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FLASH FLOOD DISASTER IMPACT AND ASSESSMENT IN CUDDALORE DISTRICT, TAMILNADU, INDIA

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ABSTRACT

The Present study to assess the flood disaster in Cuddalore District during November 2005 floods, Indian Remote Sensing Digital P6 LISS-III data was used to map the flood affected areas. Nowadays, modern techniques and tools especially remote sensing help the planners to evaluate the potential of natural dangers caused by flood Two important flood aspects were delineated and they are: a. Impact of flood in general and b. Impact on flood on agriculture in the study area. A field investigation was carried out using the GPS as well as the Indian topographical map for identification of features after the flood situations and also for near accurate classification. The classification adopted in the study area is major breaches, river and tank water, floodwater intrusion areas, water with scrub, water with mud, and unaffected area.

INTRODUCTION

The seasonal rainfall has turned into torrential rainfall with several cyclonic formations in the Bay of Bengal has devastated the entire coastal district of Cuddalore. Several river breaches were reported and breaches along the western parts of the Veeranam tank. As per the information available on November 12, 2005, the tsunami-affected areas of Thevanampattinam were coping with rain havoc. It is a precarious existence for those living in temporary shelters in the coastal village of Thevanampattinam. After the tsunami battering, they face the hardship caused by the heavy rain. The shelters have been waterlogged for the past one-week. 154 temporary shelters on Kathirvel Street in the village, located at the confluence of Then Pennaiyar and the sea, face inundation. Whenever there is a high tide, the river overflows. When Sathanur Dam was opened to let out surplus water, the river was in spate and the people had to bear the brunt. The shelters were filled with slush up to one foot. They dug trenches to drain water, but could not cope with the heavy inflow. Many inhabitants fell sick. Medical needs were not taken care of, whenever rain stopped. Flood is a major environmental problem in India as it has devastating effects on life and property. (G.D. Bhatt 2014) Flood hazard mapping is a vital component for appropriate land use planning in flood prone areas. It creates easily-read, rapidly accessible charts and maps which facilitates the administrators and planners to identify areas of risk and prioritize their mitigation efforts (Ajin 2013). Flood is one of the most devastating natural hazards which lead to the loss of lives, properties and resources. It has therefore become important to create easily read, rapidly accessible flood hazard map, which will prioritize the mitigation effects. (Eric Kwabena Forkuo 2011). Flood is one of the most harmful disasters in the world, and it is significant to obtain reliable information on flood characteristics for disaster mitigation. (Mohammed Nanoh Bello 2014)

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Objectives

To assess the damages caused in general and agricultural lands in particular due to several breaches along the rivers, streams and tanks in the study area. To demarcate the river breaches that lead to free flow of water into the rural as well as urban areas and damages

MATERIALS AND METHODS

To assess the flood disaster in Cuddalore District during November 2005 floods Indian Remote Sensing Digital P6 LISS-III data was used to map the flood affected areas , A base map for Cuddalore District was initially prepared using 12

Survey of India topographical maps for the study area such as 58 M/2, 58 M/3, 58 M/5, 58 M/6, 58 M/7, 58 M/9, 58 M/10, 58 M/11, 58 M/12, 58 M/13, 58 M/14 and 58 M/15 in the scale of 1:50,000 and it is converted into digital data by scanning and on screen digitization method (OSD). Scanned topographical maps are then georeferenced using the software tool, ArcGIS 9.0. Spatial features needed for the study are digitized. The Indian Remote Sensing P6 LISS III digital data was obtained from the NRSA and subjected to various digital image-processing techniques using the ENVI 4.1 software. The data was procured from the NRSA for the time period of 8th December 2005 and the revisit of satellite was just 2 to 3 weeks after the floods in the Kaveri delta region.

