

# Mangrove Communities and Disaster Risk Reduction: Cases in Vietnam

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## Abstract

Mangrove forest belts have a very important role on reducing the impacts of natural disasters in the coastal areas. However, in the last three decades, under the pressures of increasing population and man-made disasters, there have been many losses and degradation of mangrove forest belts in Vietnam. As a result, the seashore erosion and human damage are expected to increase due to climate related extreme weather, e.g., tropical storms, high sea waves and strong whirlwind. In order to build the natural disaster resilience and adaptive capacity for coastal communities, mangrove wetland ecosystems development is considered as a long term cost-effective strategy for poverty reduction and biodiversity conservation in Vietnam. This paper reviews and evaluates the mangrove reforestation approach, implementation and management in Vietnam as a case study.

Key words: Climate change, disaster risk, mangrove reforestation, resilience. Vietnam coasts

## Background

In the tropics and subtropics intertidal shorelines, mangrove forests that exist and adapt in high coastal areas vary. There are approximately 80 species of mangrove trees in the world (Dugan and Bellamy, 1993). The global mangrove area was estimated at about 15.2 million hectares, with the largest areas found in 124 countries in Asia and Africa, followed by North and Central America (FAO, 2007) (Figure 1).

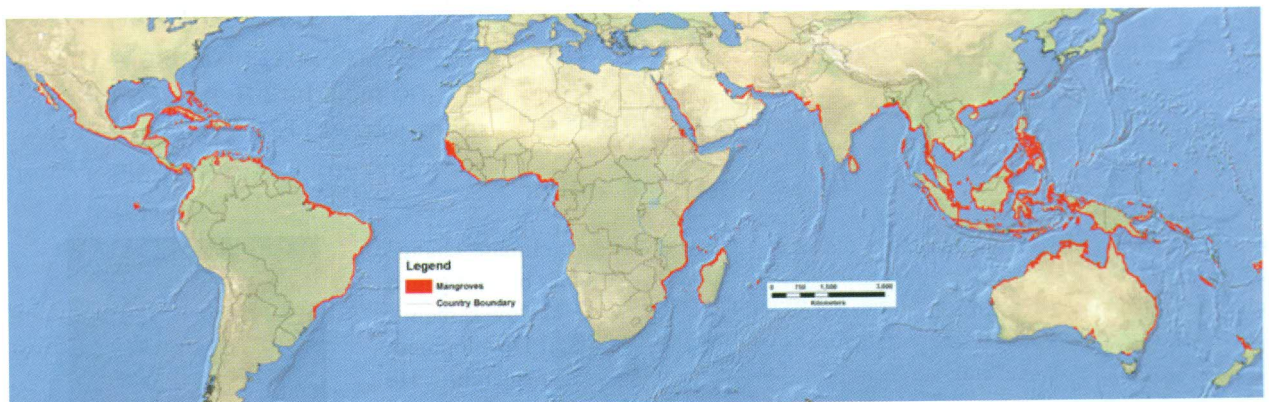


Figure 1. Global mangrove forests distribution – 2000 (Giri et. al., 2011)  
(Map redrawn by UNEP/DEW, <http://na.unep.net/geas/articleimages/Aug-13-figure-1.png>)

