

Cultivating resilience: the rehabilitation of homestead gardens in post-Tsunami Sri Lanka

Melissa Harvey*

HDRA- International development Programme, Coventry, UK

Abstract

Agricultural rehabilitation is a key sector in disaster management as it links food security, livelihoods and environmental management. The overall aim of this study was to identify conditions that affect the resilience of agricultural systems, and how rehabilitation approaches can contribute to strengthening resilience, as well as meeting immediate needs. Household and organisation interviews were carried out in Sri Lanka, focussing on the impacts and recovery of homestead gardens that had been affected by the 2004 Indian Ocean Tsunami.

This study identified agronomic, social and developmental pre-disaster conditions that impacted the resilience of homestead garden systems. Ecological agriculture approaches, agronomic and livelihood diversity and community networks were found to strengthen the capacity of the households to withstand and recover from the tsunami. Inappropriate development appeared to have increased vulnerability of households. A range of approaches to agricultural rehabilitation was being implemented; this study ascertained that they are likely to have variable positive and negative impacts.

This research adds to the new and expanding body of work on agricultural rehabilitation and linking relief and development and will be used to develop a tool for agencies to improve the sustainability of agricultural interventions.

Keywords: Agricultural rehabilitation; ecological agriculture; homestead gardens; livelihoods; resilience; sustainability.

INTRODUCTION

The agriculture sector can be severely affected by disasters, and particularly in lower income countries where agriculture is frequently the primary livelihood for the majority of people. Agriculture can be affected in many ways, through the destruction of crops, soil fertility, infrastructure, inputs, land and human capacity. In terms of agricultural systems resilience refers to the food security, income and cultural functions. The investigation of factors that contribute to agricultural resilience is a

* HDRA- International development Programme, Ryton Organic Gardens, Coventry, CV8 3LG, UK.
Email: mharvey@hdra.org.uk or harveym2@coventry.ac.uk

relatively new field, however the identification and development of approaches to improve the resilience of agriculture to disasters is an increasing priority for many organisations working in relief and development and innovative approaches to rehabilitation are being developed to this end.

Recent research on the impact of disasters on agricultural systems and the sustainability of agricultural development and rehabilitation have highlighted cases demonstrating greater resilience of traditional and ecological agriculture over high external input conventional agriculture. For example ecological agriculture practices, such as terrace bunds, cover crops and agroforestry, were found to be more resilient to the impact of Hurricane Mitch in Central America in 1998 (Holt-Gimenez, 2000, 2002). Social systems are also important and a study across six countries identified the vital role of community based organisations in supporting the recovery of agricultural livelihoods (Battista and Baas, 2004).

Disaster management actors are increasingly conscious of the potential longer-term impacts of post-disaster agricultural rehabilitation approaches. For example, recent research has found that the distribution of imported seeds to farmers can undermine growers' choice of crop diversity and local seed markets and lead to the introduction of inappropriate crop varieties. In response to this a seed fair and voucher system is now used by some NGOs (non-governmental organisations), to facilitate farmers access to seed from regional seed merchants in exchange for vouchers, thus enabling farmers choice of locally appropriate crop varieties and supporting regional seed systems (Sperling and Longley, 2002).

A higher-level approach to linking stages of the disaster cycle to improve agricultural resilience has been developed by the UN Food and Agriculture Organisation (FAO) in the form of a Resilience Analytical Framework for assessing the health of food security systems and their capacity to withstand a shock. The framework addresses both the immediate and longer-term needs of communities by providing outlines relating to immediate access to food and methods for improving rural development and productivity. Based on this framework, intervention strategies that will improve the resilience of a food system should be based on four principles: strengthening diversity; rebuilding local institutions and support networks; reinforcing local knowledge; and building on farmers' ability to adapt and reorganise. The approach prioritises both technical aspects of production such as access to inputs, land, infrastructure, credit and markets, and the knowledge and social aspects such as community networks and social safety nets (Pingali *et al*, 2005).

