of the settlement pattern that are in very close proximity to sea shore i.e. the houses are less than 100m from the sea shore. Parangipettai is also severely affected due to the presence of the Vellar river mouth. Killai Village is one of the severely affected and notable villages due to the presence of velar river mouth in the north and Khanshahip cannal in south and backwater in the east. In case of Gunduuppalavadi village there is Pennai river mouth in South. There is various relief and rehabilitation activities carried out throughout the district by various departments. The departments that provided relief amount to the people include Human resource, Fisheries, Animal husbandry department etc. Human resource department provided relief amount to the loss of life, injury, destruction of the houses, loss of employment etc. Fisheries department provided relief amount to destruction of boats, catamarans, nets, Vallams and other fishing equipments. Animal husbandry department provided relief amount to loss of livestock. Health department provides first aid and treatment to the affected victims of the habitations. This geographical information base provides data and mapping of the above-mentioned impacts and relief work carried out by various departments.

REVIEW OF LITERATURE

The Tsunami event of December 26, 2004 in the Indian Ocean had a profound impact on the south-eastern coast of India. In general, the state of Tamil Nadu in India suffered maximum damage in terms of life and property [1,2] The effects of Medu (naturally elevated landmass very close to the seashore and elongated parallel to the coast) and coastal topography on the damage pattern during the deadliest Indian Ocean tsunami of December 26, 2004 is reported**.** [4] The prevention of natural disasters is not feasible but the destruction it conveys could be minimized at least to some extent by the postulation of reliable hazard management system and consistent implementation of it. [3] The tsunami generated by the December 2004 Sumatra-Andaman earthquake had a devastating effect on some parts of Kerala coast, which is a coast located in southwest India. Results of post-tsunami field surveys carried out to understand the changes in coastal morphology and sediment characteristics in the worst affected Kayamkulam region of Kerala coast are documented.[6] The Tamil Nadu margin, in particular the Cuddalore area was the worst affected by the tsunami surge and inundation caused by the great Sumatra earthquake of 26 December 2004 (*M*w 9.3). Surge heights in this part were of the order of 2 to 5 m, with inundation of the order of few hundred metres into the interior coast, thus causing huge loss of human life and property. Several reasons were attributed to the unusual surge in this part of the Tamil Nadu margin, the main reason being its relative proximity to the origin of the event, apart from the concave nature of the shelf with a gentle gradient. (5)

OBJECTIVE

a. To demarcate the tsunami affected area and mapping
b. To assess the impact of Tsunami along the Cuddalore Coastal villages using IRS-P6 LISS 3 digital data.

MATERIALS AND METHODS

Secondary data for digital image, Indian Remote Sensing IRS-P6 LISS 3 data dated 17th April 2004 for before Tsunami and 19th March 2005 for after Tsunami to Cuddalore district collected from National Remote Sensing Agency (NRSA, Hyderabad). Resolution is 23.5 m used to access the impact due to Tsunami and useful in identification of destructions to various features both natural and manmade. From this destruction throughout the district was estimated.

RESULTS AND DISCUSSION

Natural disasters are not new to Tamilnadu State, the State being located in a highly vulnerable part of Peninsular India frequently subjected to overwhelming devastation by cyclonic storms, floods and drought. The State faced seven severe / very severe cyclonic storms in the last decade. The cyclonic storms are more frequent in the Bay of Bengal than in the Arabian Sea and records indicate that from the beginning of this century about 400 cyclonic storms formed in the Bay of Bengal as compared to just 80 in the Arabian Sea While the State is familiar with the kind of disasters mentioned above, the tsunami that struck the coast of Tamilnadu on 26th December 2004 was totally unprecedented and very destructive because of its suddenness. It was also widespread in scale affecting villages and towns all along the coastline. The death toll crossed 6000, thousands of people lost their houses and lakhs lost their livelihood. The coastal economy has been paralyzed due to the loss of fishing gear and fisheries related infrastructure. The State Government acted immediately and swiftly to alert the district machinery into action. It provided discretionary funds to Collectors to mobilize human and material resources for immediate relief and rescue operations.