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In tropical areas, the red mangrove tree (*Rhizophora mangle*) dominates mainly in mangrove swamp (Greene, 2004). Mangroves are soil salinity and sea tidal waves tolerant trees. Their densely spreading and entangled prop roots serve as vertical anchor pillars for standing in waves and tides. Mangrove trees can grow along sheltered coastlines, shallow-water lagoons, estuaries and river-mouth mudflats where current coastal flows allow fine sediments to accumulate and build up the muddy bottom. Mangroves have the ability to survive in low-oxygen (hypoxic) conditions of waterlogged mud. Mangrove forests play a vital role in coastline protection, mitigation of wave and storm impacts and mudflat stabilization, and protection of near-shore water quality (Tran Quang Bao, 2011). Growing in depositional coastal environments with high organic soil content, mangrove forests provide important habitat for a wide range of aqua-animals and wildlife species, throughout their life cycles. Mangrove belts are also outstanding ecosystems in well-protected areas from high-energy wave action, tropical low pressures and storms. The estimated value of benefits that mangroves provide humans is huge, equivalent to about \$9,990 per hectare, or \$1.648 trillion in total (Costanza et al., 1997). Nagelkerken (2008) stated that mangroves could provide almost 30 million tons of commercial fish annually. In 2008, the global annual wild fish catch was estimated by FAO at 89.7 million tons. Mangroves are recognized for their important role during extreme weather conditions. They also provide an important bulkhead against climate change (Cornforth et al., 2013). Many researches have proven that mangrove forests can generally decrease the strength of sea waves going towards the seashores (Kathiresan and Rajendran, 2005; Asano, 2008, Yanagisawa et al., 2009; Bao, 2011; Ohira et al., 2012) (Figure 2). Mangrove forests can significantly reduce the flow of tsunami waves for at least 100 meters in width (Alongi, 2008). However, the rate of wave reduction depends on the age of trees, species, vegetation density, incoming wave height, the thickness of the forest, and mangrove forests structures (Muliddin et al., 2014), as illustrated in Figure 1. Mangrove forests are really powerful “blue carbon sinks” storages that help in climate change mitigation, thus reducing negative impacts. Although mangroves occupy only 0.5% of the global coastal area, they contribute 10-15% (24 Tg C/year) to coastal sediment carbon storage and export 10-11% of the particulate terrestrial carbon to the ocean (Alongi, 2014).

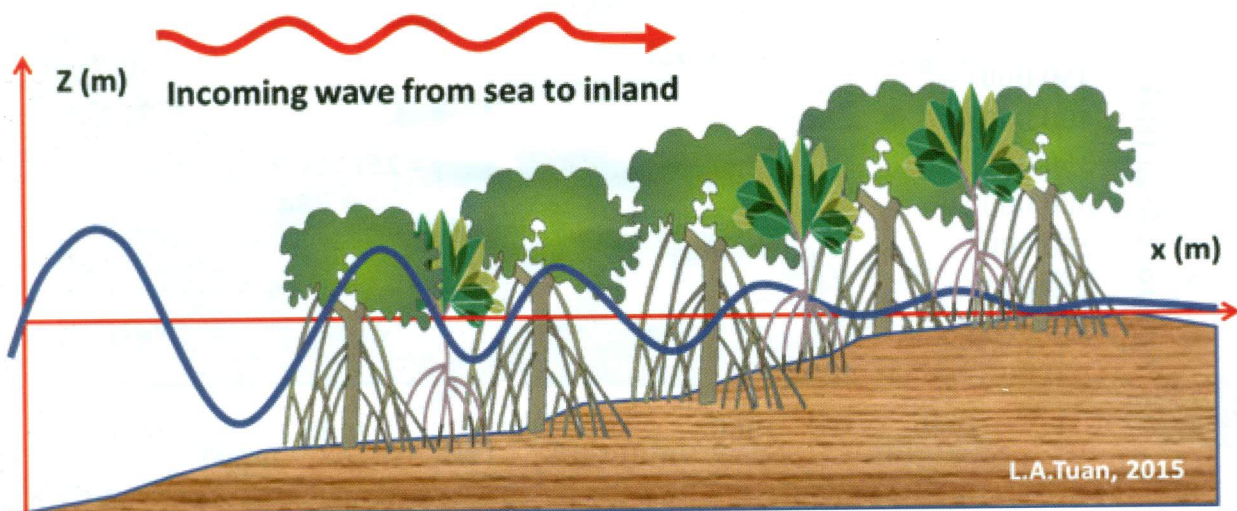


Figure 2. Illustration of sea waves reduction when passing through a mangrove forest.



There are many evidences that show mangroves in the world have dramatically decreased with respect to short-term economic interests, especially during the last three decades. Historically, mangroves were chopped down for wood and charcoal. This has been expanded to cater to shrimp and fish farming, agriculture, salt and rice production within mangrove areas. Finally, mangrove areas were converted for purposes of urban development (Susan, 2002; FAO, 2007). In global scale, mangroves are disappearing at an average rate of 1 to 2% per year (Duke 2007). Spalding et al. (2010) estimated that the world has lost approximately one quarter of its original mangrove cover. For the period 2000-2012, the estimated rate of tropical forest loss from deforestation was increasing by 200,000 hectares per year (Kim et al., 2015). There is an urgent need to recover mangrove communities in order to mitigate natural disasters and the negative effects of climate change. Increasing severe tropical storms and rising sea levels threaten lives, property and livelihoods.

