



Secure Coastal Ecosystems, Secure Communities

in Tsunami-Affected Areas



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This report communicates the learning and experiences from focus group meetings and local interviews during 5-10 October 2010, together with findings from a literature review, and the outputs of a workshop 14-16 October 2010, for the purpose of providing a picture of ecosystem rehabilitation and recovery of communities in coastal areas which were affected by the 2004 Asian Tsunami.



Secure Coastal Ecosystems, Secure Communities in Tsunami - Affected Areas

Coastal ecosystem security and
community security is the same,
because community is a part
of the ecosystem.

Preface

Mr Somchai Pienstaporn, Director-General, Royal Forest Department (RFD)
(Summarized from the opening remarks of the workshop, 15 October 2009)

The sustainable management of natural resources is no longer the mission of any one department, nor can it be treated in isolation. Local people should have a role in managing resources, and their development needs should be closely linked to the objectives of management. Similar considerations apply to the rehabilitation and management of natural resources in coastal areas.

In the provinces of Ranong and Phang Nga, both of which were hit hard by the tsunami, a collaborative and cautious approach to rehabilitating coastal resources is needed. Such an approach must take into account the role of coastal resources in local livelihoods and tourism, as well as their role in buffering inland communities and habitats against future disasters. The Royal Forest Department is fortunate to have secured funding from the ITTO (International Tropical Timber Organization) to implement the project, **Contribution to Forest Rehabilitation in Thailand's Areas Affected by Tsunami Disaster** in partnership with the Thailand Environment Institute, local communities and other government agencies. Through that project, we were able to address issues relevant to local needs and concerns.

The project was implemented in line with official government strategy, especially concerning the management of natural resources for the development and improvement of the quality of life of local people. At the same time, that management was linked to strategies for adapting to anthropogenic climate change. Protecting and managing natural resources systematically is an important priority of the Thai government. Therefore, the principles of the sufficiency economy have been incorporated into the implementation of the project, and emphasizing the development of knowledge and human resources, although not at the expense of traditional knowledge or local participation.

The Royal Forest Department is pleased to be playing a part in rehabilitating Thailand's coastal forests, and looks forward to building further partnerships with government agencies, local administrative organizations, non-governmental organizations and communities, to work towards our common goals.

Introduction

Thailand Environment Institute

No one wants to dwell unnecessarily on the Indian Ocean tsunami of December 2004, yet that tragic event has undeniably taught us much about responding to such disasters.

The tsunami devastated ecosystems, lives and property along the Andaman coast of Southern Thailand. Support for those affected was mobilized from many different parties, both for urgent relief and for long-term rehabilitation. That multi-faceted response offers us a range of lessons on how to prepare for future disasters of any size, large or small. The response of communities living in the affected areas has also been instructive. They are now more proactive in communicating with each other and seeking out news and information, and have also put a higher value on their coastal forests and ecosystems.

In the aftermath of the tsunami, the Thailand Environment Institute (TEI) partnered with the Royal Forest Department (RFD) to rehabilitate forests in tsunami-affected areas. That initiative, funded by the International Tropical Timber Organization (ITTO), aimed to rehabilitate both coastal ecosystems and communities stricken by the disaster. The learning and experiences from that work, together with the findings from a literature review and local interviews, and the outcomes of a workshop, have been collected in this report to provide a picture of ecosystem rehabilitation and the recovery of communities in coastal areas. It is intended to help readers visualize future needs more clearly, and to foster cooperation in ensuring greater security for coastal ecosystems and residents.

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Coastal Ecosystems and Communities

It is often forgotten that people are an important organism in the coastal ecosystem, and play a key consuming role in the coastal food chain.

Coastal Ecosystems and Communities

Thailand's coastline is divided into two distinct sections: the **Gulf of Thailand coast**, extending 1,600 kilometres across 17 provinces from Trat in the east to Narathiwat in the south; and the **Andaman coast**, extending 954 kilometres across 6 provinces from Ranong to Satul. Common features of the country's coastline include rocky beaches, sandy beaches, mudflats and estuarine sand bars, mangrove forests, beach forests, peat swamp forests, coral reefs, seagrass beds and various islands.

Topographically, the coastline consists of different intertidal zones and estuarine zones where fresh water draining from rivers mixes with sea water to create brackish conditions. There, organic material washed down by rivers provides nutrients which support diverse plant and animal communities, giving rise to interactions between organisms and their physical environment which together form ecosystems. It is often forgotten, however, that people are an important organism in the coastal ecosystem, and play a key consuming role in the coastal food chain.

Ecosystems are formed by interacting organisms and their physical environment. Most coastal forest ecosystems are dominated by mangrove and beach forest plant communities. A nationwide survey in 2004 revealed that Thailand's remaining mangrove forests cover about 1.5 million rai (2,400 km²), and its remaining beach forests only about 78,000 rai (124.8 km²).

- **Mangroves** are a tropical and subtropical plant community of mostly evergreen tree species. They form along coastal mudflats, estuaries, river mouths, lakes and islands, in the intertidal zone between high and low tide marks. Mangrove tree species are specially adapted with strong support roots, aerial or air - breathing roots, and thick bark and leaves. Key species include *Rhizophora* spp., which form what is commonly called *Rhizophora* forest in Thailand.



- **Beach Forests** are communities of evergreen plant species found along the coastlines of both land masses and islands, where they form on sandy, gravelly or rocky soils lying above the high tide mark. Naturally occurring species in beach forests differ from those in freshwater peat swamps or mangrove forests, and are mostly halophytes with irregular stem forms, short branches and thick leaves. And, because most beach forests occur on sand dunes formed from weathered rock or coral, they are sometimes also referred to as dune forests.

... Dr. Boonvong Thaiutsa ...

The value and worth of coastal ecosystems

Coastal ecosystems, in common with other ecosystems, provide various **ecosystem services** which contribute both directly and indirectly to various aspects of human well-being; including basic livelihood needs, security and safety, health, a liveable environment, and a free and fulfilling life.

Yet at the same time, Thailand's coastal ecosystems are threatened by disasters and human activities which can reduce or exhaust their resources. Those threats have provided an impetus to conserve the remaining resources, for example by conserving certain species restricted to coastal habitats (such as the dugong), and protecting others (such as dolphins, whales, porpoises, certain mangrove bird species, sea fans, giant clams and some types of hard and soft corals). All of those species are protected by law from unauthorized hunting, breeding, possession and trade because they are either rare or endangered.

Any damage to their remaining populations will have a disruptive and hard-to-quantify impact on coastal ecosystems and their biotic interactions.

Various attempts have been made to estimate both the market and the non - market components of the value of



ecosystem goods and services. The overall economic value of coastal ecosystems is high, although in general, it is only the value of directly harvestable ecosystem goods which is assessed. The results of two economic studies are given below:

- Krabi estuary: About 18,000 households live in the area, deriving an average value of 65,800 baht a year from traditional fishing and non-timber products collected from mangrove forests (Penporn, 2003).
- Phum Rieng village, Ban Don Bay, Surat-Thani: The village's 49 households harvest fish, crabs and molluscs valued at 17 million baht a year, or more than 8 million baht a year after subtracting costs (Bunthida, 2010).

Thailand's Department of Marine and Coastal Resources evaluated the value of mangrove forest ecosystems in an area between the mouths of the Mae Khlong and Phetchaburi Rivers on the Gulf of Thailand coast (Department of Marine and Coastal Resources, 2008). That study, intended to provide data for a court case, assessed the value of fishing and harvesting of other commercial aquatic species, the value of forest planting and maintenance, opportunity costs, timber values, forest litter and carbon sequestration values, and the value of newly formed mud flats. Taking all of these factors

into account, the study estimated the worth of mangrove goods and services as 143,067.12 baht/rai (22,890.74 baht/hectare). Multiplying this by the total area of mangrove forest in the study area - 22,600 rai (3,616 hectares) - gives an overall estimate of 3,233,316,912 baht. This figure does not include some items which could not be quantified, such as protection against erosion and natural disasters, or filtering of wastewater. Hence the actual value is likely to be higher.

Disasters and ecosystem change in coastal areas

The various disasters which occur in coastal areas include both natural and man-made disasters. They occur due to a number of important contributing factors, including a reduction in the supply of river sediment to the coast, unsuitable or over - extensive bank protection works, mangrove forest destruction, and inappropriate land uses. A distinction can be made between



hazards, which are common phenomena or conditions with a limited and manageable impact, and **disasters**, which have far greater and more severe impacts on human communities and ecosystems.

◎ Tsunamis

Tsunamis are usually caused by earthquakes under the ocean floor or, less commonly, submarine landslides or volcanic eruptions. These displace large volumes of overlying water, creating waves which may be only a few feet high in the open ocean and undetectable by the naked eye, aerial photography or remote sensing.

The cause of the Indian Ocean tsunami on 26 December 2004 has been attributed to a large earthquake measuring 9.3 on the Richter scale, whose epicentre was situated south of the province of Aceh in Sumatra, Indonesia. The resulting wave front spread out rapidly across the Indian Ocean, reaching the Andaman coast of Thailand (only 500 kilometres from the earthquake's epicentre) in one-and-a-half to two hours (Source: www.most.go.th/tsunami and www.disaster.go.th).

The damage caused by the Indian Ocean tsunami resulted from the strength of the wave and its penetration inland. Its power and impact were determined



by the topography of the coastline, including its steepness, the presence of islands and mangrove forests which could provide a buffer against the wave, and the nature of built-up areas along the coast.

◎ Coastal erosion

The entire length of Thailand's 2,614 kilometre coastline is subject to erosion, with 486 kilometres already eroded along the Gulf coast and 90.5 kilometres along the Andaman coast (Department of Marine and Coastal Resources, 2005). Erosion is a serious problem at 22 points on the Gulf of Thailand coast, most of them in the Upper Gulf, and at 8 points on the Andaman coast. Along some stretches of the Gulf of Thailand coast, the rate of erosion is as high as 30 metres a year, and in some places erosion has cut the coast back by about a kilometre.



