SHORT NOTE

Photonirvachak
Journal of the Indian Society of Remote Sensing, Vol. 34, No. 1, 2006

RAPID ASSESSMENT ON THE IMPACT OF TSUNAMI ON MANGROVE VEGETATION OF THE GREAT NICOBAR ISLAND

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The Great Nicobar island in the Bay of Bengal known for its biological wealth, was the first victim in India to the recent tsunami. Considering its close proximity to the sign of the tsunami, the latter's impact on the mangroves of the Great Nicobar island was assessed rapidly by using IRS 1C LISS III digital data. About 61% of the mangroves are estimated to be severely affected, leading to a loss of 531.70 ha of mangroves in the island.

Great Nicobar island in the Bay of Bengal (6°45'and 7° 15' N, and 93° 38' and 93° 55' E) harbours rich biodiversity (Kannan and Ajmalkhan, 2004). This island known for its high endemism has giant robber crab, crab eating macaque, megapode bird etc. It supports many endangered marine fauna like salt-water crocodiles, giant clams, sea turtles and others. More importantly, Galathea Bay, the second largest leatherback turtle nesting ground of the Indian Ocean is located in this island. Considering the biological wealth of this island, the Government of India have established Galathea Bay and Campbell Bay National Parks and declared this island as marine biosphere reserve. Though information on mangroves of Andaman and Nicobar islands are plenty (Singh, 1986; Singh *et al.*, 1987; Mall *et al.*, 1991; Dagar and Sharma, 1991; Ramachandran *et al.*, 1998) it is little in the case of Great Nicoabr island (Jagtap, 1992). Tsunami of December 26, 2004 caused considerable damage to the marine and low lying habitats of Andaman and Nicobar group of islands including the Great Nicobar island. Navalgund (2005) detailed about the tsunami of the Sumatra island. In the present investigation, quantum of mangrove destruction in the Great Nicobar island caused by the tsunami has been assessed.

Satellite data (IRS 1C LISS III digital data of September 11, 2004 and February 2, 2005; path: 117 and row: 69), Survey of India toposheets (no: 88 E/12 and 16 and 88F/9 and 13) and field data of 2003 coastal surveys carried out in the Great Nicobar island with GPS locations were used for the estimation of mangrove cover. The pre-tsunami

Received 22 June, 2005; in final form 19 December, 2005

satellite image (1:50,000 scale) was corrected geometrically taking 30 ground control points from topo sheets. The post-tsunami digital data were geometrically corrected taking the corrected pre-tsunami data as the reference. False Color Composite (FCC) was generated with the band combinations 3,2,1 in RGB. ERDAS ver. 8.6 software was used for all the image analyses. On-the-screen visual interpretation method was used to identify and demarcate the mangrove areas (dark brown smooth texture) by following Nayak and Bahuguna (2001). Utmost care was taken to delineate the mangrove areas based on the extensive field knowledge acquired from our field surveys made during 2001 to 2003 and the map. The satellite data findings confirmed the ground truth observations. Contours (20 m) were traced from the topo sheets and digitized using Altek A0 digitizer. *ArcGIS* 8.3 was used to prepare the contour layer. Digital elevation model (DEM) was prepared using the contour layer in Erdas Imagine software. Digital terrain models (DTM) for pre- and post-tsunami periods were developed by overlaying the respective satellite data on the DEM. For the better differentiation of vegetation, pre- and post- tsunami mangrove maps have also been prepared.

Kannan and Ajmalkhan (2004) have reported as many as 20 principal species of mangroves from the Great Nicobar island and Nayak *et al.* (1992) recorded about 70 km^2 of mangroves in the entire Nicobar group of islands. Though the island supports wide spread mangrove pockets all around the island along the banks of the nallahs (small estuaries), the perennial rivers Galathea and Alexandra and Laful nallah support large and dense mangrove forests at their mouths.