**Status of Mangrove Forests in Vietnam**

Vietnam has along coastline, 3,260 km extending from the North to the South, facing the East Sea and the Pacific Ocean. The coastal mangrove forests and wetlands are found in 29 provinces and cities distributed from the northeast to the southwest coast. These are in the five coastal provinces of Red River delta (Quang Ninh, Hai Phong, Thai Binh, Nam Dinh and Ninh Binh), in the 14 coastal provinces in the Central of Vietnam from Thanh Hoa to Binh Thuan and in the 10 provinces of the East and West coasts of South of Vietnam (Ba Ria – Vung Tau, Dong Nai, Ho Chi Minh City, Ben Tre, Tien Giang, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau and Kien Giang). Two main flat coastal lowlands of Vietnam, i.e. the Red River Delta and the Mekong River Delta, have high potential development for mangrove forests. Ca Mau Peninsula, located in the most southern part of the Vietnamese Mekong River Delta, is considered as the largest mangrove forest community of Vietnam. The largest mangroves cover is found in South Vietnam, the location of the Dong Nai River and Mekong River estuaries (McNally et. al., 2011).

In 1943, Maurand reported that the total mangrove area in Vietnam was 408,500 hectares, of which 329,000 hectares were developed in the south. During the Vietnam War from 1962to 1975, mangrove forest areas were destroyed mostly by herbicides spraying

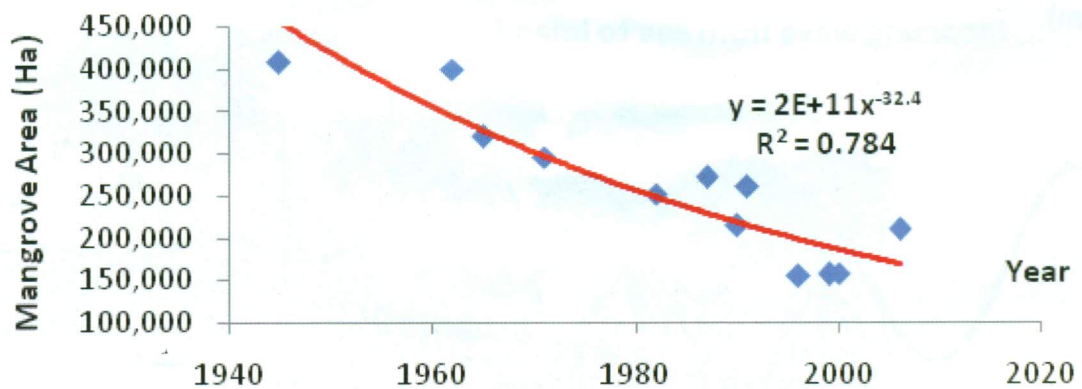


Figure 2: Trends of mangrove forests reduction in Vietnam (Graphic developed due to the combined data of Hong 1993; FAO, 2005; FIPI, 2010)



and napalm bombs. After 1975, the still-intact mangrove forests decreased largely due to changes in land-use, e. g., as expanding shrimp cultivation areas. From 1990 to 2000, nearly 30% mangrove forests in Vietnam were cut. As a result, mangrove destruction for purposes of shrimp farming has seriously caused coastal erosion, salt intrusion and reduction in aquatic biodiversity. Recognizing the losses from significant mangrove deforestation; there are many efforts to reforest and manage existing mangrove forests. Thus, the area of mangrove in Vietnam increased to 209.000 hectares in 2006 (Figure 2).