Erosion affects not only the coast but also the sea floor, though this cannot be observed directly. Sea floor erosion affects mud flats, for example the flats at Bang Pu in Samut Prakan, which were five kilometres wide in 2006 but have now shrunk to just one kilometre. At Ban Khun Samut Chin, also in Samut Prakan, sea floor erosion has reduced the width of the beach from 2.5 kilometres originally to only 1.1 kilometres today.

◎ Sea level Rise

The hazards of changing climate are currently one of the main topics of international debate. A rise in global sea levels is one expected consequence of global warming, with the IPCC (Intergovernmental Panel on Climate Change, 2007) predicting a rise of 6.9 centimetres in this century because of greater - than - expected melting of the polar ice caps. Meanwhile, the consensus among other scientists is that rising sea levels will put Thailand and other Asian countries at a greater risk of inundation in the future.

A sea level rise of 1.5-2 metres in the Gulf of Thailand would lead to inundation as far north as Ayutthaya province, and would cause damage from the mouth of the Chao Phraya River to

Nakhon Sawan province. It would affect 12 million people in coastal communities, as well as coastal infrastructure around the Gulf and in Bangkok and its environs. A large area of land in the Chao Phraya basin used for cultivation would also be destroyed.

◎ Storm surges

Storm surges are a rise in normal water level along a shore, caused primarily by strong onshore winds associated with a low pressure weather system. Climate change is expected to intensify storm surges in two ways: by rising sea levels that will lead to elevated surges, and by increasing ocean temperatures that are likely to increase storm activity. (Charoon, 2008)



Thailand's National Disaster Warning Centre has warned that the country is especially vulnerable to storm surges from October to December during the northeast monsoon season. Nevertheless, the Thai Meteorological Department is able to forecast a storm surge at least one day in advance. (Meteorological Department, 2008)

Severe coastal storms experienced by Thailand have included Tropical Storm Harriet, which came ashore at Cape Talumphuk in Nakhon Sri Thammarat province in 1962, causing 20-metre waves; and Typhoon Gay, which made landfall at Pathiu in Chumphon province in 1989, resulting in waves of 5-10 metres and substantial losses of life and property.

Disasters lead to obvious changes in coastal areas, both gradual and sudden, and have both natural and human causes. Natural disasters are said to be easier to recover from than man-made disasters, yet changes in marine and coastal areas have been cyclical, and can be divided into three phases based on sea level and water temperature (Tanawat, 2007):

- 125,000 years ago, the Earth's crust started to cool, leading to lower ocean temperatures.

- 20,000 years ago, ocean temperatures were 8-12°C cooler, and sea levels about 130 metres lower, than they are today. The Earth then started to heat up, and ocean temperatures began to rise.
- About 6,000 years ago, sea levels reached their highest point, about 2-3 metres above current levels. They then started to decline.

Between 2001 and 2005, scientists from around the world were mobilized to provide a global picture of ecosystem change in the *Millennium Ecosystem Assessment* (MA, 2005). Of the 24 ecosystems assessed, 12 were found to have been suffered extensive damage. Various changes were also found to have occurred in coastal ecosystems.

All ecosystem change affects coastal ecosystems in some way, whether directly through changes in the direction of flow and amount of fresh water, or the destruction of coral reefs and mangrove forests, or indirectly. Further, the Millennium Ecosystem Assessment report concluded that those changes have a disproportionately high impact on poor people, women, children and the disabled. The report proposed various measures to address those problems, including fairer



trading arrangements, changes in consumption patterns, the development and use of appropriate technology, and greater information and literacy.

Coastal communities and resource management

The communities living along Thailand's coastline take a variety of forms, ranging from traditional farming and fishing communities to urban communities and communities at tourist destinations. One large population group comprises fishers who use small (8-12 metre) long - tail boats and cannot make long trips, and so rely on resources from mangroves and inshore areas.

Fishing communities benefit directly from coastal ecosystems, mainly in the form of household consumption of fish and other



aquatic resources, but also through commercial exploitation of certain species, depending on location. Coastal communities also use timber from mangrove forests in house construction, and exploit various plants commercially, for example Nipa palm and medicinal herbs. Lastly, some also use their lands for nature education or tourism purposes.

Case studies of 12 traditional communities scattered along the Gulf of Thailand and Andaman coasts (Thailand Environment Institute, 2008) have found a variety of clear resource management regimes with several key features:

- **Community organising:** In most cases, community management began in the wake of greater acceptance of participatory approaches to natural resource management, particularly following the legal recognition of participation in Thailand's former Constitution of 1997. In earlier cases, community action was a necessary response to severe external pressures.



- **Driving forces:** The impetus for collective action has included the exploitation of mangrove concessions, prawn farming, fishing with destructive gear, and the encroachment of mangrove forests used by communities. All of those activities have caused resource degradation and had a negative impact on community livelihoods.
- **Community champions:** Respected community members, such as village chiefs and religious leaders, have often been the instigators of collective action. In some communities, the driving force has come from a villager with natural leadership skills. Such champions play an important role in encouraging, persuading and educating community members to take part in communal discussion and action.
- **Mobilizing cooperation:** Collective action has begun with group formation, but its sustainability has depended on continually educating and informing community members, formulating rules and regulations to govern resource use, and strengthening of internal commitment and participation through regular joint activities, with a focus on younger generations.
- **Creating links between coastal resource management and community development:** Communities have managed to support internal economic development through resource use by promoting savings groups, career development and various income-generating activities.

... Dr Chamniern Vorratnchaiphan ...

All communities in the case studies benefited from coastal ecosystem services in the form of food, timber and medicinal herbs. They have also started to develop the nature education and tourism potential of their coastal resources, aiming to attract both local people and outsiders looking for recreation and

nature study. Some communities faced problems from coastal erosion and the impacts of the 2004 tsunami, and can now see clearly that mangrove forests help to reduce the impact of wind and wave action. As a result, they are all trying to extend and improve the quality of their forests.



In general, when communities gain concrete benefits from the management of coastal resources, they are more likely to cooperate with each other, and government agencies are more likely to recognise community management regimes. Greater recognition facilitates coordination with outside parties, and helps to attract both financial and technical resources. Yet, despite such results, most communities cannot reduce their vulnerability to disasters appreciably, and continue to depend on the collaboration and support of external agencies.





Rehabilitating Coastal Forests and Ecosystems Affected by the Tsunami

Reclamation in the immediate aftermath of a disaster aims to quickly re-establish plant communities to stabilize the ground, whereas restoration focuses on promoting recovery of the diversity and productivity of the original ecosystem.

Rehabilitating Coastal Forests and Ecosystems

Affected by the Tsunami

The tsunami of 26 December 2004, which devastated parts of Thailand's Andaman coast and the coasts of neighbouring countries, resulted from a massive earthquake measuring 9.3 on the Richter scale. The epicentre of that earthquake was situated in the Indian Ocean, just west

of the Indonesian island of Sumatra. The displacement of a large volume of sea water by the earthquake gave rise to a tsunami which reached the coast of Thailand, some 500 kilometres distant from the epicentre, in around 2 hours.

Impacts of the tsunami on coastal forests and ecosystems

The force of the tsunami wave and its depth of penetration inland were determined by the topography and development of the Andaman coastline, including its steepness, its island barriers, its buffer of mangrove forests, and its built-up areas. Studies in the wake of the tsunami found the coastal region and its ecosystems to have been profoundly affected at many levels (Ministry of Natural Resources and Environment, 2008):

- **Beach forest, pine forest and other trees:** An area of more than 30,000 rai (4,800 hectares) of unused forest land was damaged, mostly in Phang Nga province.
- **Mangrove forest:** About 2,000 rai (320 hectares) of mangroves were damaged, again mostly in Phang Nga.
- **Corals:** Around 13% of corals along the Andaman coast were visibly damaged, mainly shallow-water corals



around islands rather than deep-water corals. The main cause of damage was the deposition of a large volume of water, sand and other material by the tsunami wave.

- **Seagrass:** Around 3.5% of surveyed seagrass beds were damaged by sand carried by the tsunami. Up to 10% of the extensive beds around Libong Island in Trang province were covered by sand and muddy sediments.

In conclusion, the impacts of the tsunami stemmed from the energy of the wave, the deposition of sediments and other material picked up by the wave, and the inundation of brackish water ecosystems with salt water. In addition, there was destruction of benthic fauna and other animal communities.

In terms of the impact on forests, a study of mangrove and beach forests in Ranong province (Kasetsart University, 2006) found that:

- Mangrove forests were damaged by the direct impact of the tsunami wave up to

a distance of 80 metres from the mouth of coastal inlets.

- Stands of *Xylocarpus* spp. growing along the banks of inlets were damaged most severely, being uprooted and swept away by the force of the wave.
- *Rhizophora apiculata* trees were damaged by impact with uprooted *Xylocarpus* trees.
- *Rhizophora mucronata* and other tree species growing deep within the mangrove forests were only slightly affected.
- Beach forests were more severely damaged than mangrove forests because they bore the full brunt of the tsunami wave. More than half (53%) of beach forests were uprooted and destroyed.
- Beach areas are still covered in deposits of sand, and the original water channels are now 2-3 times wider as a result of scouring.



A study of the area around Ban Nam Khem in Phang Nga province (Thailand Environment Institute, 2009) found that the tsunami had completely uprooted and destroyed the *Avicennia* stands growing along Cape Bom. Along Khlong Pak Ko, a band of *Avicennia* forest 10-50 metres wide had been destroyed, but the damage to *Rhizophora* trees was limited. However, the flowering of *Rhizophora* trees had been affected by the stripping of their buds.

Research on the impacts of the tsunami by various organisations, as well as observations by local communities, have contributed to a better picture of the links between healthy coastal forests and the level of damage to coastal areas. By absorbing some of the energy of the tsunami, healthy forests in many areas were able to reduce its impact on communities living along their inner edge.

The process of rehabilitating coastal forests



Although the damage observed in various tsunami-affected areas was linked to forest condition, the length of coastal settlement, land elevation and the intensity of the disaster, few of those factors have been taken into account in efforts to rehabilitate tsunami - affected forests. That is because the parties involved have hastened to implement emergency relief plans using commonly found species, and have not considered how forests should be rehabilitated to maximise their ability to act as a shield against wind and waves.