Roads and electricity supply were restored within 72 hours. Government sanctioned relief to various categories of persons such as persons who lost their livelihood and sustained house Damages, people who lost livelihood, orphans, destitute widows, small traders, adolescent orphaned girls, farmers, small-scale industrial units, etc. The Government also moved swiftly to provide temporary accommodation to the people who lost their houses. The relief operations continue to Provide sustenance packages to those who lost their livelihood in an effort to sustain them till they can get back to normalcy The joint mission of World Bank, Asian Development Bank and UN agencies visited Tamilnadu on an assessment mission. Consequent on their field visits and discussions with the officials of the State Government, a programme for the reconstruction of tsunami-affected areas has been formulated to revive livelihoods and promote recovery in these areas. The actual assistance has been flowing from different sources including Government of India, multilateral funding agencies and non-governmental organizations including Corporate. Other State Governments have also been extending assistance to some of the reconstruction activities.

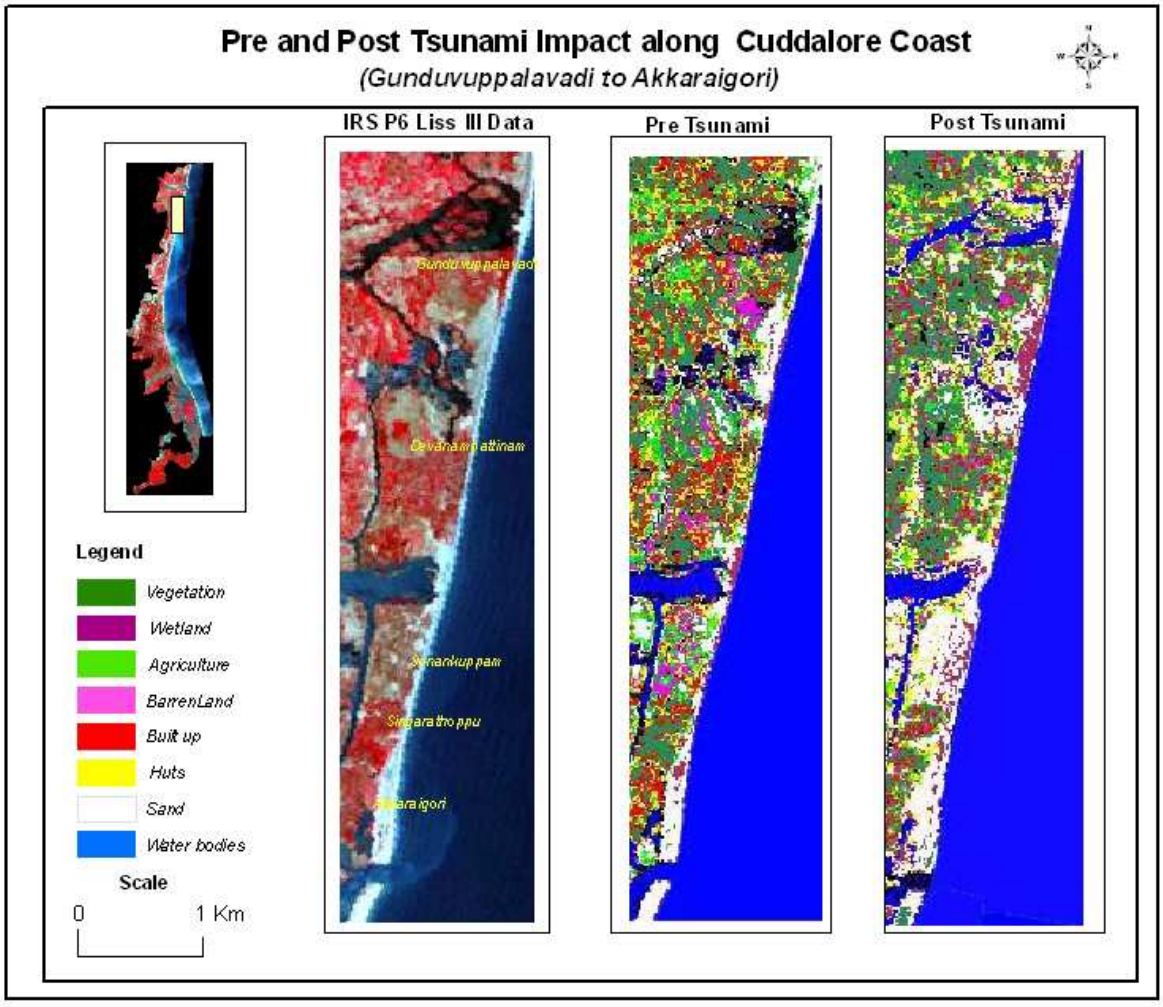

Fig -1

Fig 1 and table 1 shows the classified map of the affected villages of the Cuddalore district from Gunduppalavadi to Akkaraigori. Eight parameter is used to analyze the tsunami destruction in this coastal village. It is obtained from the table the features such as Wetland, Sand and water bodies are found increased after Tsunami and other features taken as parameter are seen decreasing this is impact of tsunami in the district

Table - 1 Satellite Image Classification Result Cuddalore District (Gunduvuppalavadi to Akkaraigori)

S.No	Region of interest	Before Tsunsmi (Area in Sq,mt)	After Tsunami (Area in Sq.mt)
1	Built-up	1610361	701358
2	Huts	1337550	1156964
3	Barren land	654416	621834
4	Wetland	500891	946004
5	Agriculture	1032155	728417
6	Sand	1546300	261379
7	Vegetation	481562	350126
8	Water bodies	8232943	8831030

Source: IRS P6 LISS III Data

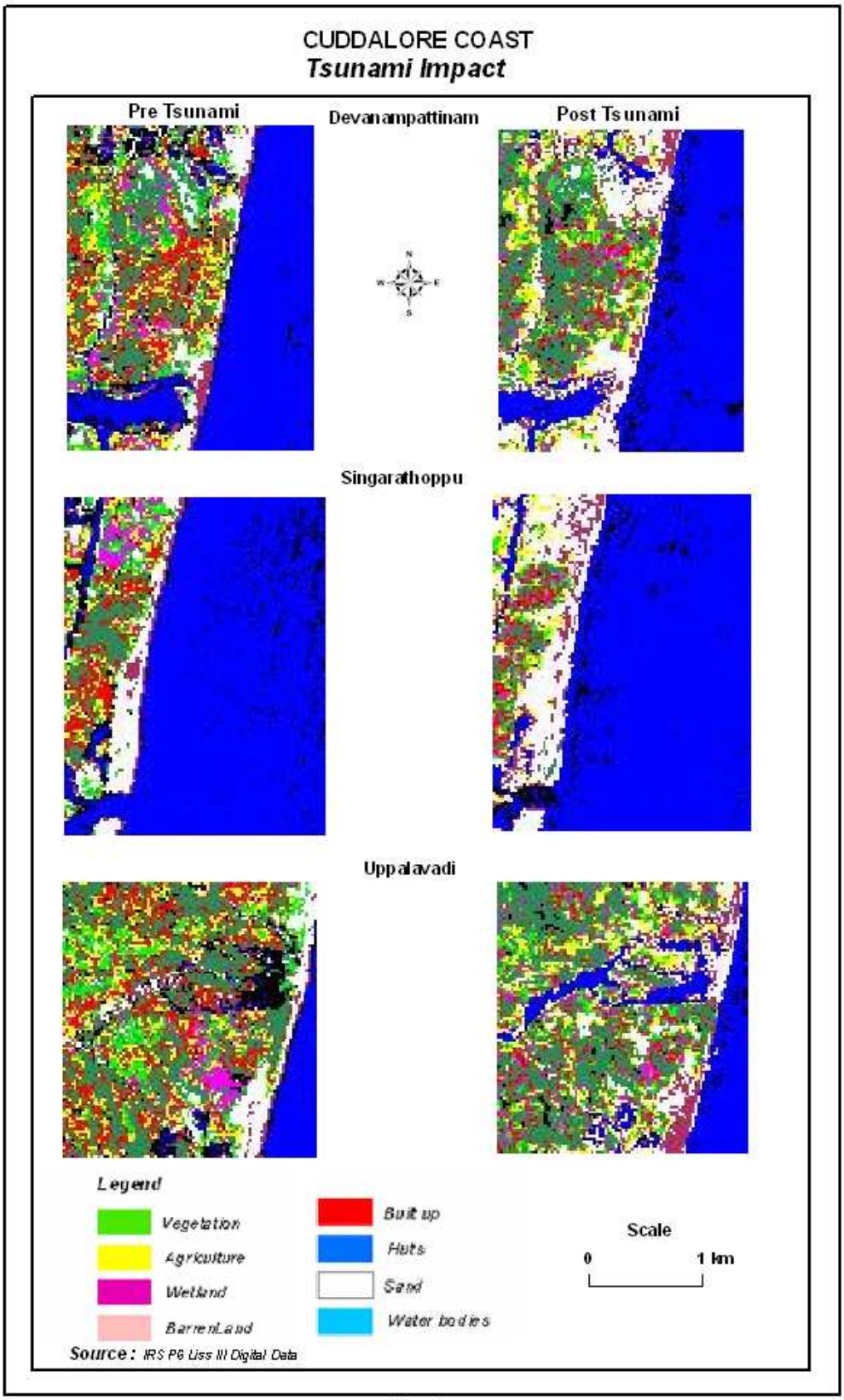
CUDDALORE COAST
Tsunami Impact
Pre Tsunami
Devanampattinam
Post Tsunami
Singarathoppu
Uppalavadi
Legend
Vegetation
Agriculture
Wetland
BarrenLand
Built up
Huts
Sand
Water bodies
Scale
0
1 km
Source: IRS P6 Liss III Digital Data

