

# Impact assessments of tsunami-affected areas

**In India, Tamil Nadu was the worst hit state, accounting for 65 – 80% of the physical damages. Here, impact assessments were carried out to guide coastal rehabilitation.**

Tamil Nadu was identified as focal region for green coast reconstruction. Green Coast prioritized 5 stretches with 102 villages within the 13 tsunami affected coastal districts of the state.

## Coastal stretches

Prioritization was based on the loss of human lives and assets and on the presence of representative ecosystems and livelihoods. A network of 6 experts and 11 NGOs carried out assessments of the environmental and socioeconomic impacts of the tsunami. The assessments were based on the collation of existing information, primary surveys, rapid rural appraisals and focal group discussions in 33 villages within the 5 priority stretches.

## Damage assessments

Assessments of the physical damage in Tamil Nadu indicate that the Coromandal coast and the west coast of Tamil Nadu were most severely impacted by the tsunami.

The Coromandal coast and the west coast of Tamil Nadu accounted for the loss of 70% of human lives, 80% of agricultural lands and 35% of fisheries equipment in this state. Palk Bay was protected by coral reefs and shielded by the surrounding 22 islands of the Gulf of Mannar. The assessment team observed a progressive increase in damages from the north to the south coast.

## Inundation

Inundation due to tsunami waves ranged from 20 to 2000m and led to changes in coastal geomorphology and heavy sedimentation in estuaries, canals and waterways. Onshore topography, near shore bathymetry and river orientation were the key determinants of the severity of the tsunami impacts. The intensity of damages was reported to be higher in concave shaped coasts that led to convergence of waves (e.g. Nagapattinam and Vedaranyam). Convex coasts that deflected the waves sideways (e.g. Pondicherry) suffered lesser damages.

## Wave impacts

Reduced impacts from tsunami waves were observed in coastal areas having embankments, groins, and parallel beach ridges separated by swales. Shallowness of near shore resulted in the formation of more energized waves. Rivers acted as carriers of tsunami waves and deposition of marine sediments on their retreat. Local increase of damages at river mouths was due to the refraction of tsunami waves, river orientation and wave direction. The waves also led to deposition of continental shelf sediments along the river beds and floodplains changing the river morphology and damaging agricultural lands.

## Groundwater

The tsunami had an impact on the surface as well as groundwater resources in the coastal region. Sedimentation and debris created by the tsunami led to water logging and salinization within the coastal lands. Tsunami waves acted along the tectonically active faults and led to overflowing of water in several wells and ponds in the Nagapattinam area. Groundwater TDS increased two to three folds, but has considerably recovered one year after the tsunami. At several places communities reported an overall increase in the rate of coastal erosion. They fear the consequences of the rapid advancement that ranges from 20m to 200m of the seafront towards the villages.

## Protection

Coastal ecosystems, as mangroves, shelterbelts, sand dunes, coral reefs and estuaries were affected to varying degrees by the tsunami, but played a considerable role in reducing the impacts in the coastal areas. The damage to the mangroves was limited, except for young plantations that were washed away. However, the mangroves of Pitchavaram and Muthupet

provided protection to 5 settlements. Settlements located behind the mangroves were physically protected by the mangroves. Not only did they serve to reduce the velocity, they also distributed the sea water along the canals and creeks associated with the mangroves. Settlements located on the beach front with no mangrove cover were completely devastated. Similarly, sand dunes in Manakudi estuary provided protection to adjoining settlements. Coral reefs played a crucial role in reducing the impacts on 22 islands in the Gulf of Mannar.

### **Main findings of the damage assessments**

The role of shelterbelts, the impact on livelihoods and gender inequalities: what were the main findings of the Green Coast assessments in India?

#### **Shelterbelts**

Shelterbelts of *Casurina equestifolia* played an effective role as coastal defense. Based on site level evidences, the state government has initiated a massive programme of raising *Casurina* monoculture as coastal defense all along the coast. However, monoculture of *casurina* has several ecological and social implications. The efficiency of monoculture of *casurina* as shelter belt is greatly reduced because *casurina* has less root anchorage. Its monoculture is less likely to provide all biomass requirements of the communities, and hence would induce little community participation in its maintenance. Women consider dense *casurina* plantations as desolate spots with very low security: a potential hazard.