Initially the image for the study area was georeferenced mechanically using the leader file in ENVI. The optical data was cloud free of more than 95 per cent. The technique implied was the supervised classification method using the Spectral Angle Mapper in the module. Two important flood aspects were delineated and they are: a. Impact of flood in general and b. Impact on flood on agriculture in the study area. A field investigation was carried out using the GPS as well as the Indian topographical map for identification of features after the flood situations and also for near accurate classification. This would also confirm the feature observed in the field and in the image and it is mainly due to the fact that the flood affected features need to be identified for flood assessment.

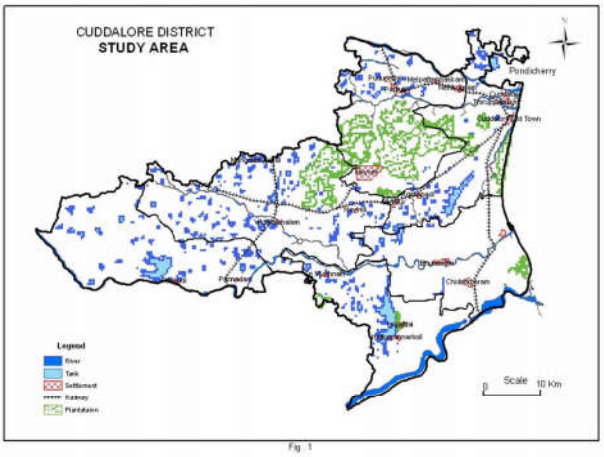

Fig. 1

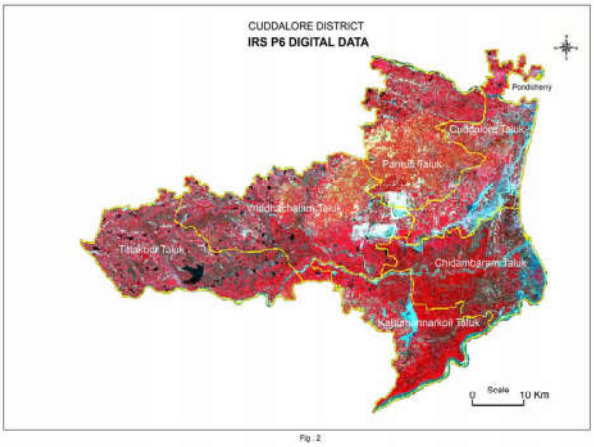

Fig. 2

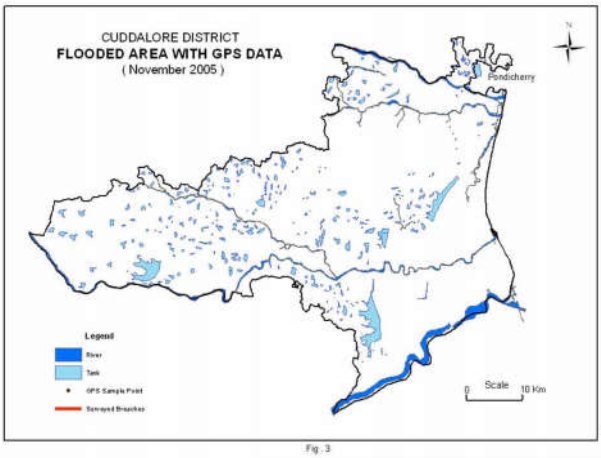

Fig. 3

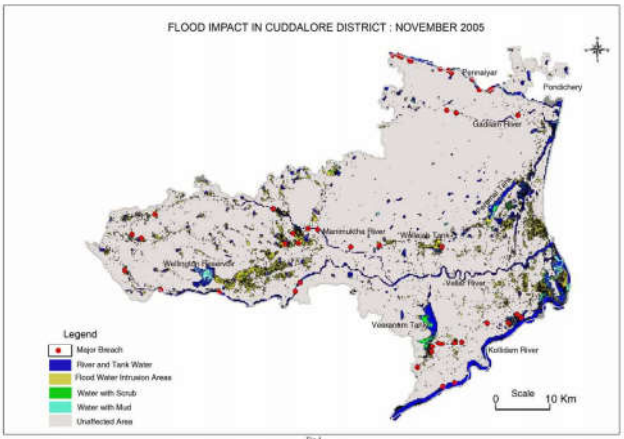

Fig. 4

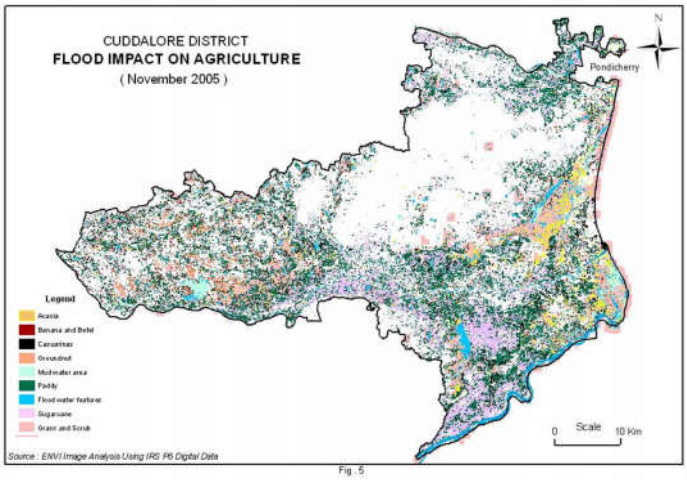

Fig. 5

The classification adopted in the study area is major breaches, river and tank water, floodwater intrusion areas, water with scrub, water with mud, and unaffected area.

Study area Description

For the administrative convenience South Arcot District was bifurcated into two districts namely Cuddalore District and Villupuram District. The District is predominantly agricultural with the coastal line stretching from Marakkanam, which is now in Villupuram District in the North to the Mouth of the river Coleroon in the South. The total Geographical area of the district is 42.83 sq.kms with a coastal line of 68 kms. Cuddalore District is bounded by Bay of Bengal in the east, Villupuram District in the west, Union Territory of Pondicherry in the North and Nagappattinam District in the South.

Flood Disaster Impact/ Assessment