Fig -2

Fig 2 and Table 2 shows the classified map of the affected villages in the Cuddalore district. It provides very clear and in depth information about the selected three most affected Villages namely Devanampattinam, Singarathoppu and Uppalavadi in Cuddalore district regarding changes in the coastal area due to Tsunami impact. Sand is found deposited at many places along the coast and in some places wetlands are found distributed. Other feature such as huts, Built ups, Vegetation and barren land is found decreased in the post tsunami image.

Table 2 Satellite Image Classification Result for Singarathoppu Village

		Singarathoppu Village		Uppalavadi Village		Devanampattinam Village	
S. No	Region of Interest	Before Tsunami (Area in.sq.mt)	After Tsunami (Area in.sq.mt)	Before Tsunami (Area in.sq.mt)	After Tsunami (Area in.sq.mt)	Before Tsunami (Area in.sq.mt)	After Tsunami (Area in.sq.mt)
1	Built up	259005.25	113764	810703	354545	810703	354545
2	Huts	224213.5	198258	624594.75	509175	624594.75	509175
3	Agriculture	272259.25	119286	489845.75	478249	489845.75	478249
4	Vegetation cover	404799.25	235259	1613674.5	1517583	1613674.5	1517583
5	Water bodies	5144208.75	5221524	483771	960363	483771	960363
6	Wetland	156286.75	303185	143032.75	360067	143032.75	360067
7	Barren land	173406.5	73449.3	226422.5	329693	226422.5	329693
8	Sand	603057	1085724	470517	641715	470517	641715

Source: IRS P6 LISS III Data

CONCLUSION

Earthquakes and tsunami waves are damage structural and nonstructural basics within the construct environment. Essential infrastructure roads, power plants, harbors, banking, etc. can be damaged which will shut down a district All structures along the low lying coastal area are mostly affected due to tsunami waves, and the remains brought by these waves. Settlements in coastal areas are severely affected floods and clean. Structures constructed of, mud, wood sheets, thatch, and structures without appropriate anchorage to foundations are disaster from tsunami waves and flooding. Other infrastructure facilities like ports and telephone, harbors, and electricity post, and cables. Ships and fishing boats near the coast are damaged and destroyed.

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