ASTER imagery of forest areas of Sundarban damaged by cyclone Sidr

Background

Sundarban, the world's largest natural mangrove ecosystem, is located in the south-western part of Bangladesh bordering the Bay of Bengal. It covers a total area of about 600,400 ha (Runkel & Ahmad, 1997). This ecosystem, placed under reservation since 1875, has been designated as a Ramsar Site. Three wildlife sanctuaries, namely, Sundarban south, east and west totaling 140,000 ha, have been declared as a World Heritage Site.

Sundarban supports very rich and diverse flora (334 species) and fauna (269 species). It plays an important role in the local and national economy. Some 300,000 people depend directly or indirectly on its resources for their livelihood (Canonizado & Hossain, 1998). Ecologically, this forest reserve is particularly important for the region as it acts as a barrier against damages by cyclones and tidal surges.

Sundarban has been increasingly threatened in recent years by intense human interventions and natural hazards. Sidr, a category four super-cyclone hit Sundarban on 15 November 2007. The cyclone brought heavy rains with wind speed of up to 220 km/h along with a tidal surge of 3 to 4 m. It caused serious damage to the forest vegetation, wildlife and infrastructures in the south-eastern part. In the last two decades, Bangladesh has experienced cyclones of increased frequency and severity, probably due to global climate change.

Satellite remote sensing has been used globally to monitor the impacts of tropical cyclones. In this study, medium-resolution satellite imageries were used to assess damages of the mangrove ecosystem.

Methodology

ASTER imageries of 21 November 2007 were analysed for damaged areas. The imageries were geo-rectified to WGS 84. Atmospheric correction and Principal Component Analysis (PCA) of the imageries were employed to obtain better results. Sidr damaged areas were delineated during image processing. Damaged areas in the field were visited for detailed analysis of the imageries. GPS trainings collected for damaged areas were used to classify the imageries. Erdas Imagine and ArcGIS were used for image processing and mapping, respectively. Existing compartment, range and wildlife sanctuary boundaries were used to analyse and map the damaged areas.

Results and discussion

After field visit, a classification system was developed. Depending on extent and severity, the damaged areas were classified into three categories: i) highly affected areas with many uprooted and broken trees, ii) moderately affected areas with trees leaning and having broken branches and brown leaves, and iii) slightly affected areas with few trees damaged.

Results showed that the total forest area damaged by the cyclone Sidr was about 133,000 ha or 22% of Sundarban (Table 1). Of the total area damaged, 11%, 69% and 20% were highly, moderately and slightly affected, respectively. It is evident that most of the damaged forests were moderately affected.

From field observations, it was found that highly affected forest areas were dominated by Keora (*Sonneratia apetala*). Trees of Keora are comparatively taller (≥15 m) and grow on newly accreted forest land. Moderately affected areas were dominated by Sundri (*Heritiera fomes*) and Gewa (*Excoecaria agallocha*). They are medium (10-15 m) to small (5-10 m) trees. Slightly affected areas were identified along the river banks and in the northern part of Sundarban. They were mainly Gewa dominated areas with comparatively smaller trees.

Out of 55 forest compartments in Sundarban, 18 were affected (Figure 1). These included 10 compartments of the Sarankhola Range and eight compartments of the Chandpai Range. The entire East Wildlife Sanctuary (31,230 ha) in the south-eastern part of Sundarban was severely affected.

As an immediate response to forest damage caused by Sidr, the Government proclaimed a one-year moratorium on harvesting non-timber forest products as well as sanitation or salvage cutting of damaged trees.

Table 1: Statistics of damaged forest areas caused by cyclone Sidr

Type of damage	Area (ha)	Damage by category (%)	Damage by total area of the Sundarban (%)
Highly affected	14,840	11	2.5
Moderately affected	91,420	69	15.2
Slightly affected	26,700	20	4.5
Total	132,960	100	22.2

National and UN organisations participated in the preliminary assessment of the damage following Sidr. Space Research and Remote Sensing Organization (SPARRSO), and Centre for Environmental and Geographical Information Services (CEGIS) reported 19% and 31% of Sundarban was damaged, respectively (SPARRSO, 2007; CEGIS, 2007). UNESCO reported 30% damage (UNESCO, 2007).

Conclusion

Remote sensing is a valuable tool for the assessment of the Sidr damaged areas in Sundarban. Monitoring of damaged areas will provide useful information on ecological changes and recovery processes of the ecosystem, enabling appropriate management intervention.

References

Canonizado, J.A. & Hossain, M.A. 1998. Integrated forest management plan for the Sundarbans reserved forest. MOEF, Dhaka, Bangladesh.