Opinions of workshop attendees:

- Agencies come into the area to plant mangrove forests, bringing money and following blanket technical prescriptions. Yet local people approach planting with greater care and attention to detail. They look at which areas need restoration, and



which areas are bare, and plant accordingly. They don't plant in rows. They try to mimic natural patterns.

- The government believes it knows everything and is the owner of these mangrove forests. Then, when the forests are damaged, it takes over the response, bringing in people to plant trees and paying their wages and transport costs. But if local people did the planting, it would cost nothing, and as part of the bargain, there would be someone to look after the planting.
- In the aftermath of the tsunami, everyone was keen to replant the mangroves and help in some way. People in the community went out and did things they almost never used to do. At first, any species that could be found were used, but later various organisations came to revive local ecological knowledge and also train villagers in new techniques. This led to greater consultation and planning in the community.

Rehabilitating coastal forests to help protect inland communities against wind and wave action clearly has to take account of many factors. Addressing only some factors would reduce the effectiveness of that protective role. Further, rehabilitation should have a broad empirical base incorporating both silvicultural principles (tree density, age classes, species composition, etc.) and traditional ecological knowledge, and using approaches adapted to local conditions.

Rehabilitating forests affected by disaster can be divided into stages:

- **Reclamation:** In the immediate aftermath of a disaster, reclamation aims to quickly re-establish plant communi-

ties to stabilize the ground. As such, it puts greater emphasis on forest community structure than diversity. In mangrove forest areas, reclamation proceeds by replanting, usually with *Rhizophora* spp., because they have strong prop roots and can be easily propagated.

- **Restoration:** Focusing on later stages, restoration aims to promote recovery of the diversity and productivity of the original ecosystem. Another goal is to create, at the same time, opportunities for community use and benefit in line with local livelihoods.

In the past, participation at the reclamation stage has offered an adaptive mechanism for communities to find ways of reducing the impact of disasters. It has



also been a way of stimulating cooperation within communities. At the restoration stage, however, it is necessary to incorporate information from experienced and knowledgeable community members, as well as and technical experts.

A straightforward way of evaluating the success of rehabilitation is by looking for the reappearance of plant and animal species found before the disaster, and by assessing the quality of the physical environment in terms of water temperature, salinity, odour, pH, concentration of suspended solids, and dissolved oxygen levels.

A case study of the impacts of the tsunami at Laem Son National Park in 2008, more than three years after the area was

damaged, found that some benthic species had started to reappear. That augured well for the success of coastal rehabilitation efforts in the National Park and other areas.

The rehabilitation of coastal forests contributes to the rehabilitation of the coastal ecosystem as a whole because they retard erosion and provide habitat for other plants and animals. At the ecosystem level, however, those are not the only considerations in assessing the impacts of rehabilitation. Coastal ecosystems interact with and influence terrestrial and marine ecosystems. For example, maintaining watershed forests and coastal water channels directly regulates the amount of organic matter and sediment carried down to the coast.

Rehabilitating any ecosystem requires an understanding of the original ecosystem. Careful planning is needed, together with the propagation and planting of a diverse range of species”

... Researcher, Andaman Coastal Research Station for Development ...

The various organisations which supported mangrove planting after the tsunami often lacked plans for monitoring and maintenance. These activities have become the responsibility of the agencies that look after the coastal area, even though they have limited budgets. For this reason we want these organisations to allocate some funds for maintaining rehabilitated areas to local communities

... Official, Mangrove Forest Resource Development Station 17 ...



Factors involved in the rehabilitation of coastal forests



An analysis of the literature and case studies on the impact of the tsunami points to a number of factors influencing the capacity of coastal forests to withstand inundation, including the breadth of forest, the age and density of trees, and species composition. Those factors must be taken into account if rehabilitation is to create healthy forests able to buffer coastlines against disasters.

1) Breadth of forest: This is the most important factor for reducing vulnerability to natural disasters. The available evidence indicates that breadth is directly related to scale of impact. In Japan, for example, an area of coastal forest 200 metres in breadth has been

found to be an effective barrier against tsunamis. Research in Thailand has shown that 8 - metre - high waves can penetrate only 50 metres into healthy mangrove forest, and in Sri Lanka 6-metre waves have been found to damage just the first 2-3 metres of mangrove forest (Kashio M., 2005).

From the experience of the 2004 tsunami, the main weakness in forest protection has been identified as insufficient breadth of coastal forest and, related to that, unsuitable species composition in forests of limited breadth. For example, in Sri Lanka it was found that *Sonneratia alba* populations in forests 200 metres wide were particularly vulnerable to uprooting (UNEP, 2005).

2) Tree density: Density, the number of trees per unit area, plays a smaller role than breadth in determining the efficacy of protection, but is nonetheless important. An average level of density - i.e. one which is neither so high that it allows the tsunami wave to ride over the forest, nor so low that it offers no resistance to the wave, such as coconut groves - is most effective for protecting against waves. Forests with open lower layers, or trees with few lower branches, are less effective for reducing wave energy. Mangrove for-



ests with dense vegetation at all levels from the understorey to the canopy, often associated with a diversity of species, age classes and layers, are more effective wave barriers.

A case study from India found that where tree density was 14-26 stems per 100 m², the efficiency of protection was 96% (Tanaja, N., Sasaki. Y., Mowjood, M.I.M., Jinadasa K, and Homechuen, S., 2007). That study also looked at understorey density, and found that an open lower layer offered little resistance to waves just 1-3 metres in height. Other factors contributing to effectiveness included the time taken to reach maturity, the strength of root establishment, and stem diameter.

3) Tree age: Age is generally related to height and circumference. Larger, more mature trees are better able to withstand the impact of waves and have stronger root systems than younger trees. Trees of different ages, and therefore different heights, can combine to create a “wall” against waves. However, research by the Thailand Environment Institute has shown that age as a factor in wave protection is related to species. For example, in mangrove forests with dense (300-550 stems/100m²) concentrations of young *Rhizophora* trees less than 0.3 metres high, individual trees nonetheless have roots up to one metre

long and broad stems which help to reduce gaps and provide better wave protection.

4) Species composition: The composition of coastal forests influences their ability to protect against wave action. The diversity and density of vegetation in all layers, as well as the strength of root establishment, will play a role in withstanding wave action at various levels. Therefore, characteristics to consider in selecting species include the form of the lateral roots, stems, leaves and branches, and the growth of vegetation in lower layers.

The current tendency is to use exotic species for planting, which has given rise to a phenomenon called “ecosystem degradation by stealth”, where exotic species are less effective than local mangrove species for protecting against wind and wave action. Ecosystem degradation by stealth is a threat because most people will look at a forest planted with exotics and think it capable of protecting against disasters, although the forest has a significant weakness.

It should always be remembered that people and forests share the same coastal ecosystem and are interdependent. Forest management which ignores human needs, or development which pays no heed to forests, undermines the security of coastal ecosystems. So any rehabilitation of



coastal forests must address social and economic factors related to the people who live in and depend on coastal ecosystems. It must also take account of local culture and traditions, local environmental knowledge and wisdom,

existing forms of forest and resource use, income - generating activities with reduced environmental impacts, leaders, groups or organisations active in coastal ecosystem management, and relevant policy and local development plans.



Rehabilitation and sustainable use of ecosystems: The case of bamboo

Bamboo is common in natural forests. It can be planted easily and is tolerant of harsh conditions. It has long provided labour and income for Thai people, being used for woven products, furniture, fuel, housing, musical instruments, food and tools. Today, research continues across the world into new uses for bamboo, for example in fibre and clothing, as well as commercial applications in foods, construction, wood working, doors, windows, floors, furniture, charcoal, pulp and paper, textiles, energy and biofuels.

Bamboo is a naturally renewable and environmentally friendly resource, generating up to 15% more oxygen than equivalent stands of trees. If trees are used to rehabilitate a forest area, it may take 15-30 years for the canopy to reach a height of 15-20 metres. If bamboo is used, however, an equivalent volume of biomass can be grown in only 2-3 years, and can thereafter be used sustainably for an indefinite period. Planting bamboo in coastal areas expands the source of bamboo for fishing gear and other uses, and provides a raw material for weaving and a source of food.

... Samit Bunsermsuk...





Recovery and Rehabilitation
of Communities Affected
by the Tsunami

Communities taking the opportunity
to strengthen themselves, and the shifting
of responsibility to local authorities

Recovery and Rehabilitation of Communities

Affected by the Tsunami

Impacts of the Tsunami on Communities

The 2004 tsunami struck six provinces of Southern Thailand, leaving a toll of 5,400 people dead, more than 3,000 missing, and a further 8,500 injured. It had a heavy impact on tourism and fishing along the Andaman coast, destroying or damaging 315 hotels and resorts, 234 restaurants and 4,306 businesses servicing the tourist industry. Furthermore, 148 large and 776 small boats used for tourism were destroyed or sunk.

The tsunami affected 422 fishing villages, of which 40 were swept away entirely and about 200 severely damaged. More than 700 fishers were killed. In financial terms, the damage to the tourism sector has been estimated at 321 million baht, the fishing sector at 60 million baht, and the farming and livestock sector at 0.65 million baht (Ministry of Interior, 2005).

Household and community-level impacts as recounted by conference attendees include:

- There have been impacts on the mental health of family members, friends and associates of tsunami victims. Further, some survivors are now fearful of storm waves and panic at anything which sounds like the alert of the disaster warning system. Some families have adopted different occupations to avoid having to work on the coast or at sea.
- The repeated showing of strong and disturbing images of tsunami destruction in the media, together with remembrance programmes and other related events, have also



served to damage the mental health of survivors.

- Vulnerable groups in affected areas, for example women, children, the elderly, the disabled, and stateless people, who already had to contend with inflexible and conditional outside assistance, have received only limited support, and their rights to assistance from some agencies have been restricted.
- The unequal distribution of relief in the aftermath of the tsunami, coming amidst the confusion and losses of those affected, gave rise to some disharmony and self-seeking behaviour. In some communities, this has caused people to become more selfish. Some groups who were unaffected by the

tsunami, as well as those who were able to help themselves, received more assistance than necessary, and in doing so reduced the amount of support going to those who needed it most.