Cuddalore study area map was prepared using the Indian topographical sheets. The sheets were scanned and then digitized using the ArcGIS to convert them in the form of digital maps. The map was traced from the village to taluk and district to trace all the minute details for the flood disaster assessment in the study area. Figure 1 shows the Cuddalore district with taluk boundaries along with the flood related features of river, tank, settlement and plantation crops with the railway track. Figure 2 is the IRS P6 digital data, georeferenced using ENVI 4.1. The AcrGIS map was overlaid on the digital data to show the exact district through digital format. The digital data was subjected to various image analysis techniques to derive the flood assessment results and mapping. Figure 3 shows the flood-affected area in Cuddalore district. This map was prepared using the IRS P6 digital data after the image analysis to demarcate the flood zones in the district. Global Positioning System (GPS) was also used to track the breaches that had transpired during the flood situation. The braches were occurred due to the continuous down poring resulting overflow along the rivers and tanks in this region.

The excess flow had entered the low-lying areas causing heavy damages to the rural as well as urban areas in this district. The entire Veeranam tank had several breaches on the eastern and western parts. The Veeranam and the eastern part of this district is the worst affected due to floods because of low lying areas along with small streams with several breaches on the banks. Major breaches were also observed and surveyed to find the exact locations of the breaches along the rivers of Kollidam on the south and the Penniyar on the North. The Vellar river and the Wellington Reservoir and Manimuthar River had been observed with major breaches which could not withstand the embankments causing heavy flood inlets to the rural and urban areas. Figure 4 displays the general flood impact map derived from the IRS P6 digital data as well as the GPS field data. Analysis and integration of these two spatial `information data reveal the areas affected due to floods in the following categories: they are: river and tank water (53.29 sq. km), flood water intrusion areas (48.87 sq. km), water with scrub (3.24 sq. km), water with mud (4.55 sq. km), water with grass (2.26 sq.km) deposits and unaffected area (2387.94 sq. km) in the study area apart from major breaches (Table-1).