There is not much available scientific documentation in the number of species of mangrove and mangrove associated trees in Vietnam. Differences in methodologies, classifications, mapping scales etc. may have led to discrepancies in Vietnam mangrove data estimations (FAO, 2005). According to Phan Nguyen Hong and Hoang Thi San (1993), there are 69 mangrove species found in the South of Vietnam and 34 species in the North. Southern Vietnam has higher mangrove biodiversity than Northern Vietnam, possibly due to the higher temperatures and better silt-clay soil topography in the South than in the North. The main mangrove species in the Camau Peninsula are *Rhizophora apiculata* (syn *R. conjugata*), *Bruguiera gymnorhiza*, *Ceriops decandra* (syn *C. roxburghiana*) and *Lumnitzera littorea* (syn *L. coccinea*) (FAO, 2005). The mangrove communities, from sea to inland, mainly have the following species: the *Avicennia*, pioneer trees in tidal mudflats; the *Rhizophoraceae*, mangrove supporting stable alluvial soil; and the *Sonneratia*, *Nypa* and other species, mixing together as terrestrial trees in inland (Figure 3). In the Mekong River Delta, the main mangrove species are: *Sonneratia caseolaris* (Bần chua); *Avicennia alba* (M61m trắng); *Avicennia marina* (Mắm biển); *Rhizophora apiculata* (Đước); *Rhizophora mucronata* (Đưng); *Bruguiera parviflora* (Vẹt tách); *Bruguiera cylindrical* (Vẹt trụ); *Ceriop decandra* (Dà); *Lumnitzera racemose* (Cóc vàng); *Xylocarpus granatum* (Xu ổi); *Nypa frutican* (Dừa nước); and *Threspecia populnea* (Tra).

Under the Law on Protection and Development of Forest of Vietnam (Law No. 29/2004/QH11), mangrove forests are classified into three types, based on their main environmental protection uses: (i) Protection forests (rừng phòng hộ), (ii) Special-use forests (rừng đặc dụng) and (iii) Production forests (rừng sản xuất).

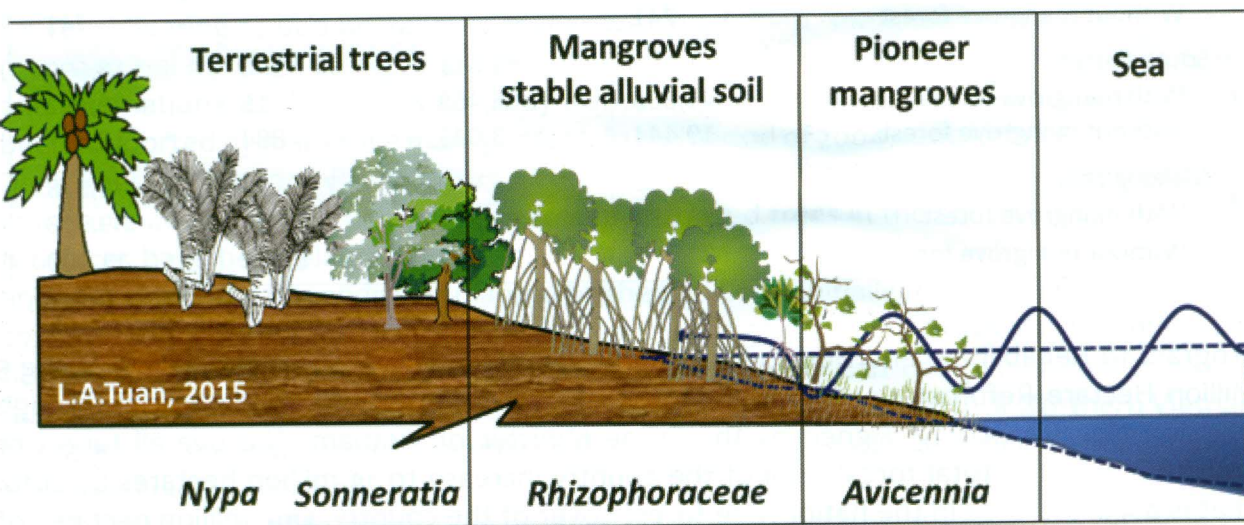


Figure 3: Illustration of typical mangrove communities along the coastal areas of Mekong River Delta, Vietnam



- Protection forests are mainly used to protect water sources and land, prevent erosion and desertification, regulate climate and mitigate natural calamities.
- Special-use forests are mainly used to conserve nature, specimens of the national forest ecosystems and forest biological gene sources; to do scientific research; to protect historical and cultural relics as well as landscapes; and to cater to recreation and tourism services.
- Production forests are used mainly to produce and trade timber and non-timber forest products.