- Some communities had established their own management learning processes before the tsunami, so were able to muster a response fairly quickly. The formation of groups for specific tasks was a mechanism for coordinating with all parties, both inside and outside the community. It helped to reduce confusion and distribute relief where it was needed. Further, the creation of groups for specific purposes has intensified in many communities. In that way, the disaster has also had a positive impact on communities who were prepared.

Relief efforts by outside agencies

Most of the many emergency relief and rehabilitation operations immediately after the tsunami were uncoordinated and fragmented, even in areas where Public Disaster Relief Centres had been established. Most official interest and resources were directed at tourist areas, where different types of support were provided either directly by government or through local agencies and administrative organisations. Support took the form of

compensation to small business owners, fishers and farmers; support for students and orphaned children; and so on. In general, however, the support provided failed to meet the specific needs of people affected, because each organisation focused on its own area of interest and was under pressure to release funds quickly, which meant that the necessary detailed preparatory work in each community could not be carried out.



There was repeated questioning by agencies and relief organisations who had not prepared any information in advance but wanted to donate money or supplies. They would take pictures of their work to boost their achievements and image, but sometimes they also raised unrealistic expectations amongst survivors

... workshop attendee ...

UNEP-United Nations Environmental Programme, 2005 reported that people received assistance passively, without any role in planning or decision making. Problem solving overlooked the needs and capacities of communities, who were also given little information on what was being done. That led to changes in local power structures, and fully half of all households were forced into debt by a lack of relief fund management.

Cases of community recovery

Community learning in the wake of the tsunami varied depending on impacts, social capital and pressures. The following sections present diverse stories of community experience, recovery and preparation against future disasters.

Nature has taught us a lesson through the tsunami. We have to adapt, and the ecosystems which were damaged must themselves adapt. We can help these ecosystems to adapt more quickly by using our understanding of how they work. As for community adjustment, we can see that various communities used the tsunami as an opportunity for strengthening solidarity, both internally and between communities and outside agencies, in particular local administrative organisations.

... Sompoch Nimsantichareon ...

- **Ban Bang Kluay Nok, Ranong province**



The community of Ban Bang Kluay Nok had started a process of organising internally to support learning and development well



before the 2004 tsunami. In the wake of the disaster, the members of the community, who had a strong spirit of inquiry, came together to see how they could use the crisis as an opportunity for further learning.

Ban Bang Kluay Nok is a large community of more than 200 households, situated in the sub-district of Naka in Suk Samran. It is divided into two groups: households who farm on the coastal plain and inland slopes, and those who follow traditional fishing practices along the coast. The latter came into conflict with commercial fishers around 15 years ago, prompting them to form a local association to guard against over-fishing. Faced with a steady decline in fish resources, they came up with a plan to use small fish usually discarded as bycatch to make fish sauce. A group was formed to produce the sauce, but could not raise the necessary funds to obtain raw materials.

The support received by Ban Bang Kluay Nok after the tsunami helped to engender learning about situation analysis and its use in developing projects. That new capacity gave the fish sauce group a chance to put into action its plans to produce sauce for household consumption. Its initiative is helping to conserve coastal resources and develop self-sufficiency and integration of the community. Study tours and other support, for example vocational training in the repair of fishing boat engines, are giving community members

new skills, which may not help to maintain the group dynamic, but nevertheless expand individual capacities.

We have discussed the issue within the community and decided that in future we won't wait for others to help us - we will help ourselves first. This process can begin with developing occupations which increase our self-sufficiency and ability to organise activities, such as training in boat engine repair. The community is interested not just in mangroves, but also in watershed forests as elements of a comprehensive resource management plan. So we've encouraged the families who farm around watershed forests to adopt chemical-free practices that will have a lesser impact on downstream households.

*... Phaleeha Padungchart,
community member ...*

The community's revolving fund for supporting livelihoods and the environment received only limited support, and so has been used in different ways from other communities. In particular, it has been used to capitalise the community shop group and fish buying group, which together generate a clear income and widespread benefits. Part of that income has been allocated to managing the community's mangrove forests.



Ban Bang Kluay Nok has also surveyed its forest resources, replanted areas of mangrove forest damaged by the tsunami, and on several occasions released aquatic species to enhance remaining wild populations. Those efforts have been supported by local government agencies and external organisations, who continue to work with the community.

The tsunami did not lead to people moving or switching occupations at Ban Bang Kluay Nok, largely because those affected were internally displaced Thai people without land or other livelihood options. They responded only by strengthening their houses, and are also participants in the mangrove protection activities regularly organised by the community.

Looking ahead, the community of Ban Bang Kluay Nok must strengthen the links between its existing work on coastal resources, watershed forests and sustainable agriculture. It also has to develop collaborative learning networks with nearby communities. Any support provided by external organisations in the future should respect the course set by the community.

- **Moken communities, Surin Islands, Phang Nga province**

A paper on knowledge management and adjustment in communities at risk by Narumol Arunothai of Chulalongkorn University's Social Research Institute



(Arunothai, 2007) paints an interesting picture of the historical survival of the Moken in the face of numerous threats to their coastal home. The Moken have made their living both on the land and on the sea, alternating between living in homes on the coast and living on boats. When the tsunami struck on the morning of 26 December 2004, the Moken communities on the Surin Islands escaped without any deaths, even though two of their villages were destroyed.

Many elderly Moken in the villages of Ao Bon and Ao Sai En know that a sudden drop in sea level presages a tsunami (or laboon as they call it) and that people should immediately take refuge on higher ground. A fall in sea level when there are no waves is a warning or “danger signal” for the Moken. The older people have that knowledge, even though the Moken have no written language, because previous generations suffered tsunamis and “managed” the experience, learned from



it, and incorporated it into their oral tradition (“history tells us”) as the legend of the “seven-storey wave”. This tradition can be considered “hidden knowledge” that has helped communities to survive disasters, and has been passed to younger generations as part of the social learning process within communities.

The Moken word for tsunami, laboon, is not a loanword, which indicates that historical experience has been filtered through a process of knowledge creation that has added a new word to their language.

- **Ban Thung Rak, Phang Nga province**

Ban Thung Rak is a small coastal community in the sub - district of Mae Nang Khao in Khuraburi. The sub-district takes its name from Mae Nang Khao Mountain that extends from north to south along the east side of the area. The community is relatively new, having been established no more than about 40 years ago. It has grown steadily since then, and now numbers about 125 families.

Communities on the coast have to confront both natural disasters which cannot be predicted and man - made disasters. After the tsunami, a community moved into the area from

outside and the demand for natural resources intensified. We saw this as a challenge which we had to work together to tackle by establishing a system to manage our limited resources sustainably

*... Likhit Yodying,
community member ...*



In the wake of the tsunami, Ban Thung Rak was asked to support about 200 resettled families, mostly from nearby Phra Thong Island. Those households have formed two small but separate communities within Ban Thung Rak, known as Chai Pattana-Saphaka Chart Thai village and Thepparat village.

There has been some division between the original and the new communities, because external support has focused on the latter, both in terms of public facilities and in terms of livelihoods. This



support appears to have gone beyond immediate needs and has contributed to obvious splits between the villages. The rehabilitation of coastal resources damaged by the tsunami has been carried out by the original community group with support from local and provincial government agencies.

Ban Thung Rak began conserving its natural resources more than a decade ago, after community leaders took part in training under the Mangrove Forest Volunteer Guard scheme. They formed a team to patrol against illegal timber cutting and fishing, as well as carry out replanting and monitoring. The community later formed a mangrove conservation group and submitted a proposal for 5,000 rai (800 hectares) of forest to be registered as a community forest so they could define access and implement regulations. Ban Thung Rak is also a member of the Mae Nang Khao Mountain Conservation Group, a network of 6 villages in the Bang Wan and Mae Nang Khao sub-districts situated around the mountain. The Group was formed to identify ways of protecting Mae Nang Khao, which is an important source of water and timber but under increasing threat from encroachment and over-exploitation by the larger post-tsunami population.

- **Kor Khao Island, Phang Nga province**

Kor Khao Island, a sub-district of Takua Pa, was once an important and prosperous entrepôt on the Andaman coast. It was exposed to the full force of the tsunami, which killed 75 people and destroyed the houses, boats and fishing gear of about 100 families.

The tsunami struck the sandy beaches on the south and west of Kor Khao Island directly, causing great damage to the communities and tourist sites there. The muddy beaches on the north and east of the island, and the surrounding mangroves, were also damaged, though with considerably less loss of life or property.

According to local villagers, support from at least 50 different agencies flooded into the five communities on the island in the two years after the tsunami. The communities were overwhelmed with donations of supplies, and began to think they would have to send some to survivors in other provinces. They also received help for reconstruction and road repairs, replacing boats and fishing gear, revolving funds and rehabilitating mangrove forests. New plans for rehabilitation and tourism management were also drawn up.





Amidst the damage of the tsunami, people became more selfish. Some received more in support than they had possessed before the tsunami, and only waited for more. Some got their relatives from outside the area to register for new fishing boats. This competition continued until the support ended two years later, at which point the community began to think about restoring the environment. They then started to form groups to carry out regular replanting, though the tsunami had given them many foreign friends and a network of agencies and tsunami survivors in other areas.

*... Prachob Ditpan, Village head,
Moo 4, Kor Khao Island ...*

Organising groups was one of the requirements imposed on Kor Khao by external organisations as a condition of their support. As a result, more than 50 new groups were formed, most with overlapping committees and members. Today, the only groups still functioning are the savings group, the revolving fund group, and about 15 different mangrove conservation groups. The group system is nevertheless helping communities to learn from their successes and failures.

Although the rehabilitation of mangrove forests was initially carried out in haste by government agencies, who hired outsiders to plant areas outside the main zone of damage, it helped to increase local appreciation of the importance of mang-



roves. That appreciation, together with regular support for study and learning, has led villagers to cooperate to plant and restore nature study trails, formulate regulations and carry out management. Today, some communities are starting to manage their mangrove forests by themselves. Ban Nok Na, for example, has submitted an application for a community forest of 1,500 rai (240 hectares). As yet, however, there has been no rehabilitation of damaged beach forests on the east side of Kor Khao Island because those areas are mostly privately owned.