Table 1. Cuddalore District: Floodwater Classification Statistics

Sl.No	Region of Interest	Area in sq. meter	Area in sq. km
1	River and Pond	53283281.25	53.29
2	Mud water area	4551875.00	4.55
3	Water with grass	2258750.00	2.26
4	Water with Scrub	3236250.00	3.24
5	Flooded area	48871250.00	48.87
6	Unclassified	2387938125.00	2387.94

Source: ENVI Image Processing Results

Figure 5 shows the flood impact on agriculture crops in Cuddalore district. This map was derived using IRS P6 LISS III digital data through ENVI image analysis method. Field samples of the individual agriculture crops were also taken using GPS to differentiate the crops that were in the flood affected region as well as in the unaffected region because of the changing nature of the spectral reflectivity. The following major crops were severely affected due to floods they are acacia, banana and betal, causuarina, groundnut, paddy, sugarcane, grass and scrub, apart from the mud/sand water areas in the agricultural crop fields which causes major environmental concern in the long run. Loss in Agricultural productivity due to November 2005 floods indicate that there has been heavy loss to paddy (60237.46 ha), Ground nut (6511.75 ha), Sugarcane (1324.39 ha), Black Gram (1158.08 ha), Casuarinas (64.39 ha), Cowpea (23.62 ha), Cotton (52.42 ha), Sunflower (248.7 ha), Coconut (0.09 ha).

The following table gives the results of the pixel-by-pixel classification estimates through the digital image processing Technique of the affected agriculture crops in this district (Table-2).

Table 2. Cuddalore District: Loss to Agricultural Crops

Sl.No	Region of Interest Theme	Area In Sq.meter	Area In sq.km
1	Flood water features	62774809.75	62.77
2	Mud water area	5362715.67	5.36
3	Grass and Scrub	6473842.67	6.47
4	Paddy	36372289.5	36.37
5	Casuarinas	2148988.83	2.15
6	Acacia	2475368.583	2.48
7	Banana and Betel	1286374.33	1.29
8	Sugarcane	15324753.42	15.32
9	Groundnut	1906919.25	1.91
10	Unclassified	2810258138	2810.26

Source: ENVI Image Processing Results

According to the image analysis results, about 36 sq. km area was worst affected in the district; followed by sugarcane (15.32 sq. km), Acacia (2.48 sq. km), Casuarinas (2.15 sq. km), Groundnut (1.91 sq. km) and Banana and Betel (1.29 sq. km). Flooded features are seen in about 62 sq. km area and the mud water area is about 5.36 sq. km which further affects the agricultural fields in the long run.

Conclusion

The present study due to non-perennial character of some of the small streams, a portion of the land has been allotted to the farmers and this is an obstruction during floods. Similarly the

river embankments were used as the site for brick line industries and this is considered to be encroachments and during flooding these features would divert the floods. The Satellite Image clearly shows that some of the major tanks consisting of mud and scrubs and vegetation covers. The field investigation in these tanks would also reveal the fact that this will not allow the water for seepage and during heavy rainy and flood season this will heave a major impact on the surrounding areas and affect the villages/urban centres adjacent to these tanks. Thus it requires a periodical cleaning of the tanks and it is very essential for precautionary measure. In the present study area, anaicuts namely, Memathur, Pelanthurai and Vriddhachalam are not properly maintained and there were breaches along these anaicuts, which has resulted for heavy flooding nearby villages of these anaicuts. Field investigation reveals that some of the small bridges were laid on the surface of the rivers without anticipating their impact during flash floods. During flooding season these bridges might be an obstruction as well as diverting phenomenon to other parts of low lying areas and this may be rectified in future.

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