The research on which this paper is based was carried out in Sri Lanka following the Indian Ocean Tsunami of 26th December 2004. Sri Lanka was one of the countries worst affected by the tsunami, both proportional to its size, and in absolute terms. 68% of the coastline was hit, causing over 35,000 fatalities, and displacing over 500,000 people. The impact on livelihoods was severe, and in the affected areas nine out of ten income earners lost their source of livelihood. Although less widely covered by the media, agriculture was the most severely affected sector after fisheries. While the coastal areas are not the most important in Sri Lanka for

agricultural production, agriculture is a very important part of the livelihoods of many coastal dwellers. The tsunami affected over 4,200 hectares of agricultural land and over 9,000 farming families and, in addition to this, an estimated 27,710 homestead gardens, which are an important source of fresh and nutritious food and income for many families (UNDP, 2005, FAO, 2005, Green Movement of Sri Lanka, 2005).

The tsunami had many short and long term impacts on agriculture. Inundated ground crops were invariably destroyed, either being washed away, or dying later from the increase in salinity. Many trees were uprooted and, of those that were not, many species were killed or badly damaged. In some areas a thick layer of sediment was deposited, and fertile topsoil was also washed away. Large debris prevented cultivation on many areas of land, and the clearance of these was one of the first tasks in the recovery effort. Inundated land was contaminated with salt, although well-drained areas were desalinated following rains and flooding shortly after the tsunami. There were also significant losses of livestock, stored equipment and inputs such as seed, tools and irrigation and processing equipment, and infrastructure such as sheds and roads (FAO, 2005, Green Movement of Sri Lanka, 2005).

AIMS OF THE STUDY

The aim of this study was to identify conditions that affect the resilience of agricultural systems, and how rehabilitation approaches can contribute to strengthening resilience, as well as meeting the immediate need to improve production and livelihoods. The study builds on previous research on the resilience of agriculture to disasters and different approaches to rehabilitation and their potential impacts on the longer-term sustainability and resilience of agricultural livelihoods. The research used indicators of resilience and long-term sustainability to evaluate the impact of the tsunami on agricultural rehabilitation approaches.

The main objectives of the research were:

- To identify social and ecological pre-disaster conditions that affected the impact of the tsunami on homestead gardens and/ or facilitated its rehabilitation.
- To identify the agricultural rehabilitation activities of government and NGOs and evaluate how they impact the longer-term development and resilience of homestead garden systems.

METHODOLOGY

The survey focussed on homestead garden production in three districts of Sri Lanka affected by the tsunami. A combination of agronomic, social and economic resilience indicators were investigated, based on existing research and analysis of agricultural resilience and sustainability. A qualitative research approach was the most appropriate to address a broad range of issues in sufficient depth, given that respondents were diverse and that no pre- or immediate post-disaster baseline data was available on individual interviewees. The survey was carried out in three districts

of Sri Lanka to represent different agro-ecological and socio-economic regions: Matara, Hambantota and Ampara districts. The selection was undertaken with the help of the University of Ruhuna and national and international NGOs.

Household and focus group interviews were held with homestead growers affected by the tsunami. Information was gathered on the agronomic system (types of crops, methods of cultivation, processing activities); the impact of the tsunami on basic needs, cultivation, food security and income; whether cultivation had been resumed; and any assistance that had been received. The information was triangulated through observation during plot walks and information from neighbouring growers. Interviews were held with government organisations and NGOs working on agricultural rehabilitation and development and further information was gathered through participation in meetings, informal discussions, email correspondence, and participation in a web-based discussion group on agricultural rehabilitation.

DISCUSSION

This study identified several key themes relating to the pre-disaster conditions that impacted the resilience of homestead garden systems to the tsunami, and the potential short and longer-term impacts of agricultural rehabilitation aid on food and livelihood security and resilience, discussed below. These themes substantiate the emerging concerns relating to agricultural resilience and rehabilitation aid, which should form the basis for further in depth investigation and analysis.