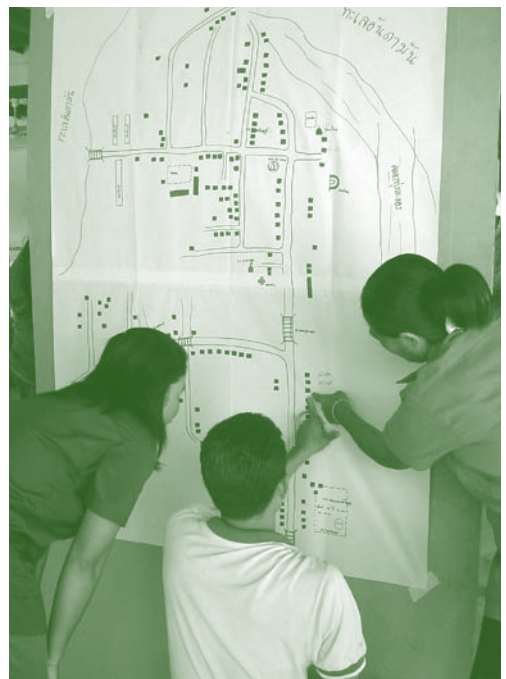
About 30 families on Kor Khao Island who were affected by the tsunami subsequently moved to higher ground where they felt safer. With this move, they switched from fishing to farming and occasional wage labour. In general, the communities on the island are now much more active in tracking information and warnings on disasters. One warning tower has been erected in the north of the island, and a second at Ban Nam Khem on the island's southern side, which also services the adjacent community of Ban Pak Kho. These two communities are discussing the erection of a repeating tower for the warning signal, and are building a communal disaster shelter because there is no high ground in their vicinity.

The sharing of information and discussion in regular monthly village meetings is a clear form of community self-management on Kor Khao Island. Further, the capacity

to coordinate with outside agencies has helped to improve the communities' ability to obtain support that meets their own particular needs, and has moved the community - agency relationship to a more equal and collaborative footing.

- **Ban Nam Khem, Phang Nga province**

Ban Nam Khem is situated in Bang Muang sub - district of Takua Pa, one of the areas hardest - hit by the tsunami. Before the disaster, the community was crowded and growing without direction. Its inhabitants came from different backgrounds and lived separate lives with little communal participation or civic responsibility.



Research by Phasika (2007) for a thesis entitled “Knowledge Management for Community Rehabilitation and Disaster Preparation: A Case Study of Ban Nam Khem, Phang Nga” found that many organisations helped Ban Nam Khem after the tsunami, but their efforts were uncoordinated and often duplicated. However, such disorder and confusion did not discourage the villagers. Some decided they would not wait passively for help, but would instead try to surmount the situation and face their fate together. Once people recognised that their fortunes were interlinked, they started to form horizontal relationships.

A process of self-organisation began from that point, based on communal discussion, networking and collaborative learning. A space was created for tsunami survivors to exchange learning through meetings and a “Coffee House”, and the crisis became a lesson and stimulus for villagers to become more public-spirited and do more for their community. Further, with the refusal to wait for help from day to day, community members became more forward-looking and hopeful, rather than preoccupied with their losses.

A community coordination centre has since been established at Ban Nam Khem to address various issues systematically. It is a point of focus for assistance that helps tsunami survivors and outside

organisations to collaborate in drawing up rules and regulations. The leaders of Ban Nam Khem also have regular opportunities to exchange learning and experiences with outside agencies, which are passed on to the community at large to use in rehabilitation.

- **Kuk Kak, Phang Nga province**

The sub-district of Kuk Kak has six village communities located along the coast. They are a mixture of traditional and immigrant communities, and so it is not possible to specify their exact number of inhabitants. All were affected by the tsunami, however, which caused a great loss of life and property. The community at Laem Pakarang (Coral Cape) was hit hardest. In other areas, the damage was mostly to tourism.

After the tsunami, almost 200 families from Laem Pakarang and the surrounding area were resettled in permanent housing built at Ban Bang Khaya and Ban Thung Khamin by different agencies.

The 70 Moken families affected by the tsunami at Ban Thung Wa, however, remained in their original settlement about 2-3 kilometres from the coast. New houses were built for them by outside agencies, but they have to stay alert and listen for the disaster warning signal at all times.



The process of resettlement at Kuk Kak did not force many people to switch from fishing to other occupations, though they were given occupational support and a revolving fund. Most continue to fish as they did before the tsunami. A channel next to their new housing provides a mooring point for their small fishing boats.

The tsunami had a severe impact on the beaches scattered along the coast at Kuk Kak, and also damaged mangrove forests at Ban Bang Khaya. They have yet to be rehabilitated because the community is unsure who owns the land, and fears it may be privately owned. If it is not, the community is ready to work together to rehabilitate the forest. Meanwhile, the damaged beach areas have been restored by government, though there are still public areas which should be managed to maximise their benefits.

Before the tsunami, the beaches at Kuk Kak were beautiful and were used by turtles to lay their eggs. After the tsunami, the turtles vanished and other sea creatures declined. An area of mangrove forest at Ao Makham was taken over for development and the natural water channels filled in. Parts of the mangrove forest disappeared and the ecosystem as a whole started



to degrade. Villagers also lost the mooring for their fishing boats. If no agencies had come to intervene, the entire beach area might have been taken over by investors.

... Sangiam Saraek, Assistant to Village Head, Moo 1, Kuk Kak sub-district ...

The preceding examples are only a small selection of the communities affected by the tsunami, but they serve to show the variety of relief, adaptation and recovery measures in the years after the disaster. The cases offer lessons for other communities and for the agencies that will play a role in helping coastal populations affected by future disasters.





Lessons from the Tsunami

Communities learned and mitigated the effects at 3 levels, which were individual, community-based and global.

Lessons from the Tsunami

The well-being of coastal communities is closely related to the goods and services provided by coastal forests and ecosystems, in particular food, community-based tourism and protection against wind, waves and erosion. Ecosystem valuation is becoming more common, but it is mostly the direct, marketable benefits of ecosystems that can be valued. There are still insufficient data to allow a valuation of their indirect benefits, which are considerable.

The relationship between human well-being and ecosystem benefits was made even clearer by the tsunami of 2004, which confirmed that coastal forests can protect lives and property. In the future, however, climate change, coastal development and other pressures may lead to more frequent and more damaging disasters (see Figure).

Studies in different areas affected by the tsunami have found that the damage varied according to different risk factors, in particular:

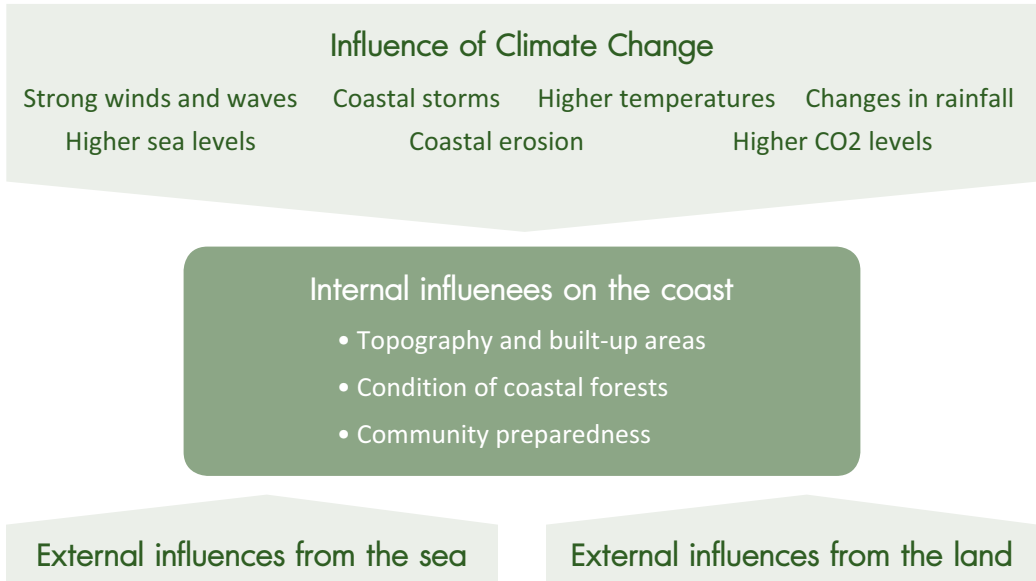
- The topography of the area, including its gradient, distance from the beach, design of construction and infrastructure, and so on.
- The condition of mangrove and beach forests, which can reduce the impact of wind and waves and function as a barrier against disasters.
- Community systems for responding to and managing disasters.

To reduce the probability of natural disasters, therefore, the focus of action should be on reducing internal risk factors and mitigating climate change. In the conference, and in this report, there has



been an emphasis on understanding the internal risk factors related to forest condition and community preparedness,

by looking back at past events and forward to the future to identify appropriate courses of action.