#### **Impact on livelihoods**

Livelihood across all sectors, including fisheries, agriculture and non-farm sectors were affected by tsunami. The impact was the highest on the fisher community due to loss of fishing crafts and gears. In the 5 coastal stretches the tsunami damaged 21,800 catamarans, 4,424 vallams and 1,610 mechanized boats. Most of the damage occurred in the Villupuram – Pitchavaram and the Nagercoil – Colachel stretches. Agriculture productivity was lost in 9,600 ha due to deposition of sand, sludge and water logging. The tsunami hit the coast just as the crops were to be harvested, so the loss of agricultural productivity led to a high economic loss and credit load for the farmers.

#### **Women and dalits**

Female wage labourers and dalits were rendered most vulnerable after the tsunami due to reduced fishing and agricultural activities as well as a longer recovery period. The rehabilitation process did not pay adequate attention to the needs of these communities. The tsunami induced a perceptible shift in gender roles and responsibilities. Declining productivity of fisheries and agriculture led to increased reliance on wage earning by female members of the households. Increased workloads and early marriages have also seriously impacted girl child's education access and performance.

#### **Assessing rehabilitation efforts**

**The post tsunami rehabilitation efforts were one of the largest humanitarian efforts ever. Nevertheless there was a marked absence of planning for sustainable livelihood reconstruction.**

The lack of planning for sustainable reconstruction led to serious implications on the natural resources in the coastal areas, threatening the sustainability of livelihoods of tsunami affected communities.

#### **School dropouts**

Replacement of damaged fisheries crafts and gears have at least led to a ten-fold increase in the number of FRP boats. As all the non-mechanized traditional fishing boats (vallams) have been replaced by motorized boats, this has led to increased mechanization of the fishing crafts. The increased number of mechanized boats has also created a proportional increase in labor requirement by 50%. Therefore more children are being drawn to the workforce at an early age, leading to higher school dropouts.

## **Fishing pressure**

The present level of data is not sufficient to assess and forecast the impact of changes in fishing pressure on the overall catch and its sustainability. There is a need for scientific assessment of the fisheries of the coastal, demersal and deep sea fishing in the Indian Ocean to develop strategies for sustainable fisheries.

## **Inferior boats**

An asset replacement approach was adopted for post tsunami relief and reconstruction for most of the sectors. Emphasis was laid on replacement of damaged crafts and gears of fishermen. Rehabilitation process therefore left out several landless communities. Particularly dalits engaged either as labourers in agriculture and/or fisheries and widowed women engaged into fish retailing. Similarly the lack of community participation in the design of livelihood interventions has reduced the overall impacts of reconstruction initiatives. In Pitchavaram area, for instance, fishermen were provided with mechanized boats which were not suited to their traditional fishing grounds in the mangrove creeks. At several occasions, efforts to provide boats to a larger number of fishermen led to compromising the quality of these boats. Inferior boats create a potential risk for the fishermen using them.

## **Sanitation needs**

Houses are being reconstructed at several locations, without integrating water and sanitation needs into the settlement's design. The construction of shelters in natural slopes has led to water logging and to the accumulation of sewage and drainage water from top row houses in the lower areas. Sewage disposals have not been planned. As separate water connections are not provided to each house, the utility of toilets and bathrooms is considerably lowered.

## **Women's aspirations**

Inadequate addressing of gender concerns also reduced the overall effectiveness of the reconstruction efforts. Women in fishing villages are marginalized in local institutions like caste panchayats, that played a major role in tsunami relief and rehabilitation programmes. Therefore women's needs and aspirations were weakly represented in these programmes. Livelihood reconstruction has primarily focused on the implementation of micro-enterprise development programmes through Self Help Groups. The number of these groups increased six – seven folds. In order to be effective they urgently need further support.

## **Delay for farmers**

Reconstruction efforts within the agriculture sector were largely limited to generic interventions, viz application of gypsum for reduction in soil salinity and removal of top soil. As the farming communities have lesser community organization, the NGO and government support to the farming community was delayed. No systematic effort was made to integrate innovative agricultural practices based on assessment of various soil types. Interventions for removal of top soil were undertaken without assessing the impacts of removal of the most fertile soil layer on the overall crop productivity.

## **Coastal vegetation**

Rehabilitation processes have not adequately addressed the restoration of mangroves in coastal areas and of vegetation within the homesteads that play a key role in supporting livelihoods. Most plantation efforts were piecemeal efforts that did not address the biomass needs of communities and cultural linkages. Limited efforts have been made to raise awareness on the need to conserve and manage coastal resources for sustainable livelihood reconstruction.