Pre-conditions relating to the resilience of homestead gardens

The sustainability and resilience of locally adapted natural resources

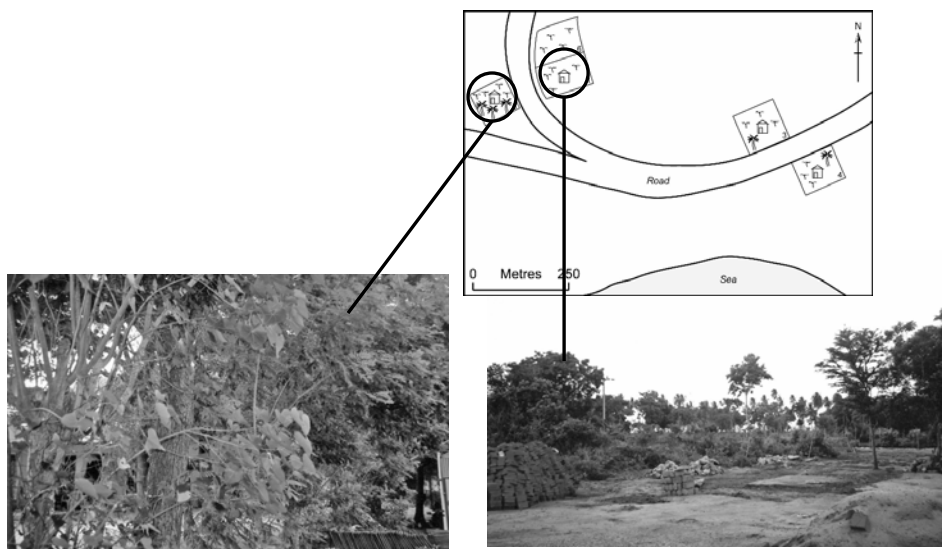
Following the tsunami coconut palms were one of the few crops to consistently survive the inundation. Coconut trees are superbly adapted to coastal conditions being salt and drought tolerant and with flexible trunks, which absorb the energy of wind and waves. Although some trees were uprooted, because of their adaptation most withstood the impact and survived the increased soil salinity levels. All households interviewed for whom a significant proportion of their income had come from coconut production were still making this income following the tsunami, and for several households this meant that they were still earning about half of their pre-tsunami income.

Farmers around the world use specifically adapted crops to spread the risks relating to hazards such as climate fluctuations and pest attacks. For example, in drought prone areas farmers have traditionally included some drought resistant crops in their cultivation. Flood prone communities, such as those in Bangladesh, also manage this risk by using adapted rice varieties and other crops. However, within current trends towards the intensification of agriculture and focus on commercial crops such adapted varieties are being less utilised and lost (Mogina, 1999, Mortimore and Adams, 2001, ITDG-B, 2002). The coconut industry has traditionally been fundamental in the Sri Lankan economy and coconut products are used in food,

industry (eg. rope, sacks for tea) and construction (eg. roofing, timber). However competition from other products such as plastic rope and sacking is impacting the market for coconut products. In response to this there are calls to modernise the traditional coconut industry rather than allow other products to take over.

Living barriers – the multiple functions of hedges

The large-scale protection provided by natural coastal buffers such as mangroves and other natural coastal vegetation has been confirmed by countless examples following the 2004 tsunami. A United Nations Environment Programme (UNEP, 2005) study found that, even on a small scale, natural barriers such as mangroves lessened the force of the wave, protecting both property and lives. This study found that living fences planted as part of an ecological farming system offered similar protection. This was clearly demonstrated by two adjacent holdings surveyed in this study, one of which was surrounded by a living fence, while the other was exposed to the sea (as shown in the pictures below). Both of the householders suggested that the vegetation had made a difference in the impact between them. Several other households mentioned living fences and vegetation as a mitigating factor to the tsunami impact. Furthermore it was observed that all surveyed households that had



traditional diverse homestead gardens received generally lower impacts on home infrastructure and basic needs, such as shelter and access to water and sanitation facilities.

The pictures above show the different impact of the Tsunami on neighbouring plots as shown on the sketch map. Both were about 470m from the coast, however one household was surrounded by a living fence. The exposed house was completely destroyed along with crops and possessions. The other house was only partially damaged and many of the trees survived.

Living fences in Sri Lanka comprise a variety of species, often including leguminous (nitrogen fixing) species such as *Gliricidia* and *Leuceana*. They are particularly

beneficial for tropical soils as they enhance fertility, provide shade from intense heat, and the leaves of many species can be used as a mulch to add organic matter to the soil, or as animal fodder. These species also seem to have been resilient to the impact of the tsunami, with many surviving sea-water inundation and, in one plot, numerous *Leuceana leuceophala* appearing as volunteer plants and growing vigorously.