Relationship between external and internal influences on coastal areas

Options for Rehabilitating Coastal Forests and Ecosystems

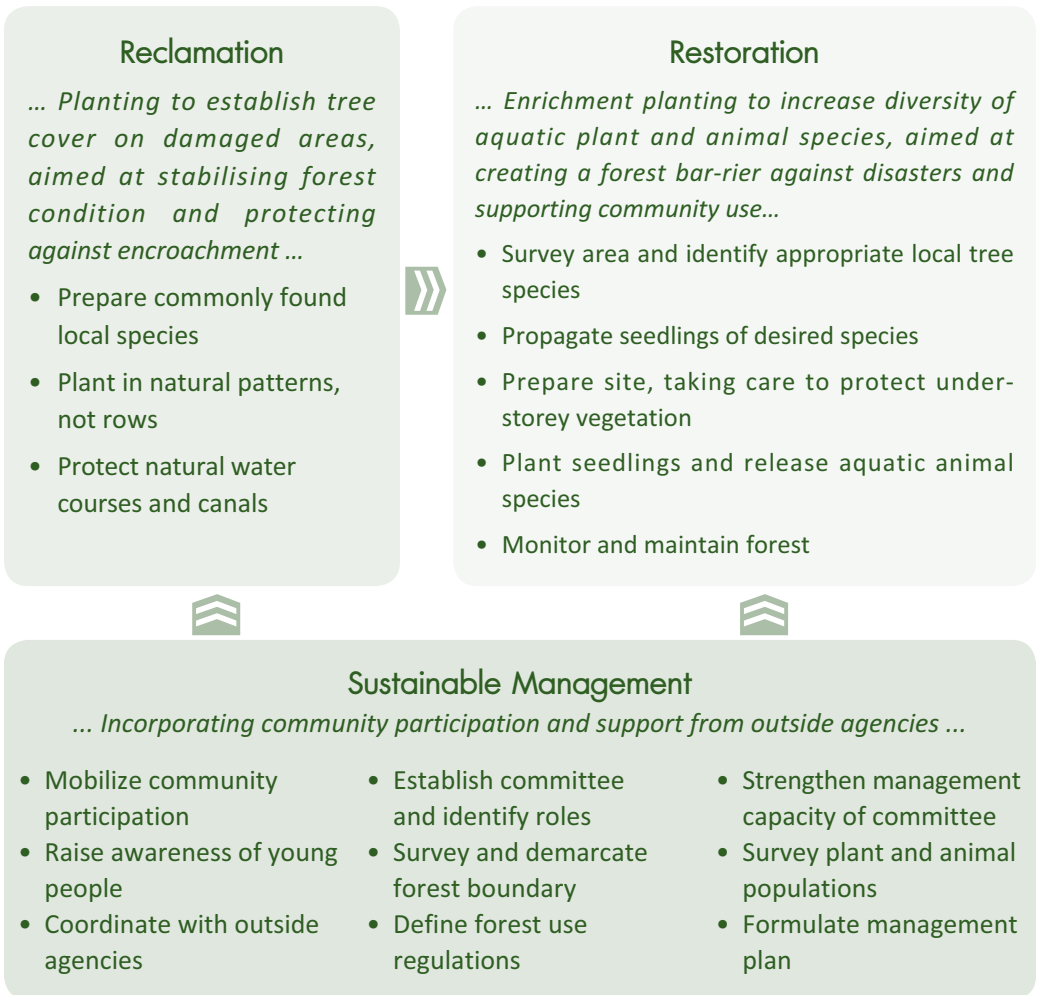
Human activities, natural disasters and climate change are accelerating the rate of change and degradation across the world, although coastal ecosystems are also constantly changing as a result of natural processes. Those diverse influences must be studied and understood.

Experiences in many different areas, particularly tsunami - affected areas, have taught us that the ability of forests to

shield against disasters is determined by several key factors, namely, forest breadth, tree density, age distribution and species composition. Rehabilitation should therefore aim to create a diverse, multi-layered forest with a healthy understorey and no exotic species. Further, planting should not be in rows, but aim instead to mimic natural distribution patterns in nearby forests.

In the immediate aftermath of the tsunami, replanting was carried out as part of uncoordinated emergency measures aimed at reclamation of damaged areas. Later, the emphasis shifted to restoration of coastal biodiversity to enhance ecosystem and human security. In many areas, however, stakeholders have emphasised

the continuity and sustainability of both reclamation and restoration. Those sustainable management approaches have been based on community participation and targeted support from outside agencies at all stages of the rehabilitation process.



Process of rehabilitating coastal forests



The approach and methods used in rehabilitation will differ from place to place depending on who is involved and local conditions, in particular the condition of the remaining forest. In some areas, the forest may be in a conservation area managed by government officials, in which case the community has to adjust its role to support their work. In all cases, com-

munities should identify and adopt an approach suited to local conditions and needs. That approach should cover the entire watershed from the uplands and headwaters to the coast. It should also take into account sustainable uses of the ecosystems aimed at improving the quality of people's lives.

Forms of adaptation by coastal communities

Disasters can be both natural and man-made. In both cases, a lack of preparedness leads to higher losses and greater impacts on people and ecosystems. Various kinds of disasters can occur in coastal areas, for example erosion, rising sea levels, tsunamis and storms. Case

studies of six tsunami-affected communities in Ranong and Phang Nga provinces showed that communities have learned and adapted in response to the disaster at three levels: the individual, the community, and the global (which includes adaptations linked to climate change).

Changes in individual behaviour

- Domicile
- Occupation
- Demand for information
- Awareness of forest values
- Participation in rehabilitating resources

Collective action

- Group formation
- Exchange of information
- Self-management of livelihoods and finances
- Rehabilitation and management of resources
- Coordination with agencies
- Awareness of forest values

Adaptation linked to global climate change

- Obtain and disseminate information
- Community preparedness
- Conserve and increase forest cover

Adaptation by coastal communities in response to the tsunami



◎ **Individual adaptation:** Changes in behaviour in the face of disasters, for example:

- Increasing rates of resettlement away from the coast in cases where outside agencies have built new housing or where people have land of their own they can move to.
- Fishing closer to the coast, to allow for a quicker return to land in the event of a threat.
- Increasing the height of houses, coupled with greater use of stronger building materials, in areas where people cannot move or do not want to move because they are close to their fishing areas and can move their boats and gear easily.
- Paying greater attention to news and information, in particular information related to climate change.

- Valuing coastal forests more highly, which leads to regular participation in activities to rehabilitate and conserve coastal resources.

◎ **Community adaptation:** Collaborative learning among community members on the changes needed to tackle disasters, for example:

- Forming internal groups for different purposes:
 - To share learning and information, for example the traditional knowledge of the Moken people, or general news and information
 - To self-management, usually in response to promotion by external supporting organisations. Such promotion has given rise to small activity groups, for example savings groups, conservation groups, revolving funds and occupational groups. Such



adaptations can be considered “*passive*” adaptive responses.

- › To coordinate with outside agencies. Such groups are not common, but are found in cases where other groups have already formed, for example in Ban Bang Kluay Nok; or where the community faces new pressures and demands, for example in Ban Nam Khem. Those groups coordinate activities, conduct internal consultations, and negotiate with agencies who want to provide support to ensure that community needs and interests are met. Such adaptations can be considered “*proactive*” adaptive responses.
- › To increase the capacity of community leaders, which also gives rise to new leaders, in step with increased communal participation. This form of adaptation tends to occur in strong communities with good internal relationships. In some communities, however, threats and other pressures help to strengthen participation; in others, participation may be a condition or a focus of assistance from external agencies.
- Increasing learning from the adaptations communities have made in response to external assistance with different mechanisms and procedures, in particular the establishment of revolving funds, coordination with

outside agencies, and project development and management.

- Increasing awareness of communal capacity to manage local natural resources, though regular and sustained mangrove forest rehabilitation and coastal resource management activities. Many communities have established clear management systems which are now recognised by various government agencies.

◎ *Adaptation linked to global climate change*

- Although most adaptation is in response to changes which concern communities directly, reducing the impacts of climate change is something which concerns the world as a whole. Forest rehabilitation and conservation are direct approaches to mitigating climate change because they increase the amount of



CO₂ sequestered in biomass. At the same time, they help to support overall ecosystem functioning. In the future, however, ecosystem change may accelerate if nothing is done to prevent it. To that end, the learning and

participatory processes which communities are developing will be important tools in managing those changes and ensuring that the impacts of climate change are reduced.

The very first priority for the community's adaptation to unexpected disaster is acquiring collectedness so that intelligence can be instrumental in coping with the consequential damages. A large number of communities are able to overcome the crisis by themselves but certain communities need to rely on support of external agencies. If totally directed by external agencies, such communities will possibly fall into a state of confusion and self-destruction. Thus, community - based actions should be carried out so that it corresponds to their local way of life. However, the communities themselves shall have to be well-prepared in advance, otherwise, if complacent, they cannot act timely. It is also strongly advised that terrestrial forest be seriously attended to due to a very high degree of its depletion. The holistic management of resources must be pursued, covering watershed area, or upstream, midstream and downstream areas. In so doing, participation that shall deliver the maximum benefits to the communities must be the significant focus. Mere attendance to the meetings does not suffice but participation on a continued basis is the key, through which sharing ideas, joint actions and benefit sharing are the requisites.

...Pracha Carvijitr...





Looking Forward to Ecosystem and Human Security in Coastal Areas

Integrated rehabilitation of up-stream,
mid-stream and coastal areas by
formulating watershed plans and
developing local management

Looking Forward to Ecosystem and Human Security

in Coastal Areas



The ideas and proposals for future work discussed in this section are based mostly on the outputs of the conference. The 95 participants were divided into three working groups of 25-40 people each, representing communities from Ranong and Phang Nga, and supporting organisations. The groups exchanged information and experiences, and discussed future options for collaboration to strengthen ecosystem and community security.

The scope and meaning of security in the community context

Group brainstorming began with a discussion of the meaning of “security” to elicit people’s ideas and perspectives before moving on to identify ways of enhancing security. The shared view of participants was that ecosystem and community security are essentially the same thing: people are an integral part of the coastal ecosystem, so greater ecosystem security will lead to greater security for communities.

In summary, the security of coastal ecosystems and communities, as understood by community leaders and organisations working in this area, must cover three issues: ecosystem health, ecosystem management and community security.



Community Security

- *Strong leadership and inter-community networking*
- *Forest barriers against disasters and wind and wave action*
- *Community forests or other collective forests under sustainable management regimes*
- *Income generation from coastal resource management*

Ecosystem Health

- *Healthy terrestrial, mangrove, peat swamp and beach forests*
- *Species breeding grounds and nursery areas*
- *A diversity of animal and plant species*
- *Populations of rare endemic species*
- *Undisturbed water channels with adequate depth and flow*

Ecosystem Management

- *Healthy terrestrial, mangrove, peat swamp and beach forests*
- *Species breeding grounds and nursery areas*
- *A diversity of animal and plant species*
- *Populations of rare endemic species*
- *Undisturbed water channels with adequate depth and flow*

Components of coastal ecosystem and community security

Most coastal communities have a similar understanding of security. For them, the coastal ecosystem provides a basis for sustainable production and living, achieved through participatory management systems which ensure food, income, livelihood and social security.

