AGRICULTURAL IMPACTS IN TSUNAMI-AFFECTED AREAS: REGIONAL PERSPECTIVES

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Abstract

Following the devastating tsunami on 26 December 2004, several projects were initiated to assess the damages to agricultural lands and to plan appropriate interventions which included activities such as rehabilitation of damaged agricultural lands and infrastructures, reclamation of salt-affected soils for resumption of crop production. To assess the present status of the rehabilitation activities and share experience and knowledge for development of future plans and strategies for the longer term rehabilitation and development of the agriculture sector, FAO assisted the affected countries identifying suitable interventions for longer term rehabilitation and reconstruction of the agriculture sector in a sustainable manner best suited to the local agro-ecological and socio-economic conditions. The assessment of the damage caused by the Tsunami to the agricultural lands and water resources was conducted to develop strategies to reclaim the land and water resources and to train agricultural staff in monitoring soil salinity and translating the results into practical advice to the farmers. Salinity was not a major problems restricting crop cultivation as it was only a temporarily nature, but the lack of experience and knowledge of how to cope and deal with salinity was a major impediment to speedy re-engagement in crop production.

BACKGROUND

Following the devastating tsunami on 26 December 2004, numerous international and national institutions and organizations were involved in assisting affected countries in resumption of agricultural activities and restoration of shattered livelihoods. Three months after the disaster, a regional workshop on salt-affected soils from seawater intrusion was organized by the FAO Regional Office for Asia and the Pacific, which provided an excellent opportunity for participants to share information, collectively assess initial findings related to rehabilitation needs and opportunities, share plans and proposals for future rehabilitation work, and develop mechanisms for collaboration and joint activities (FAO, 2005). Several projects were initiated to assess the damages to agricultural lands and to plan appropriate interventions which included activities such as rehabilitation of
damaged agricultural lands and infrastructures, and reclamation of salt-affected soils for resumption of crop production. One of the main challenges was to identify suitable interventions for longer-term rehabilitation and reconstruction of the agriculture sector in a sustainable manner best suited to the local agro-ecological and socio-economic conditions. An integrated and participatory approach was needed to identify promising technologies that could be easily adopted by the farmers.

COUNTRY OVERVIEW

India

In all four states, Andaman and Nicobar, Tamil Nadu, Andhra Pradesh and Kerala, the standing rice and plantation crops were significantly impacted upon. The extent of damage incurred due to the tsunami were over 11 000 ha of agriculture, horticultural and plantation crops and estimated losses was US$149.58 million.

About 4 000 ha, 2/3 of the total area, of rice crop was lost or severely affected in Andaman and Nicobar Island (FAO, 2006a). Among the plantation crops areca nut, coconut and banana stands were severely affected. Seawater intrusion not only affected the standing crop but also resulted in the salinization of soils and water bodies. In some areas in the Andaman and Nicobar Islands land was permanently inundated and cannot be reclaimed.

Immediate responses by both the Government and NGOs included the repair of dykes, spillways and irrigation canals; the analysis of soil samples to assess the extent of salinization; the clearing of debris from fields; scraping of surface salt from rice fields and plantation lands; the application of organic amendments to affected fields; the application gypsum to selected fields; the construction of check dams, ponds and the supply of pumps; the provision of farm implements and equipment to affected farmers; provision of emergency cash payouts to affected persons; the establishment of self-help groups within affected areas as a means of effecting the rehabilitation process; creation of awareness amongst farmers in the management of salinity; and the distribution of salt tolerant crop varieties.

The rehabilitation process has had a major impact in returning the agricultural sector to its previous level of productivity. Whilst this sector was initially neglected in the overall recovery process, it has become evident that the agricultural sector was critical to the livelihoods of numerous coastal communities. Natural leaching and flushing of salts facilitated by abnormally high post-tsunami rainfall in some states and helped crop lands return to pre-tsunami production levels. The growing of crops such as sun-hemp and sesbania has been shown to be effective green-manures that can assist in the
rehabilitation of salt-affected lands along with traditional salt tolerant crop/vegetable varieties.

**Indonesia**

The impact of the tsunami was felt in ten districts in Nanggroe Aceh Darussalam (NAD) Province and two districts in North Sumatra (Nias Islands). Significant losses and negative impacts were incurred with respect to human resources, loss of land, livestock, office buildings, laboratories, housing complexes, and infrastructure. The estimated loss of productivity in the agriculture sector amounts to US$270 million with the quake and tsunami resulting in salinization and sedimentation of crop and plantation lands (FAO, 2006a). The estimated budget required for recovery amounted to US$397.6 million with focus on the rehabilitation of land in order to facilitate the recovery of economic activities for rural communities, rehabilitation of the capacity of agricultural support services (physical and human resources), and people empowerment and institutional development through technical and organizational support.