Trees have multiple functions that can mitigate the impacts of such hazards: root structures stabilise soil, reducing erosion and the risk of landslides; in an agronomic context trees add nutrients and organic matter to soil, improving water retention and fertility, and many species provide food and animal fodder; trees form a barrier, slowing strong winds and the process of water inundation, and, as a last resort, can also be used by people to cling on to in such events (Sivakumar *et al.*, 2005). A key characteristic of ecological farming systems is the integration of multipurpose trees. The Holt-Gimenez study (2000, 2002) in Central America following Hurricane Mitch found that ecological farms were more resilient to the impacts of the hurricane as a direct result of the different practices, specifically the greater density of trees acted as a barrier and mitigated erosion.

The importance of community networks

This study has found numerous examples of individuals and community groups facilitating their own rehabilitation, and mobilising to assess needs and request appropriate external assistance. Several farmers CBOs (community based organisations) established before the tsunami had reconvened in order to access inputs, identify needs and apply for funding to meet them. They were aware that they had a greater capacity and chance of being responded to as a group than as individuals. One group had collected some money from each member to send off a soil sample to test if their soil was suitable for cultivation. On finding that it was suitable for cultivation they made applications for assistance to several NGOs in the area.

Many individual households displayed a great degree of resourcefulness towards re-establishing their livelihoods and those of their community. One individual, from a community that had lost many of its agricultural inputs, had accessed seeds from some distance away for himself and other community members, although this was not under the umbrella of a community group.

People have always had to manage catastrophes and, before the advent of the institutionalised humanitarian response, coping methods were based within family and community networks. The vital role of community response to disasters is increasingly recognised by the disaster management sector, and the 2004 World Disasters Report (IFRC, 2004) focussed on community resilience in situations such as the Bam earthquake and the Afghan crisis. The local communities are present at the impact of a disaster and know the culture, landscape and infrastructure of the area and are thus able to direct the recovery and rehabilitation process appropriately.

Resilience through diversification of livelihoods

Diversification of income generating activities and off-farm employment in rural communities are recognised as important factors in the development of sustainable livelihoods. Many households take on additional activities such as processing and sale of agricultural produce, contract work, crafts and niche foods and products (Hussein, 1997). Many of the interviewees in the survey were engaged in off-farm employment, such as office work or contracted farm labour, or non-land based agricultural activities, such as coir processing, mushroom cultivation or seedling production.

All of the interviewees who had diversified sources of income, had continued to gain some earnings following the tsunami. Those engaged in off-farm employment had resumed this work following the tsunami, and none specified that this employment had been severely affected by the disaster. The households surveyed that made their main income from coir processing, mushroom production, and seedling cultivation had been able to resume their work, albeit on a smaller scale. Two significant factors appeared to contribute to this. As the activities are not land-based, they were not constrained by damage to land, and growing substrates and necessary equipment could be brought in from unaffected areas. This facilitated the rehabilitation of such livelihoods, as the inputs and equipment required were specific and could be readily identified by the householder and aid organisations for replacement.