Workshop attendees also highlighted a number of existing threats to security, for example:

- A lack of comprehensive ecosystem management, encroachment and clearing of watershed forests to plant cash crops, and dredging of water channels.
- Inappropriate coastal development which increases the flow of sediments onto seagrass beds, corals and the nursery areas of aquatic species.



- Landfilling in mangrove forests and coastal construction without adequate preparatory studies, causing water runoff, flooding and erosion problems.
- Private entrepreneurs, who own the majority of coastal land and beach forest, but are not involved in management.
- Duplication and a lack of clarity in the roles of different coastal management agencies.

It is clear that security is both necessary and indivisible for coastal communities, so management efforts to improve security in different areas should be integrated. However, communities still tend to see the problems closest to them as most critical, for example encroachment and degradation of the coast in front of their village. Such problems may not be resolvable at the local level, but instead require changes to wider administrative and regulatory frameworks.

... Prathip Mikhatitam ...

Suggestions for further work

The actions suggested by conference participants to improve security and address existing threats focus mainly on rehabilitating ecosystems and developing robust and sustainable coastal management regimes. They include:

- 1) Rehabilitating upstream, mid-stream and downstream ecosystems under sub-watershed management plans implemented by local organisations or communities.
- 2) Managing coastal areas through land-use management, information surveys, reviews of tenure rights, demarcation of land boundaries, and reliable maps and databases.



- 3) Surveying and rehabilitating local biodiversity through setting aside conservation areas, propagating rare local plant species, and promoting the integrated use of traditional and scientific knowledge.
- 4) Continuous building of community capacity and networking for sustainable coastal resource management, and enhancing incomes from management, for example by adding value to fishery products and developing ecotourism ventures.
- 5) Promoting the role of local administrative organisations and collaborative networks in managing overlapping systems of management.

- 6) Promoting the formation of business groups to draw up codes of conduct for their members, in particular codes for activities in or around threatened beach forests.

To achieve their goals, those actions must allow for meaningful participation based on prior stakeholder identification and analysis. The institutional and regulatory framework for coastal management in Thailand is complex and still evolving. In this situation, participatory approaches, particularly those between communities and local administrative organisations, should be established without waiting for central government to take the lead. Such collaboration will help to carry forward activities at the local level.

Roles of Communities and Other Stakeholders

The next phase of coastal management will mark a turning point for Thailand, thanks to increased community awareness, the emergence of greater corporate social responsibility (CSR), the devolution of powers by state agencies, and an increased role for local administrative organisations. Further, an ongoing process of community organising is creating new capacity for local coastal management initiatives.

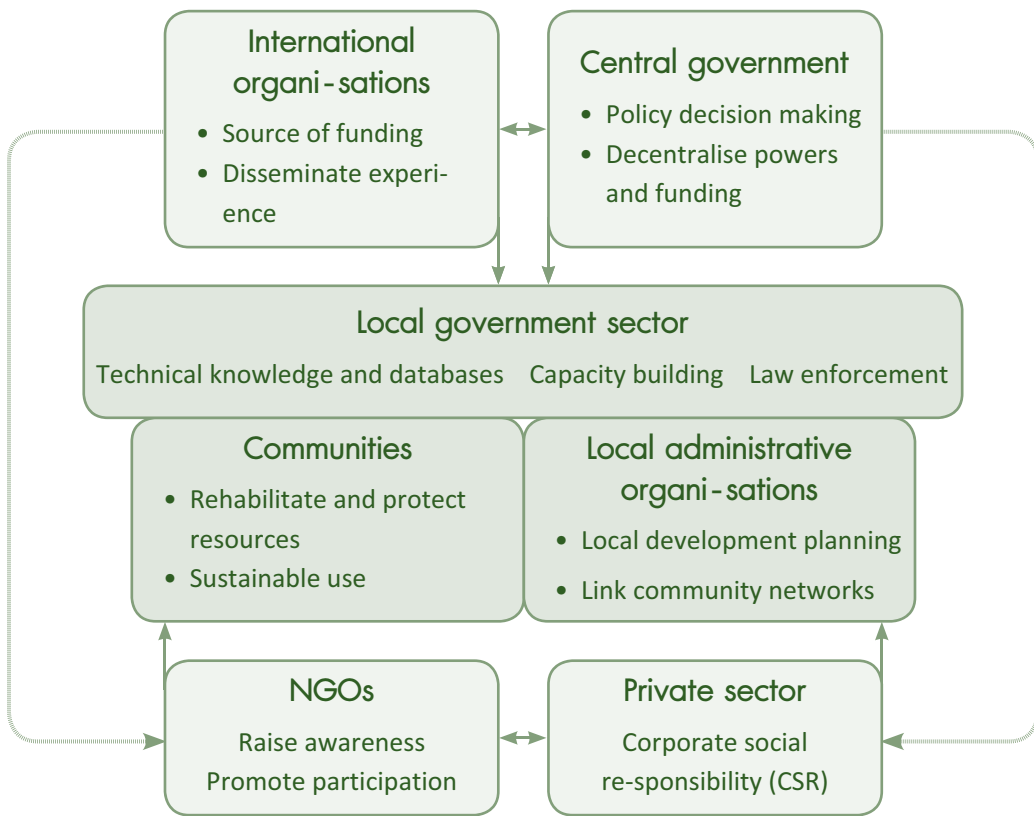
The key stakeholders in coastal resource management are communities, local administrative organisations and local government agencies. Those three groups rely on local development plans and community-level plans as tools to help direct their efforts towards the same goals. A fourth group - external organisations - plays a role in building local implementation capacity. This group includes inter-



national organisations, central government agencies, NGOs and the private sector.

Central government can be said to play a key role through setting the direction of policy to support local objectives. Local government agencies play a role in plan-

ning and implementation, and various external organisations contribute to implementation in different ways, for example by providing funding, building awareness and participation, replicating results, conducting outreach, and so on (see Figure).



Role of Communities and Other Stakeholders in Rehabilitating and Managing Coastal Ecosystems



International organisations can play many roles, but they function mainly to provide funding and implement projects through central government, to create links to international networks, and to disseminate learning. Nevertheless, they can also help to push for broader policy changes based on local practice and experience.

... Somsak Soonthornnawaphat ...

As someone who has played a part in developing and promoting the Rehabilitation of Forests in Tsunami - Affected Areas Project since 2005 (though it did not start until several years later), I have seen how management approaches have been adapted to local conditions to better meet sustainability goals. In this respect the project has been more effective than many other emergency responses to rehabilitating tsunami-damaged ecosystems. The project's target areas have a high ecological value, so it is of the utmost importance that they are managed systematically. This is the challenge we face, and I hope to see some concrete results and experiences which can be shared with other Indian Ocean countries.

... Suchart Kalayawongsa ...





- ⦿ References and Supporting Document
- ⦿ Workshop Program
- ⦿ List of Attendees

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Workshop Program

October 5-10th, 2009 Group discussions

October 14th, 2009 Field visit for members of project steering committee

Site#1 Ban Thung Rak, Mae Nang Khao, Khuraburi, Phang Nga: Management of coastal resources linked with terrestrial forests by local community networks in collaboration with local state agencies.

Site#2 Ban Bang Kluay Nok, Naka, Suk Samran, Ranong: Management of mangrove forests, guarding coastal resources, development of alternative agriculture and community economies and their relevance to watershed conservation by local communities.

Site#3 Khuek-khak Beach, Kuk Kak, Takua Pa, Phang Nga: The restoration of beach forest and tourism sites by the state sector, while local government organizations take a role in taking care of restored areas, which requires ap-proprate land utilization plans.

Site#4 Kho Khao Island, Takua Pa, Phang Nga: The adaptation and aware - ness of local communities living in risky areas. Mangrove forest resource management, resource surveying and mapping, and management of revolving funds of local communities.

October 15th, 2009 Workshop with stakeholders

09:00-09:30 Opening Ceremony

By Mr.Somchai Pienstaporn, Director - General, Royal Forest Department (RFD)

Dr.Chamniern Vorratanachaiphan, Senior Director of Thailand Environment Institute (TEI)



- 09:30-11:00 Panel discussion: Experiences on tsunami disaster impacts mitigation and reduction
By the representatives of local organizations and communities
- Bang Kluay Nok community and Naka local authority, Ranong
 - Andaman Coastal Research Station for Development (Prapas Beach), Kasetsart University
 - Kuk Kak community
 - Kho Khao Island community
- Moderate by: Sompoch Nimsantichareon
- 11:00-12:30 Group discussion: Look forward for securing the coastal ecosystem and livelihoods of local communities
- 12:30-13:30 Lunch Break
- 13:30-13:45 Presentation of the findings and learned lessons
By Ms.Benjamas Chotthong, TEI
- 13:45-15:45 Presentation of the outputs of group discussion Commentators;
- Dr.Bunvong Thaiutsa, Senior Civilculturist
 - Dr.Chamniern Vorratnchaiphan, TEI
 - Mr.Samit Boonsermsuk, RFD
- 15:45-16:00 Closing Ceremony
- Mr.Suchart Kalayavongsa, RFD
 - Mr.Pracha Karvijitr, Bang Tip village headman