The immediate activities included the rehabilitation of drainage, irrigation, and land (12,961 ha); the rehabilitation of 15,000 m$^3$ of farm-roads; food and horticulture crops production resumed in 25,800 ha; compensation for losses of livestock totalling 7,745 animals; replanting the estate crops to cover 5,331 ha; replanting the palm oil on 4,950 ha; the procurement of agricultural machinery and tools (1,256 units); food security packages (4,000) to be distributed; and development of the capacity of agriculture organizations, farmer groups, and agricultural personnel (FAO, 2006a).

The long-term rehabilitation programme focused on the rehabilitation of heavily affected paddy fields with an emphasis on the rebuilding of new paddy fields; the establishment of new farms to produce coconut and palm oil; the development of workshops for the servicing of agricultural machinery; the rebuilding of market facilities for livestock; the redevelopment of farmers organizations and extension workers; the redevelopment of agricultural education and training; the development of new suitable technologies appropriate for agro-industries; the development of market oriented activities through the establishment of agribusiness terminals; and establishing of business partners.

The FAO assistance aimed at rapidly kick-starting basic agricultural activities through the supply of urgent agricultural inputs and the rehabilitation of basic farm infrastructure, thereby reducing dependency on food aid. In total, 23,000 farmers benefited from the distribution of seed. More than 15,500 farmers received vegetables and secondary crop seeds. In addition, estate crops were distributed to more than 5,000 beneficiaries.
Maldives

Thirty-nine islands were damaged and nearly a third of the population, or 100,000 people, were affected. Fourteen islands were completely destroyed and had to be evacuated. Approximately 12,000 people were displaced from their islands, and another 8,500 temporarily relocated within their home island. It was estimated that the tsunami damaged field crops in 2,100 farms; destroyed home gardens and agricultural tools in 11,700 homesteads; and damaged more than 700,000 fruit trees and 840,000 timber trees in inhabited islands. The damage to land and groundwater resources was severe in 35 agricultural islands, and saline water intrusion affected 112 inhabited islands (FAO, 2006a).

The geographical dispersion of the islands severely constrained the collection, collation and analysis of reliable data in a timely manner to inform the required immediate intervention responses of the Government and its supportive international development partners. The situation was further compounded by the lack of baseline data on the agricultural sector prior to the tsunami.

In an effort to rehabilitate the agricultural sector, assistance focused on the replacement of basic production inputs to tsunami affected farmers and home gardeners; the strengthening of agricultural extension to facilitate the re-establishment of agriculture and horticulture; and the strengthening of agricultural institutional capacity.

The main post-tsunami relief/recovery activities included the provision of a package of technical assistance through short-term consultants/experts, capacity building for farmers and MFAMR staff effected through training workshops and the distribution of replacement packages of agricultural assets (start-up agricultural kits comprising a range of selected inputs: seeds, seedlings, cuttings, fertilizer, compost and assorted implements).

Myanmar

The tsunami had a limited impact and was confined to areas of the Myanmar coastal zone. The Pyinsalu sub-township of Labutta Township was the worst affected area with 25 people losing their lives, more than 1,000 people left homeless and 289 houses totally destroyed. Four villages, namely Khar Pyat Thaung, Lay Yin Kwin, Kaingthaung and Aung Hlaing in the Pyinsalu sub-township were severely affected (FAO, 2005).

The main goal of the assistance was to provide necessary assistance so as to resume the livelihoods of tsunami affected fishers and farmers with a focus on both the immediate and long-term. Farmers
who lost their crops, livestock assets and home gardens to the tsunami were provided with fertilizers, HYV seeds, OPV seeds of various crops including paddy, pulses (peas and beans), oilseed crops (sunflower) and different kinds of vegetable seeds (gourd, melon, squash, watercress, rosella, chilli, tomato, egg plants). Agricultural hand tools were also provided together with training activities that included home gardening and harvest management; field crop production and management technology; crop protection; and salinity mitigation approaches were undertaken.

**Sri Lanka**

Within the agricultural sector 7,843 families were affected by the tsunami with 3,646 ha of paddy and a further 488 ha of food crops/vegetables destroyed. More importantly, from a livelihoods and household food security perspective 27,710 home gardens were destroyed with significant loss to livestock (FAO, 2006a). Land and groundwater bodies were affected by salinity and a number of water storage facilities lost.