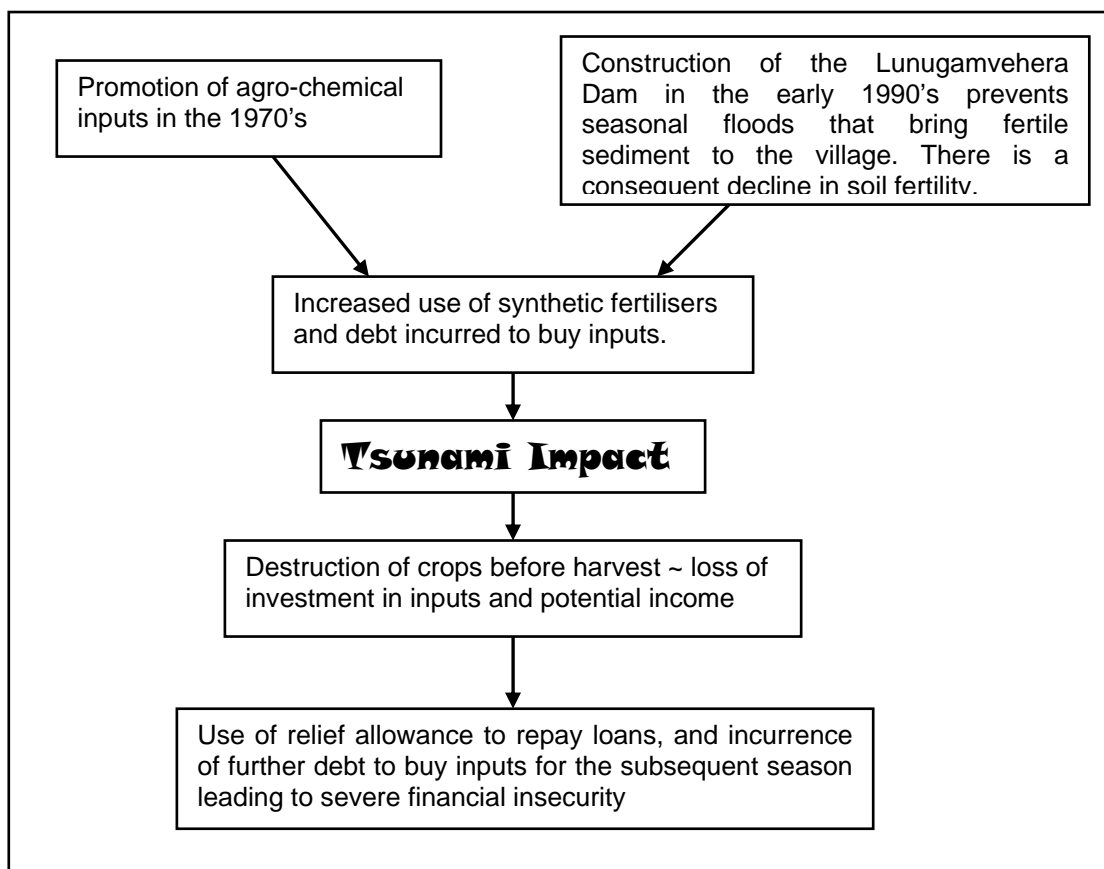
The impact of inappropriate development

In one survey location in the Hambantota district all households interviewed remarked on a dam that had been built about 15 years previously. Prior to this seasonal flooding had brought fertile sediment to the land, but the dam had altered the river flow preventing the flooding. Agrochemicals were widely promoted by extension system in the 1970's, and growers mentioned that following the dam construction they had had to further increase their fertiliser use and that there were fewer coconut trees. The dam had been an Asian Development Bank (ADB) project aimed to increase irrigated land in the district and create a location where communities from other congested parts of Sri Lanka could settle. However, a combination of factors resulted in the project being - according to the ADB itself - "less than successful", and, despite some improved infrastructure in the area, it achieved none of the primary aims (ADB, 2000, Green Movement of Sri Lanka, 2000).

After the tsunami growers not only lost their crops, but still had the debt incurred from purchasing the inputs. One household was compelled to use government relief money to repay its debt, and would have to take out further loans to buy inputs for the following season. Several households mentioned the high cost of inputs, and one described that they took out a loan at the start of each season to buy inputs that would be repayed with income generated from the sales of the crops. However, one

grower stated that profit margins were comparable in high and low input systems as the higher yield of the latter was offset by greater spending on inputs. The diagram on the following page shows hypothetical links between the dam construction, promotion of green revolution technologies and the vulnerability of the community.

Inappropriate development and natural resource management have frequently had unprecedented negative effects on communities' livelihoods and resilience. In the case of the tsunami, the unsustainable harvesting of coral reefs and mangroves was found to have increased the impact of the wave. Other impacts of development, such as the destruction of forests, increased dependence on external markets and the development of settlements in hazard-prone areas, have also served to increase vulnerability across the globe (Pelling, 2003).