October 16th, 2009

Wrapping up meeting by project working group



List of Attendees

Community representatives, Phangnga Province

- | | |
|----------------------------|--|
| 1. Ms.Sangeam Sarrage | Ban Pakveeb, Kuk kak, Takua Pa |
| 2. Mr.Mongkol Lunsopar | Ban Bangnaing, Koh Kor Khao, Takua Pa |
| 3. Mr.Alun Wichitt | Ban Bangnaing, Koh Kor Khao, Takua Pa |
| 4. Mrs.jumnean Doiydee | Ban Nokna, Koh Kor Khao, Takua Pa |
| 5. Mrs.Sutjai Marglie | Ban Nokna, Koh Kor Khao, Takua Pa |
| 6. Mrs.Praneewajegama | Ban Maung Mai, Koh Kor Khao, Takua Pa |
| 7. Ms.Mayuda Malagud | Ban Maung Mai, Koh Kor Khao, Takua Pa |
| 8. Mr.Prajop Ditpan | Ban Maung Mai, Koh Kor Khao, Takua Pa |
| 9. Mr.Thararatt Hmaenthong | Ban Pak Khoa, Koh Kor Khao, Takua Pa |
| 10. Mr.Manus Tadum | Ban Tung Teuk, Koh Kor Khao, Takua Pa |
| 11. Mr.Chaweng Krotnune | Ban Tung Teuk, Koh Kor Khao, Takua Pa |
| 12. Mr.Sunun Jitpatch | Ban Tung Rak, Mae Nang Khaw, Kura Buri |
| 13. Mr.Likit Yodeying | Ban Tung Rak, Mae Nang Khaw, Kura Buri |
| 14. Mr.Somboon Wangtisue | Ban Tung Rak, Mae Nang Khaw, Kura Buri |
| 15. Mr.Chertchai Prodepai | Ban Bang Krung, Bangwan, Kura Buri |
| 16. Mr.Suriyan Aodthon | Ban Bang Krung, Bangwan, Kura Buri |
| 17. Mr.Darhode Rawangngarn | Ban Bang Krung, Bangwan, Kura Buri |
| 18. Mr.Prachar Karwijit | Ban Bang Krung, Bangwan, Kura Buri |

Community representatives, Ranong Province

- | | |
|------------------------------|-------------------------|
| 1. Ms.Patcharaporn Sangthong | Ban Chimi, Kapur, Kapur |
| 2. Mrs.Gaesra Sangthong | Ban Chimi, Kapur, Kapur |
| 3. Mr.Ittipon Ningrawee | Ban Chimi, Kapur, Kapur |
| 4. MeSamart chuenSukjai | Ban Chimi, Kapur, Kapur |
| 5. Mr.Preechar Hormrosklow | Ban Chimi, Kapur, Kapur |
| 6. Mr.Pramoune TapeTasn | Ban Dan, Kapur, Kapur |
| 7. Mr.Pachern Kawchangkean | Ban Dan, Kapur, Kapur |



- | | |
|--------------------------------|-------------------------------------|
| 8. Mr.Boonreang Kongthong | Ban Bang Lampoo, Kapur, Kapur |
| 9. Mr.Pitak Wongpeungpaiboon | Ban Bang Lampoo, Kapur, Kapur |
| 10. Mrs.Nutthawaree Sumnug | Ban Bang Lampoo, Kapur, Kapur |
| 11. Mr.Leahar Dechsongprack | Ban Bang Hin, Bang Hin, Kapur |
| 12. Mrs.Chantira Ponkate | Ban Bang Hin, Bang Hin, Kapur |
| 13. Mrs.Ya Kulpakdee | Ban Bang Hin, Bang Hin, Kapur |
| 14. Mrs.Wanna YarHnoo | Ban Bang Hin, Bang Hin, Kapur |
| 15. Mr.Haros Sangthong | Ban Bang Hin, Bang Hin, Kapur |
| 16. Mr.Anuchar Harnjit | Ban Bang Hin, Bang Hin, Kapur |
| 17. Mr.Kor Kolpakdee | Ban Bang Hin, Bang Hin, Kapur |
| 18. Mr.Manop Boonsok | Ban Bang Hin, Bang Hin, Kapur |
| 19. Mrs.Sumlee Jannark | Ban Bang Hin, Bang Hin, Kapur |
| 20. Mrs.Farleea Padungchart | Ban Bangklauy Nok, Naka, Suk Samran |
| 21. Mrs.Marream Marnoch | Ban Bangklauy Nok, Naka, Suk Samran |
| 22. Mrs.Harteeyar Chaikowthong | Ban Bangklauy Nok, Naka, Suk Samran |
| 23. Ms.Charpeena Wantar | Ban Bangklauy Nok, Naka, Suk Samran |

Local Government Authorities

- | | |
|---------------------------|--|
| 1. Mr.Kemchart Deehnoo | Phangnga Provincial Administration Organization |
| 2. Mr.Wirote Dajsongprack | Kapur (Tambon) Administration Organization,
Ranong |
| 3. Mrs.Lyarace Rugsakaw | Naka (Tambon) Administration Organization,
Ranong |
| 4. Mr.Suchart Mittulakan | Mae Nangkhaw (Tambon) Administration
Organization, Phangnga |
| 5. Mrs.Wassana Pechgate | Mae Nangkhaw (Tambon) Administration
Organization, Phangnga |
| 6.Mr.NiPak Rugbamrung | Bangwan (Tambon) Administration Organization,
Phangnga |
| 7. Mr.Rujipas jinako | Koh Kor Khao (Tambon) Administration
Organization, Phangnga |
| 8.Mr.Nirut Buttnoi | Koh Kor Khao (Tambon) Administration
Organization, Phangnga |



Government and academic Institute

- | | |
|-----------------------------------|--|
| 1. Dr.Boonyawong Thiaiusar | Kasetsart University |
| 2. Mr.Surat Kanjanakunchorn | Royal Forest Department |
| 3. Mr.Suchart Kanlayawongsar | Royal Forest Department |
| 4. Mr.Smith Bunsermsuk | Royal Forest Department |
| 5. Ms.Preyanan Meangsan | Royal Forest Department |
| 6. Mr.Suthad Loewskun | Royal Forest Department |
| 7. Mrs.Aruneeweenim | Royal Forest Department |
| 8. Mrs.Panee Denrungreang | Royal Forest Department |
| 9. Mrs.Mayuree JitKaw | Royal Forest Department |
| 10. Mr.Nutthakorn Samesonpat | Royal Forest Department |
| 11. Ms.Srunthorn Sukkawatnijakoon | Royal Forest Department |
| 12. Mr.Kongsak MeeKaw | Royal Forest Department |
| 13. Mr.Somboon Booneyean | Royal Forest Department |
| 14. Mr.Supat Sanrak | Bureau of Forest Management 11 (Surat Thani) |
| 15. Mrs.Monpat Wangkarnuwat | Office of Natural resources and Environment,
Ranong |
| 16. Mr.Prasit Learsittayanon | Office of Natural resources and Environment,
Ranong |
| 17. Mr.Kittitheeya Wannaboonya | Forest Coordination Center, Ranong |
| 18. Mr.Maetha Nunloy | Muang Klaung Wildlife Sanctuary |
| 19. Mr.Pairat Krutwisai | Kapur Plantation |
| 20. Mr.Natthawut Lobstid | Kapur Plantation |
| 21. Mr.Natthaphong Toehard | Mangrove Resources Development Station 9
(Kapur) |
| 22. Mr.Tounpech SengJareansuk | Mangrove Resources Development Station 17
(Kura Buri) |
| 23. Mrs.Kobkaw Choticheay | Mangrove Resources Development Station 18
(Bangwan) |
| 24. Ms.Worrakamon Jareanlab | Mangrove Resources Development Station 18
(Bangwan) |
| 25. Ms.Chaweeluck Kongmhun | Mangrove Resources Development Station 18
(Bangwan) |
| 26. Ms.Nutsinee Koykobkarn | Faculty of Fishery, Kasetsart University |
| 27. Ms.Amornrat Inpar | Faculty of Fishery, Kasetsart University |
| 28. Ms.Wassana Thakonrat | Faculty of Fishery, Kasetsart University |



- | | |
|-------------------------------|---|
| 29. Ms.Jularat Rungswang | Faculty of Fishery, Kasetsart University |
| 30. Mr.Hutsdin Treeyamaneerat | Faculty of Fishery, Kasetsart University |
| 31. Mr.daechar Dounghamon | Andaman Coastal Research Station for
Development, Kasetsart University |
| 32. Mr.Surinporn Sriin | Andaman Coastal Research Station for
Development, Kasetsart University |
| 33. Mr.Wisai Kongkaw | Andaman Coastal Research Station for
Development, Kasetsart University |

Non-government Organizations

- | | |
|-----------------------------------|----------------------------------|
| 1. Dr.Chamniern Vorratanachaiphan | Thailand Environment Institute |
| 2. Ms.Benjamas Chotthong | Thailand Environment Institute |
| 3. Mr.Pradit Boonplod | Thailand Environment Institute |
| 4. Ms.Boonthida Katesomboom | Thailand Environment Institute |
| 5. Ms.Tanirat Thanawat | Thailand Environment Institute |
| 6. Mr.Sumree Kaemok | Rak Thai Foundation |
| 7. Mr.Sadawat chailuek | Rak Thai Foundation |
| 8. Mr.Somsak Soonthornawaphat | IUCN, Thailand |
| 9. Ms.Siriporn Sriaram | IUCN, Thailand |
| 10. Mr.Pateep Meekatitham | Wetlands International, Thailand |
| 11. Mr.Sompoach Nimsantijalearn | SNIM Co.Ltd. |
| 12. Ms.Nuttikarn Harnsat | SNIM Co.Ltd. |
| 13. Ms.Sukanya Pechpeng | SNIM Co.Ltd. |



Founded in 1993, the **Thailand Environment Institute (TEI)** is a non-profit, non-governmental organisation focusing on environmental management and sustainable development. The Institute carries out policy research, develops capacity and implements field projects to mitigate climate change, conserve natural resources and manage the man-made environment at local, national and regional levels.

www.tei.or.th

The **Royal Forest Department** was established by King Rama V in 1896 under the Ministry of Interior. It was later transferred to the Ministry of Agriculture and Cooperatives, and is currently part of the Ministry of Natural Resources and Environment. The Department has responsibility for the oversight, management and protection of the forests under its jurisdiction. It also carries out research and promotes tree planting, both in community forests and in economic forests.

www.rfd.go.th

The **International Tropical Timber Organization (ITTO)** is an inter-governmental organisation founded in 1986 to develop forest-based trade and industry, and to promote sustainable forest use and management. Today, ITTO focuses more on community forestry, forest law enforcement and governance, and reducing forest degradation. The Secretariat of ITTO is located in Yokohama, Japan.

www.itto.int



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