The present study clearly indicates that, though the Great Nicobar island was very close to the epicenter, it was protected to some extent because of its hilly terrain but the coastal areas have been affected much (Figs. 1a, b). In general, the south-west and south-eastern sides of the island have been worst affected when compared to the north and north-eastern sides, which are more hilly and steep in nature towards the seaward side. The pre-tsunami data shows about 871.40 ha of mangroves in the Great Nicobar, while the post-tsunami data show only 339.70 ha, leaving 531.70 ha of mangroves to the killer waves. The estimate indicates that 61% of mangroves of this island have been affected badly. The present estimates are in conformity with the findings of Ramachandran *et al.* (2005) who have also reported the loss of 51% (335.70 ha) in Camorta, 69% (339.03 ha) in Katchal, 100% (152.53 ha) in Nancowry and 68% (240.06 ha) in Trinkat islands of the Nicobar group using IRS P6 AwiFs data. Though it is expected that more than 50% of the mangroves would have shed their leaves, and there are possibilities of rejuvenation in the near future after complete defoliation. The remaining plants would have been uprooted or they fell down and the possibility of their survival is questionable. Especially, the extensive mangroves of Galathea and Alexandra rivers and Magar nallah have been much affected while the mangroves of Laful nallah have escaped the nature's furry (Figs. 2a, b).

Damage to the mangrove pockets means that the dominant mangrove species viz. *Bruguiera gymnorrhiza, Excoecaria agallocha, Heritiera littoralis, Nypa fruticans, Rhizophora apiculata* and *R. mucronata* might have been affected much as these species dominate the vegetation cover in most of the mangrove pockets of the island. More importantly, damage to the *Nypa* palms could have been severe in the Galahea Bay which has received the tidal waves directly and where the waves have penetrated the mangrove ecosystem with a high speed. Sparse mangroves of the west coast and other coastal vegetation of the western side of the island should have also suffered considerably due to the tidal waves and the damage caused to the mangroves of Alexandra river complex of this island may be unrecoverable. As expected, mangroves of the Megapode island have been totally affected as this mangrove islet was located in the open sea and