The diagram above shows a hypothetical flowchart linking the dam construction, promotion of green revolution technologies and the vulnerability of the community

The sustainability of agricultural rehabilitation aid

Due to the timing of the study it was not possible to evaluate the impact of agricultural rehabilitation approaches. However, initial activities and responses have been evaluated in the light of other research on agricultural rehabilitation.

Agronomic assistance

Although many of the agricultural rehabilitation programmes were only in the planning stage, several others were in the process of implementation. These included the distribution of hybrid vegetable seeds and packages of paddy seed and fertiliser. The longer-term impacts of the distribution of hybrid vegetable seed has potential negative impacts on local agricultural bio-diversity and the accessibility of appropriate planting material in subsequent seasons. In this survey almost all of the growers interviewed in the survey saved their own seeds for planting. Based on results from other research (e.g. Sperling and Longley, 2002) the distribution of imported hybrid seeds could undermine the use of locally adapted traditional crop varieties, challenge local seed saving and distribution networks, and may not comprise varieties best adapted to local growing conditions.

An analysis of food security interventions in East Africa identified specific conditions in which seed distributions may be appropriate: when targeted households lack seeds; there is a general lack of availability of seeds of the right quality and; this lack is limiting production (Levine *et al*, 2004). The impact of the Tsunami was an unusual disaster in that the impact was limited to a small band along the coast. Thus, although many farmers own stores of seed may have been lost, there was no reason to believe that seed availability had been impacted on any larger scale. One international NGO, known for its innovations in agricultural rehabilitation approaches, had organised seed fairs at which farmers were given vouchers exchangeable for seeds from regional seed sellers. Along the same line, a national NGO had organised a farm fair where farmers were given vouchers to exchange against different inputs including a variety of tools, seeds, fertilisers and pesticides. Farmers had a choice of what to buy, but quantities of pesticides and fertilisers were restricted for environmental reasons. This approach can support local agricultural input systems and enable farmers to choose the products that are most familiar or appropriate to them.

Some of the post-tsunami agricultural programmes identified in the survey were designed specifically to minimise aid ineffectiveness and negative side effects. Some organisations offered distributions on a part grant/ part loan/ part training basis in order to stimulate beneficiaries' investment in the programmes and reduce the possibility of conflict over, or ongoing reliance on, handouts.

The methodological approach to needs assessments and project design can also impact the longer-term impacts of agricultural rehabilitation programmes. Several NGOs carried out assessments using PRA (participatory rural appraisal) methods or through community and regional committees. These approaches aim to stimulate community participation in, and ownership of, rehabilitation. In these cases the organisations anticipated integrated programmes, with agriculture likely to be a significant component, but also to include health, nutrition, education etc.

Psychosocial rehabilitation and agriculture

Since the 1980's there has been increasing attention to the psychological needs of disaster affected populations in addition to their physical and material needs. A diversity of relief and rehabilitation approaches have emerged to address these issues, including psychiatric care, counselling, religious/ spiritual ceremonies and community social activities. Due to very high levels of fatalities in certain locales, the tsunami had a severe impact on communities in terms of their human capacity: their well-being, households and livelihood resources, as well as their social networks, and these impacts were widely noted and many programmes implemented to address these issues.

Many householders expressed depression and a lack of motivation due to the loss of family members, insecurity from being in temporary shelters and fear of further tsunamis. Several organisations identified these problems as major constraints to the rehabilitation of livelihoods. There were several agricultural or agro-processing programmes with a specific psychosocial focus. For example, one international NGO was implementing community activities such as coir spinning, dying and weaving, and home garden promotion. The primary aim of these was to bring people together in order to build community spirit, motivation, confidence and skills, with a secondary outcome on potential income generation.

