2 A timeframe for agricultural recovery

Key points

- Immediate activities (within 6 months) after a tsunami:
  - Clean up waste and debris.
  - Survey land levels.
  - Train agricultural staff in soil and water assessment and observation.
- Short-term activities (3–12 months) after a tsunami:
  - Communicate with local farmers, especially women.
  - Coordinate advice and planning.
  - Repair irrigation and drainage infrastructure.
  - Train agricultural staff and farmers in rehabilitation methods.
  - Avoid establishing crops on saline land.
  - Incorporate shallow sediments into the soil.
  - Remove deep or highly saline sediments.
  - Use irrigation water (or rainfall) to flush salt from the soil.
  - Investigate other methods of producing income in rural areas.
  - Establish home food gardens.
- Long-term activities (› 12 months) after a tsunami:
  - Transfer technology and knowledge to farmers.
  - Maintain training programs for agricultural staff and non-government organisations.
  - Monitor plant nutrition and crop health.
  - Monitor the long-term health of tree crops, which might be affected by seasonal fluctuations in saline groundwater levels.
  - Expand support and training to surrounding areas less affected by the tsunami.

Photo: Kerry Sieh, Singapore Earth Observatory

Following a tsunami, some issues will require immediate action, some will take 12 months or longer to address, and others will need managing in the long term. The recovery timeframe for agricultural production outlined in this section is based on experiences in Aceh. Under different conditions, the timeframe may differ from the one presented here. Details about specific tasks relating to assessment and restoration of soil and water, crop management, and other activities to aid the recovery of agriculture can be found in Sections 3, 4 and 5 of this guide.

Immediate activities: 0–6 months

Clean up

Restoring public health and safety is the top priority in the aftermath of a major disaster (Waste Management World 2013). Sustainable management of disaster debris involves:

- collecting debris
- determining the constituents of the debris
- determining the potential toxicity of the debris and waste
- sorting the debris
- recycling
- disposing of residual wastes.

Large amounts of debris similar to construction and demolition waste are generated in disaster events in urban areas; in rural areas, debris is more likely to contain natural materials and organic matter.

In Aceh, the bulk of the waste on agricultural land (Figure 6) consisted of sediments of various origin (see Section 3), organic matter and, on fields closer to urban centres, building debris.

In Japan, the three prefectures most affected by the tsunami on 11 March 2011 accumulated 22.5 million tonnes of tsunami waste (Jakarta Post 2013). Japanese authorities established temporary storage sites before separating the waste and incinerating combustible material.

Photos: Assessment Institute for Agricultural Technology, Aceh

Figure 6 Deep layers of sediment and debris, which covered farmers' fields in the worst affected areas

Survey land levels

When a local earthquake triggers a tsunami, land levels can be altered. Surveys may be needed to establish the land levels, and direct the rehabilitation of drainage lines and irrigation channels. Some coastal areas may no longer be suitable for agriculture as a result of subsidence and increased frequency of tidal inundation.

The earthquake that produced the Aceh tsunami had a significant effect on the topography of the Aceh coast—land levels dropped 1–2 m in some coastal areas (FAO 2005c). Areas that were previously inhabited became permanently flooded, and drainage patterns and river flows changed, particularly in estuarine areas. In West Aceh, farmers reported that sand dunes disappeared, the river mouth clogged up and drainage channels changed, making land unsuitable for dryland crops. Restoring agriculture in such areas without adapting to these changes can lead to inappropriate management and wasted resources, and can be dispiriting for farmers who are already traumatised by the tsunami. Indonesia's Soils Research Institute mapped tsunami-affected land on Aceh's west coast using the Food and Agriculture Organization of the United Nations classification system (see Section 1), and GIS-referenced data and mapping software.

This enabled assessment of the suitability of land for certain crops in tsunami-affected areas.

Topographic changes were not a problem in tsunami-affected countries such as Sri Lanka, India and Thailand, which were further from the earthquake zone. The combination of earthquake-induced changes in topography and the high inundation force of the tsunami led to more complex impacts in Indonesia than in other countries.

Assess soils, and train agricultural staff and farmers

The degree of soil salinity resulting from seawater inundation will depend on the soil conditions at the site, the duration of inundation and subsequent rainfall. Tsunami-affected agricultural soils need to be tested for salinity, physical condition and nutrient levels to ensure that farmers avoid sowing crops in unproductive soils. Farmers should be closely involved in these soil assessment processes to improve their understanding of soil conditions in the area and build their soil management capacity.