In addition to the above, Article 3.1 of the Forest Law states that forests include both planted forest (rừng trồng) and natural forest (rừng tự nhiên). Table 1 provides the mangrove forest areas in Vietnam following the three types of forest classification. Table 2 gives an inventory of mangrove forests data along the Mekong River Delta of Vietnam.

In 1998, the Vietnam National Assembly (Prime Ministry, 1998) approved the “National

Table 1. Area Distribution of Mangrove Forests in Vietnam according to Major Uses (2008)

| Location                     | Total (has.) | Forest classification (has.) |             |            |
|------------------------------|--------------|------------------------------|-------------|------------|
|                              |              | Protection                   | Special-use | Production |
| Nationwide                   | 323,712      | 153,294                      | 41,666      | 128,752    |
| With mangrove forest         | 209,741      | 115,950                      | 28,311      | 65,480     |
| Without mangrove forest      | 113,971      | 37,344                       | 13,355      | 13,355     |
| Quang Ninh & Red River delta | 88,340       | 43,776                       | 8,589       | 35,975     |
| With mangrove forest         | 37,651       | 30,928                       | 4,489       | 2,234      |
| Without mangrove forest      | 50,689       | 12,848                       | 4,100       | 33,741     |
| North of Central Vietnam     | 7,238        | 4,420                        | -           | 2,817      |
| With mangrove forest         | 1,885        | 1,340                        | -           | 544        |
| Without mangrove forest      | 5,353        | 3,080                        | -           | 2,273      |
| South of Central Vietnam     | 743          | -                            | -           | 743        |
| With mangrove forest         | 2            | -                            | -           | 2          |
| Without mangrove forest      | 741          | -                            | -           | 741        |
| South Eastern                | 61,110       | 41,511                       | 900         | 18,699     |
| With mangrove forest         | 41,666       | 38,468                       | 16          | 3,182      |
| Without mangrove forest      | 19,444       | 3,043                        | 884         | 15,517     |
| Mekong Delta                 | 166,282      | 63,58                        | 732,177     | 70,518     |
| With mangrove forest         | 128,537      | 45,213                       | 23,806      | 59,518     |
| Without mangrove forest      | 37,745       | 18,374                       | 8,371       | 11,000     |

Program to Rehabilitate and Develop 5 Million Hectares of Forests”, better known as the 5 Million Hectare Reforestation Program (5MHRP). This Program was made official through Decision No. 881/QĐ/TTg, signed by the Prime Minister of Vietnam. The overall target of 5MHRP is that the total forest area of the country increase to 14 million hectares by 2010. That is a 43% increase in the nationwide forest cover of the country. One million hectares of forest in 5MHRP have been planted in coastal watersheds, creating wind break walls, fixing sand dunes and protecting coastal dikes. However, the implementation of the program did



Table 2. Area Distribution of Mangrove Forests in Delta Mekong Provinces (2010)