A subtle but potentially significant psychological effect was observed as a result of the emphasis on the impact of salinisation on agricultural lands, in assessments, the media and public information. Several growers stated that concerns about soil quality and salinisation were preventing them from re-planting. However, of those that did replant, only a few experienced lower yields than 'normal', and this was variously thought to be because of lower soil quality or lower rainfall than usual. Some growers seemed entirely satisfied with their crops, and one group had a soil test that showed no adverse levels of salt. However, many people were reluctant to invest in the work and inputs needed for re-planting when they were not convinced that the crop would be successful. Although there was some soil testing by the Department of Agriculture, primarily for paddy land, there seemed to be little institutional support for soil testing or assessing the viability of planting at the homestead garden scale. One individual had set up a small trial plot of several different crops to establish whether they would grow and thus would it be feasible to plant field scale crops. However information about soil quality testing and possible approaches to trials to test the land had not reached any of the growers interviewed. This impact of concern around excess salinisation was also observed in a post-tsunami programme in Banda Aceh where replanting was postponed by many organisations due to concerns about salinisation. However, one organisation that did replant trial areas of paddy found no adverse effect of salinisation and observed a hugely beneficial psychological effect from seeing the new crops growing (Bradbury and Stewart, 2005, Bradbury *et al*, 2005). This impact demonstrates the importance of accurate information provision in post-disaster situations.

CONCLUSIONS AND RECOMENDATIONS

This study has identified factors relating to the agronomic and social resilience of homestead gardens to the tsunami in Sri Lanka and the interactions between these and rehabilitation and development aid. The findings are supported by theory and the findings of other studies regarding disaster impacts and interventions, and thus lead to recommendations on approaches to rehabilitation and development and suggestions for further research. Because the context is geographically localised - impact along the coast and up to 5km inland - the issues around agriculture relate primarily to livelihoods rather than food security. However, if extrapolations are possible to other hazards with less localised impacts, food security may also be affected making the resilience of such systems imperative.

Enhancing the resilience of homestead gardens

This study identified agronomic, social and development pre-conditions that enhanced or weakened the resilience of homestead gardens. In terms of linking development with disaster mitigation, the findings of this paper and other similar research should be integrated into agricultural development programmes and information networks.

Resilient agronomic conditions identified were based on ecological agriculture principles of diverse cropping systems including the use of locally adapted crops, in this case often the coconut and multi-functional living fences. Households in this survey with diverse livelihood options were also found to have recovered at least part of their livelihood activities. Ecological approaches were not actively promoted in government agricultural extension or information networks, and only in a few NGO training programmes operating in the field sites. Given the good uptake of methods promoted through extension and training, it is important that this service provides balanced information on a variety of approaches, their problems and benefits. Development networks should also promote diversification of appropriate crops and livelihood options.

The impact of inappropriate development on vulnerability was demonstrated in this study through the example of the dam construction and the promotion of green revolution technologies. A disaster risk reduction lens can be applied to all aspects of development, and greater awareness of the potential of certain practices to improve resilience may be integrated into agricultural training and extension. More investigation is required in order to forecast the potential costs and risk reduction benefits of different methods in terms of sustainability and resilience.

This study identified the vital role of local communities and institutions such as farmer groups in terms of facilitating post-disaster rehabilitation. These findings support the increasing recognition by the disaster management community of the crucial role of local institutions and community networks in relief and rehabilitation. There are many opportunities for agricultural development programmes to work with

community groups in order to build their capacity and strengthen them in the 'pre-disaster' phase. There is also great potential for rehabilitation programmes to work closely with established community groups so as to deliver appropriate aid and inform their activities. The documentation and dissemination of case studies where community based needs assessments and rehabilitation assistance delivery have worked (or not worked), could facilitate future disaster management programmes to make the most of these institutions.

Addressing the sustainability of agricultural rehabilitation approaches

Several different approaches to agricultural rehabilitation were noted in this paper, some taking a conventional approach of handout distribution, and some more innovative approaches. Due to the timing of this study, it was not possible to assess the impacts of the different approaches, however, in the light of other research it is likely that there would be a mixture of positive and negative impacts. As knowledge and understanding about post-disaster rehabilitation is constantly evolving, it is important that different approaches are monitored and evaluated and both positive and negative impacts publicised for learning.

A major component of psychosocial programmes is the development of human capacity, including livelihoods and skills. As agriculture and agro-processing industries are so fundamental to many people, they lend themselves to psychosocial rehabilitation activities. This may have a significant impact in terms of both confidence building and skill development, leading to livelihood development. Agricultural practice may have an additional psychological benefit as a therapeutic activity and demonstration of a return to 'normal' seasonal cycles. The psychological benefits of resuming cultivation and seeing crops growing has not been widely examined, but could be a valuable area for investigation.

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