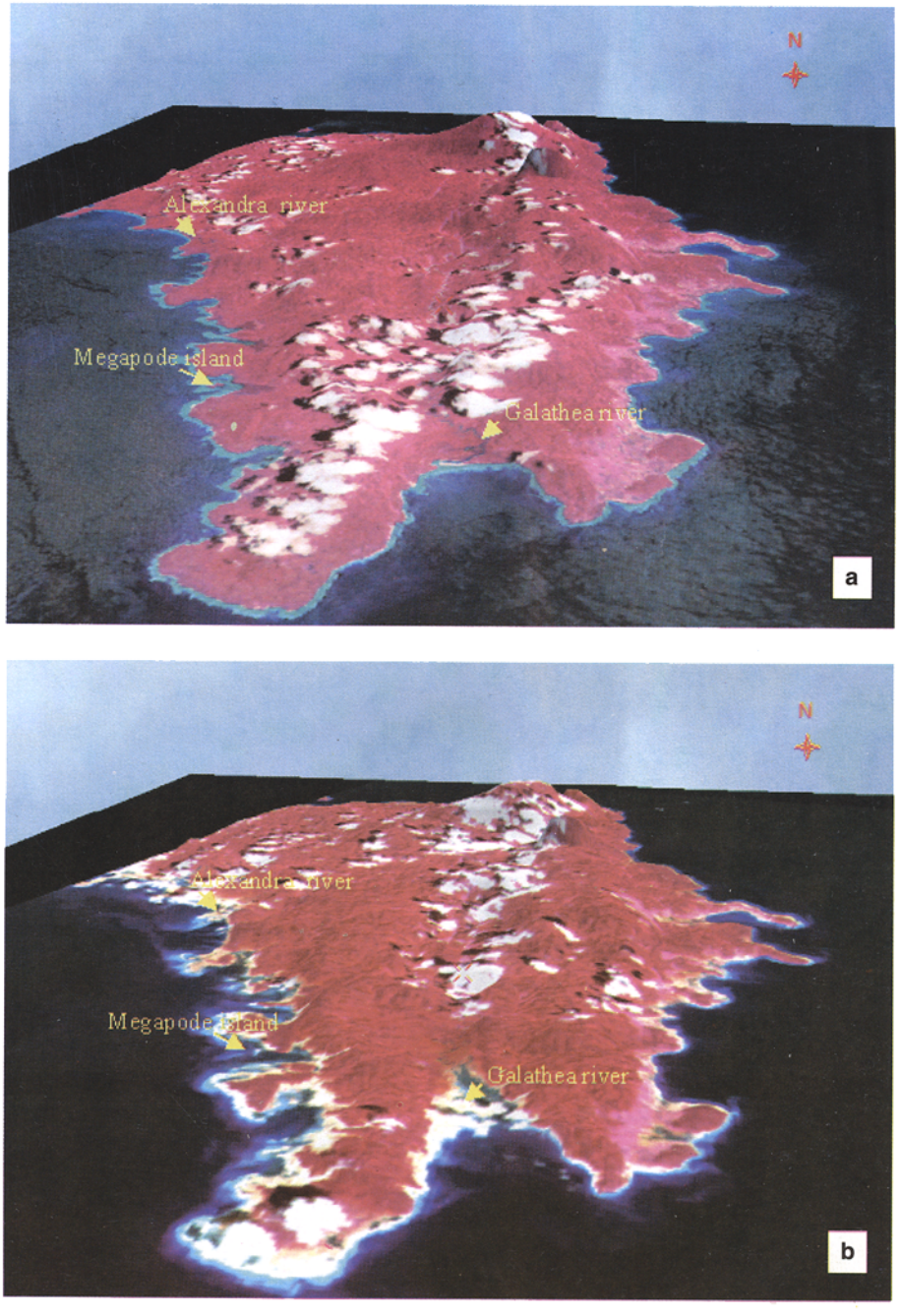

Fig. 1. Digital terrain model (DTM) of the Great Nicobar island
(a) Pre-tsunami and (b) Post-tsunami views.

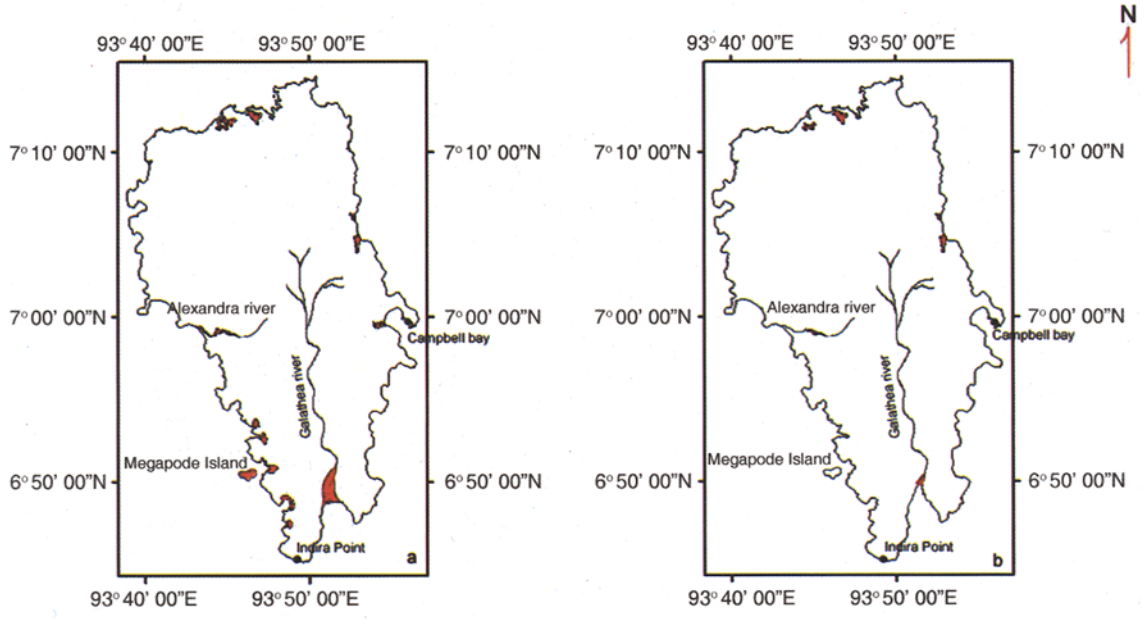

Fig. 2. Classified mangrove map of the Great Nicobar island
(a) Pre-tsunami and (b) Post-tsunami views.

was very near to the worst affected south-western side of the Great Nicobar island, without any physical protection. The satellite imageries clearly indicate the total disturbance to the vegetation of this island.

Rapid assessment of the important coastal habitats of the Great Nicobar island made using the satellite data, has indicated that there is considerable damage to the mangrove habitats and coastal vegetation of this island, which is the habitat for the Nicobarese and Shompens. It may be expected that over 50% of the affected mangroves from all these mangroves regions would be recovering partly or fully. Hence, it is imperative to undertake further detailed vegetation mapping study after a reasonable period of time year so that precise estimates of mangrove and other coastal vegetation loss and recovery can be made.

Authors thank the Director, Centre of Advanced Study in Marine Biology and the authorities of Annamalai University for facilities and encouragement. They also thank the Ministry of Environment and Forests, Government of India for financial support.

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