Details about how to assess soil salinity, water salinity and soil nutrient status are provided in Section 3.

Short-term activities: 3–12 months

Communicate with the farming community

Participatory surveys with the rural community will indicate immediate and longer-term needs of farmers and their families, and help avoid misdirected and wasted aid efforts. Participatory rural consultations in Sri Lanka following the 2004 tsunami provided a valuable opportunity for communities to prioritise their needs (Koralagama et al. 2007).

Coordinate advice and planning of rehabilitation activities

Tsunami-affected farmers need consistent advice about how to manage sediment and soils, and the suitability of their land for farming. Government agencies and non-government organisations (NGOs) need

to work together to provide this advice. Aid organisations should work closely with local agricultural extension staff and farming groups in any land rehabilitation effort.

Train agricultural staff and farmers

Since government officers, NGO staff and farmers may have limited experience with the post-tsunami soil and crop conditions, training may be needed in assessing soil salinity and nutrients, reducing soil salinity, propagating and supplying seeds, and making compost.

Repair irrigation, drainage and other farming infrastructure

The 2004 tsunami deposited debris and sediment over farming land, and destroyed irrigation and drainage canals, aquaculture ponds and pumps, sheds and other equipment. In Aceh, it was evident that successful agricultural restoration could not occur before physical infrastructure was repaired and restored. This included removing debris and sediment; restoring roads and tracks; and replacing fences, agricultural machinery (such as hand tractors, ploughs, rice milling equipment and pumps) and buildings (such as milling and storage sheds, field shelters and latrines).

Assessment and repair of irrigation and drainage infrastructure are a priority for successful agricultural recovery. In some areas of Aceh, agricultural production was limited long after the tsunami by inadequate drainage and irrigation. The recovery effort focused on rebuilding infrastructure, such as roads and housing, and often overlooked irrigation and drainage systems. Communities in Sri Lanka ranked the reconstruction of irrigation channels as their top priority for post-tsunami recovery (Koralagama et al. 2007).

Incorporate shallow sediments

Where the sediment layer deposited by the tsunami is shallower than 15–20 cm and not highly saline, it can be incorporated into the soil below. Clay sediments may contain high levels of organic carbon and nutrients (Chaudhary et al. 2006) that can improve the water-holding capacity and fertility of sandy soils. In Aceh, sandy sediments were generally shallower than clay sediments and could be incorporated into the soil.

Remove deep or highly saline sediments

Where sediment removal is an option, sediment that is deeper than 20 cm or contains high levels of salt should be removed. Salty sediments can be stockpiled at the edges of fields and spread back onto the fields after rainfall has leached the salts.

Flush salt from agricultural soils

Where supplies of irrigation water are available, soil salinity levels can be reduced by flushing the salts from the top of the catchment. This can only occur if there is sufficient drainage infrastructure and irrigation capacity, and land levels have not been significantly altered by earthquakes.

In Aceh, irrigation water was used to flush salt from rice paddies. Because the tsunami occurred in the wet season, most fields were already moist; most rice paddies around Banda Aceh contained water, which limited infiltration of saline water into the soil. Wet-season rainfall and the availability of irrigation water helped to flush salt from the soil, except where impediments to drainage were present.

In rainfed areas, ponds and reservoirs may need to be pumped empty of saline water and refilled with rainwater to accelerate leaching.

Avoid farming saline land

Successful crops are an important part of the recovery process after a tsunami, but most crops struggle to be productive in saline soils. Early salinity surveys can identify areas unsuitable for farming, and periodic monitoring will determine when these areas are ready for planting.

Section 4 provides further details on selecting suitable sites for cropping.

Provide high-quality planting material

Supplies of seed and planting material may be scarce, but it is vital that only certified quality seed is supplied to farmers, to ensure that post-tsunami crops do not fail (see Section 4). Before distribution, aid groups should test the quality of seed and other materials intended for farmer use. Sperling (2008) provides a useful guide to assessing the local seed

supply and security situation. Farming implements may also be needed to ensure successful establishment of crops.