The first priority of the relief effort focused on supporting farmers to resume their livelihoods. Activities in this respect included monitoring the degree of salinization in soils and waters; the distribution of seeds and fertilizers to farmers; establishment of vegetable, fruit and ornamental nurseries at the community level; distribution of hand tools and water pumps; the allocation of livestock to farmers that included poultry, cattle and goats; monitoring and rehabilitation of land affected by salt; and training workshops on improved farming techniques; animal husbandry; and food processing techniques and nutrition.

In addition to the distribution of aid to beneficiaries, the FAO programme has been responsible for the successful introduction of salt tolerant varieties of paddy to salt-affected areas as an interim stage in the rehabilitation of these production systems; the introduction of improved agricultural practices; achievement of high crop yields even in the presence of elevated saline levels; promotion of water savings technologies; support to post-harvest technology; improved nutrition practices; introducing various approaches for the management of salinity issues; strengthening of laboratory facilities with respect to salinity assessment and monitoring; and the establishment of coordination mechanisms with other organizations and, of greatest importance, the return of farmers back to their lands.

The degree of soil salinization was contingent on the period of inundation; dug wells remain saline even after the soil had been flushed of salts; land productivity as indicative of crop production has increased considerably, but still did not reached the levels of...
productivity that were achieved prior to the tsunami; and the cultivation of sun hemp and its incorporation into the soil as a green manure showed to be an effective tool in reducing salinity. In addition, the application of large quantities of organic matter was demonstrated to improve the productivity of saline affected soils (FAO, 2008).

Soil samples were collected to assess the degree of salinization and permanent monitoring sites established to assess the degree of remediation associated with the monsoon. There was clear evidence to indicate that significant leaching and flushing of salts occurred associated with natural rainfall. Field demonstration plots were established to evaluate different strategies and adoptable crop species. In addition, crop recommendations were made based on soil salinity levels. Damaged wells were reconstructed, by pumping out of saline waters where needed. Capacity building in salinity reclamation through the field and institutional training activities along with the establishment of crop demonstration plots in the field was also emphasized. The introduction of cowpea, sunflower, and vegetables was identified as a very effective strategy in enhancing existing production systems.

Thailand

The effects of the tsunami in Thailand were confined to coastal communities along the Andaman Sea. A total of 5,800 people died with 2,900 declared missing; 3,600 houses were destroyed and 412 communities were affected. The worst affected Province was Phang-Nga where 4,225 people lost their lives and 4,394 households were affected by the disaster. Within the Province 957 ha of agricultural land was lost and 412 farmers were affected. Along with this, livestock were destroyed and natural resources (i.e. mangroves, beaches, corals and fresh water) were all negatively impacted.

External agencies such as FAO provided coconut, oil palm and cashew nut seedlings for 94 ha. Similarly, gypsum, inorganic and organic fertilizers and vegetable seeds were supplied to farmers for rehabilitation and establishment of crops. Selected farmers were provided with inexpensive vegetable hydroponic kits and associated training. A key element in moving forward was the promotion of diversified production systems along with the establishment of markets.

A soil salinity classification system was developed for the tsunami affected land based on high resolution satellite imageries and aerial photos and the attributes including present land use, type and extent of damage, salinity level, soil texture, and water table depth were developed (FAO, 2006b). Sedimentation was a significant factor in the
damage afflicting agricultural lands. Using a weighed scoring index based on the importance of the aforementioned attributes, affected fields were classified into zones and guidelines for the proposed rehabilitation of these lands. Findings from this study also indicated that most of the areas affected by salinity had decreased considerably compared to the initial assessment made immediately after the event. GIS based maps of the damaged areas along the Thailand coast were produced and were being used to target rehabilitation efforts.

**CONSTRAINTS FACED IN REHABILITATION OF AGRICULTURE**

Several constraints were experienced during the operation of emergency assistance in Agriculture sector (FAO, 2006a). These constraints include the followings:

- Inadequate human resources within governments, lack of accurate data and planning, inadequate coordination systems, complex logistics, inadequate administrative mechanisms, unpredictable delivery schedules and other factors created difficulties in planning and organizing the activities.
- Remoteness of the tsunami affected areas and damaged infrastructures made travelling and transportation in the affected areas for all activities difficult and delayed.
- While the affected receive daily food allocations and supports such as from the WFP, resumption of livelihood activities of agriculture was lower priority.
- No clear records of farmers and farm lands made the verification of beneficiaries of assistance difficult and delayed.
- The problems experienced in delivery of agriculture inputs due to several causes are illustrated in below Figure 1.
- Procurement of sufficient quantities of quality seed and planting material to re-establish crops and plantation, the availability of appropriate varieties of seed and planting material suited to the prevailing soil conditions, and availability of local organic composts/manures and inorganic fertilizers were the constraints commonly faced.
- Poor road infrastructure affected transportation of relief supplies and impeded the rehabilitation process.
- Inadequate availability of suitable earth moving equipment to remove debris from affected fields as the first phase in the rehabilitation process and to assist in the construction of dykes, water storage structures and roads hindered progress.
Incomplete agricultural packages delayed the cultivation of secondary crops and vegetables and predisposed crops to serious damage from livestock. In some cases, provided inputs such as seed, fertilizers and hand tractors were sold off to generate cash.