CEGIS 2007. Effect of cyclone Sidr on the Sundarbans: A preliminary assessment, Dhaka, Bangladesh.

Runkel, M. & Ahmad, I.U. 1997. Area, distribution and status of forest types from 1985 to 1995, Dhaka, Bangladesh.

SPARRSO 2007. Cyclone-affected areas of the Sundarban as inferred from Terra-MODIS satellite data, Dhaka, Bangladesh.

UNESCO 2007. UNESCO - world heritage centre report, Dhaka, Bangladesh.

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Forest areas damaged by cyclone Sidr

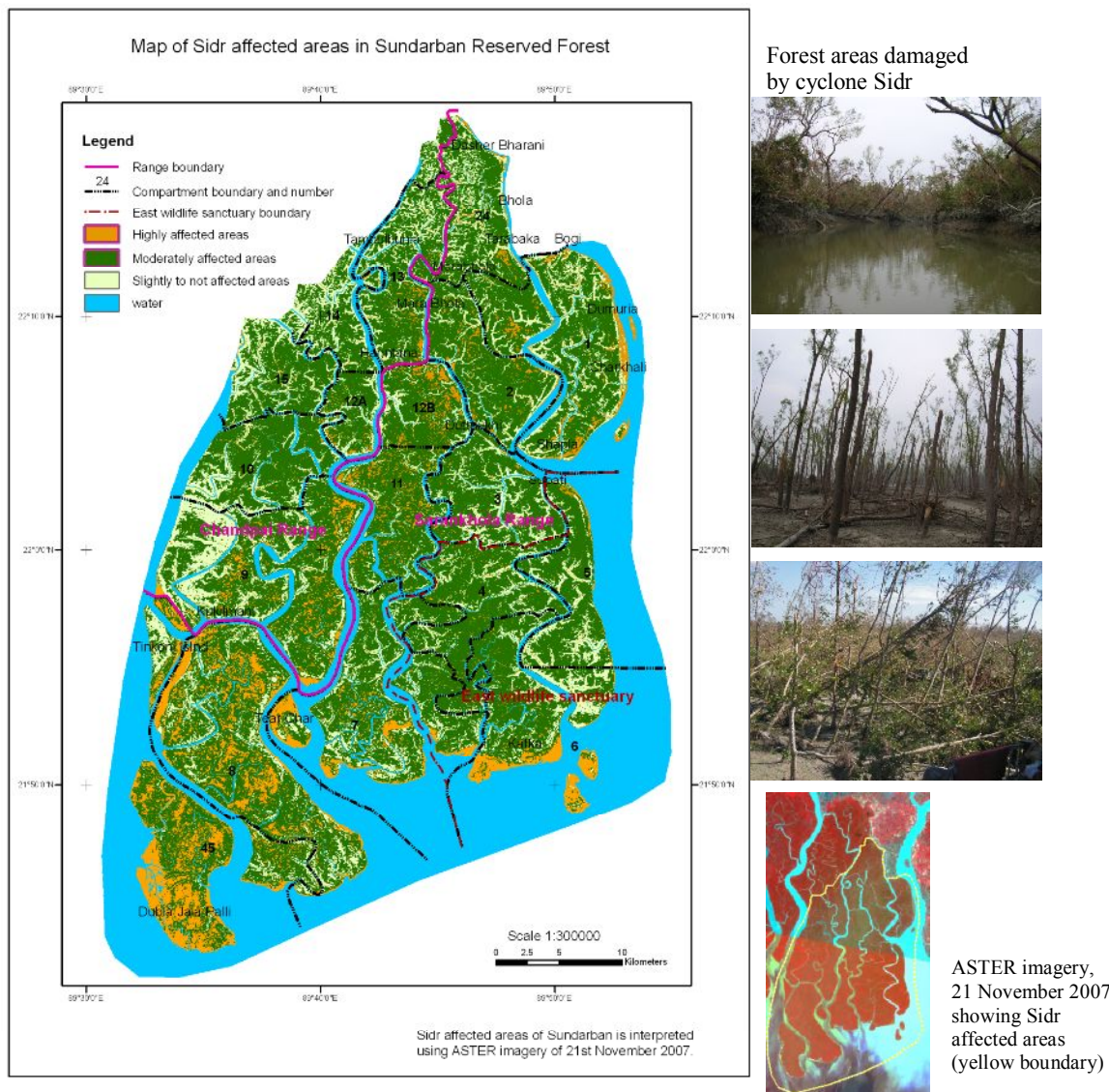ASTER imagery, 21 November 2007 showing Sidr affected areas (yellow boundary)

Figure 1: Forest areas of Sundarban affected by cyclone Sidr