Grow salt-tolerant crops, where necessary

While salt could be present in the soil, varieties of rice and other crops that can be grown in saline soils must be identified and recommended to farmers (see Section 4). The crops must be matched to the soil salinity levels.

Establish income-producing opportunities for the farming community

In the short term, it may not be possible to generate income from farming activities. During this period, it is important to employ farmers and their families in assessing and repairing drainage and irrigation infrastructure, assessing soil salinity and nutrients, and composting organic waste. These activities will provide income, return farming land to production and encourage independence from food aid. Microfinance to help groups of farmers re-establish may be appropriate once farming activities recommence.

Establish home food gardens

For farmers and villagers who were not displaced by the impact of the tsunami, there is the opportunity to restore home gardens and encourage food growing while agricultural land is rehabilitated. The 2004 tsunami affected local employment, increased inflation as basic commodities became scarce and destroyed local ecosystems that people relied on for survival. These impacts particularly affected poor rural communities. Food-growing programs can be extended into more severely affected areas once housing and infrastructure have been restored.

A number of projects established in Aceh and Sri Lanka (Porteus 2008) focused on backyard food production and developing livelihoods for poor rural communities. A feature of the program in Sri Lanka was collaboration among local community-based organisations, with a longer-term goal of increasing food production and diversity in the affected region.

Establishing home gardens in disaster relief camps is also recommended. Food gardens based on indigenous plant knowledge maintain a connection to tradition, especially for displaced rural people, and reduce dependency on food aid. They can also contribute to improving the wellbeing of displaced people through activity and improvements to camp aesthetics and environment, helping to ease social tensions. Displaced people in Aceh remained in shelters and camps for up to 3 years. Opportunities to support small-scale food production and improve nutrition in camps and temporary shelters were missed by relief agencies in Aceh (Adam-Bradford and Osman 2009).

Consult women farmers and establish women's farming groups

The Aceh tsunami was followed by great social trauma and isolation. Until affected areas were rehabilitated, many women had limited access to employment and activities outside their homes. Women's farming groups provide important social outlets, extra income for the family and farming knowledge.

Long-term activities: 12 months onwards

Transfer technology and knowledge to the farming community

As information on farming on tsunami-affected soils becomes available, it needs to be passed on to farmers as quickly as possible to ensure that they receive up-to-date information. Farm demonstrations, field days and training for extension staff will all show farmers what methods work best.

Continue to build the capacity of farmers, extension staff and non-government organisations to manage soils

The Aceh experience showed that important relationships and networks were established though training and extension activities after the tsunami. These networks need to be strengthened over time to build farming knowledge and expertise, and to maintain contact between farmers, agronomists and NGOs. Training can focus on the agronomic and ecological aspects of farming in existing and new agricultural areas,

and the importance of protecting natural ecosystems, such as peat land, wetlands and forest. Demonstration sites (see Section 4) are important for bringing groups together for updates on farming practices and rehabilitation efforts, and for possible collaboration.

In many cultures, women comprise the majority of the workforce in agriculture. All consultation processes should involve women farmers (see Section 5). They should assess issues such as education, the contribution of home-based food production to local food security, improved family nutrition provided by a diverse diet, income-generating activities, and equitable and secure access to land.

Expand support programs to unaffected areas

Areas unaffected by the tsunami may miss out on the support and training provided to farmers in tsunami-affected areas. In Aceh, for instance, the unaffected inland areas have higher levels of poverty than the coastal areas, and an even greater need for information and training.

Monitor plant nutrition

Although crops may be re-established relatively quickly after a tsunami, the loss of organic matter, and residues of salt and sediment can contribute to longer-term nutritional disorders affecting growth, flowering and fruiting, or grain filling (see Section 4). Monitoring plant nutrition over the long term is therefore essential.

Monitor tree crops

Tree crops are an important part of coastal farming systems in many areas. The post-tsunami condition of tree crops should be monitored over the longer term. Saline water can severely affect commonly grown tree crops, including rambutan, mangosteen and rubber. Although soil and groundwater salinity declined rapidly with wet-season rainfall, groundwater salinity in West Aceh continued to fluctuate (Marohn et al. 2012), and recurring episodes of elevated salinity damaged rubber tree crops and reduced coconut yields. New plantings of deep-rooted tree crops may be affected some years after the tsunami where groundwater levels and salinity continue to fluctuate.