Soil fertility in most of the affected areas was low as the farmers could not afford to use chemical fertilizers and the availability of organic fertilizers was limited.

In some countries, farmers in the affected areas were not familiar with the growing of a second crop such as pulses and vegetables after paddy.

Security situation in some countries hindered access and activities.
CONCLUSION AND RECOMMENDATIONS

The following lessons were learnt from experiences in the rehabilitation process.

- Assessment of damage: A participatory needs assessment should be undertaken with the full involvement of farming communities before making decisions associated with the rehabilitation process. Parameters for assessment of damage that have been incurred and the proposed rehabilitation programmes need to be based on a transparent and scientific basis.

- Variation in damages and intensity: The impact of the tsunami was not uniform throughout the affected areas. Differences in the extent of damages and the contrasting soil types that were affected call for different rehabilitation techniques and approaches. Hence a blanket approach should not be encouraged.

- Coordination: There was a need to harmonize coordination between implementation agencies to avoid overlap of service provision, enhance the impact of these activities and improve the effectiveness of the rehabilitation process. Improved systems and mechanisms of coordination must be developed at the sub-district or village level to avoid overlapping of programmes or duplication of the same inputs.

- Technical expertise: Mixed messages regarding the rehabilitation process were often experienced by farmers. Operational guidelines for rehabilitation need to be in local languages and made simple.

- Targeting and policy: The rehabilitation programmes need to focus on the farmer working on the land who may not always be the owner of the land. Programmes need to be gender sensitive and provide opportunities for women to earn an income. Policies/programmes need to consider the food security requirements of the farmers’ families in order to ensure adequate dietary intake, enhanced health and reduced vulnerability.

- Comprehensive approach: Since lands affected by the tsunami were contiguous, a comprehensive approach to reclamation from salinity should be undertaken that includes lands of larger farmers. Reclamation should be part of an integrated farming practice to include diversification, value addition, capacity building and linkages for more sustainable agriculture.

- Need for coordination: In the context of several actors involved in rehabilitation, each with differing priorities, there is a possibility for gaps and overlaps. Geographical coordination, coupled with a consensual approach, helps to effect uniform reclamation.
− Role of information collection, trends analysis and dissemination: There was a need for the collection of information, trends analysis and dissemination as a means of influencing stakeholders.

− The rehabilitation of damaged structures and agriculture/livestock services in general was inadequate. If it were adequately addressed, adverse environmental impacts could have been minimized and immediate employment opportunities in affected villages created.

− Soil salinity was recognized as a significant problem in the affected areas, although there was noteworthy progress with respect to its mitigation. This was largely due to the positive impact of natural rainfall on leaching/flushing salts from the effective root zone. However, there was a need to continue monitoring this process as there is evidence to suggest that sodicity and crop nutritional imbalances were posing a problem in some areas.

− Proper and effective drainage networks to be maintained to allow seawater to immediately drain from fields. Rehabilitation of irrigation/drainage canals occurred to a limited extent. In areas where leaching was not feasible due to a lack of adequate drainage, it was estimated to take more than a few years before reclamation would be completed.

− The use of gypsum as a soil amendment should be targeted to specific situations where the reclamation process warrants the use of these materials to enhance structural stability of soils and to correct nutrient imbalances.

− Farmers were encouraged to grow salt tolerant crop varieties in coastal regions wherever feasible.

− The introduction of cowpea, sunflower, and vegetables was very effective strategy in enhancing existing production systems and their incomes. This approach to further enhancing current agricultural production should be encouraged and promoted along with the use of compost and organic fertilizer.

Strategies effecting the overall development of a sustainable agricultural sector were deemed to include:

− A systematic recovery process should be implemented. This would require a greater degree of cooperation between all parties.

− Monitoring of feedback and follow-up activities.

− Sustainable solutions should include vulnerability reduction of people dependent on agriculture, risk transfer and disaster preparedness.
- Income generation through integrated agriculture systems, agribusiness and agro-industry.
- Marketing network arrangement and provision of market information.

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