| Province          | Protection Forest in Has. |               | Special-Use Forest in Has. |              | Production Forest in Has. |               | Total Hectares |               | Overall Total Area (in Has.) |
|-------------------|---------------------------|---------------|----------------------------|--------------|---------------------------|---------------|----------------|---------------|------------------------------|
|                   | Natural                   | Planted       | Natural                    | Planted      | Natural                   | Planted       | Natural        | Planted       |                              |
| Long An           |                           | 65            |                            |              |                           |               | -              | 65            | 65                           |
| Tien Giang        |                           | 1,358         |                            |              |                           |               | -              | 1,358         | 1,358                        |
| Ben Tre           | 343                       | 1,469         | 145                        | 1,885        | 13                        | 347           | 502            | 3,700         | 4,202                        |
| Tra Vinh          | 821                       | 3,479         |                            |              |                           |               | 821            | 3,479         | 4,300                        |
| Soc Trang         | 1,759                     | 4,885         |                            |              |                           |               | 1,759          | 4,885         | 6,644                        |
| Bac Lieu          | 1,599                     | 1,014         |                            |              |                           |               | 1,599          | 1,014         | 2,613                        |
| Ca Mau            | 3,976                     | 21,066        | 3,879                      | 5,391        | 155                       | 18,458        | 8,009          | 44,914        | 52,923                       |
| Kien Giang        | 805                       | 3,042         |                            |              |                           |               | 805            | 3,042         | 3,847                        |
| <b>Total Area</b> | <b>9,304</b>              | <b>36,377</b> | <b>4,024</b>               | <b>7,275</b> | <b>168</b>                | <b>18,804</b> | <b>13,496</b>  | <b>62,456</b> | <b>75,952</b>                |
| <b>Percentage</b> | <b>12%</b>                | <b>48%</b>    | <b>5%</b>                  | <b>10%</b>   | <b>0%</b>                 | <b>25%</b>    | <b>18%</b>     | <b>82%</b>    | <b>100%</b>                  |

(Source: MONRE & GIZ, 2012)

not reach its objective. For the period 1998-2005, the total of new plantation forest area was only 70% of the target, and afforestation of industrial plantations achieved only 49% of the target (Prime Minister, 2007). Since year 2000 to the present, many laws and regulations that are related to forest rehabilitation, protection and management have been approved by the Vietnam National Assembly. The Forest Protection and Development Law (Decision 29/2004/QH11, dated 3 December 2004) regulates protection and management of forests and wild species. This Law focuses on varying forest management rights and responsibilities in Vietnam. It recognised distinct categories of forest ownership in allocating forest land use rights to communities, as well as to individual households.

Between 1991 and 2002, eight coastal provinces, i.e., Quang Ninh, Hai Phong, Ninh Binh, Thanh Hoa, Nghe An, Ha Tinh, Thai Binh and Nam Dinh, received various foreign NGO support for rehabilitating 14,000 hectares of mangrove. In addition, some mangrove nature reserve (i.e., Tien Hai Nature Reserve, the Thanh Phu 2 Nature Reserve and the Bac Lieu Sanctuary) and two national parks (i.e., Xuan Thuy National Park and the Ca Mau National Park) have been supported by mangrove management. In the period of 2004 – 2007, thanks to the World Bank Coastal Wetlands Protection and Development Programme, about 4,662 hectares of mangrove and an additional 1,214 hectares of scattered trees in the southern Mekong Delta provinces have been planted. Experiences from Thai Binh and Nam Dinh provinces in 1996 and 1997 proved that mangroves planted by the Red Cross initially for environmental reasons constituted a good green wall to protect sea dykes against typhoon waves. This means no flooding of agriculture fields or settlements. Fishing boats can use mangroves as shelter during typhoons. The number of deaths fell. In 2003, two typhoons struck Northern Vietnam in July and August but only four people died, no rice fields were flooded and the impact of the typhoon rapidly weakened.

Vietnam expects to develop an additional 100,000 hectares of mangrove forest in the 2010's in order to recover the mangrove losses in the past. In January 2010, Vietnam became



a full member of the Mangrove for the Future (MFF) Initiative and has been receiving support for mangrove planting and restoration activities. The MFF is implemented by the multi-stakeholder National Coordinating Body (NCB). This includes representatives from the Central Government (the Ministry of Natural Resources and Environment, Ministry of Agriculture and Rural Development), the Hanoi National University of Education, the local National Non-Government Organisations (e. g., the Center for Resources and Environment Study, Centre for Marinelife Conservation and Community Development, and others), the international Non-Government Organisations (World Wild Fund, CARE), and international organizations (UNDP, FAO, and IUCN). MFF's priorities in Vietnam are community resilience, adaptive management and knowledge sharing, with mangroves prioritized in the broader context of Integrated Coastal Management.

The concept of forest ownership and management rights has been introduced and applied in Vietnam through long-term leases or management agreements (FAO, 2010). This means that forest management rights and responsibilities are transferred from public administration at the national level to local communities (including indigenous and tribal communities). In the community-managed mangrove forests of Da Loc Commune, Thanh Hoa province, the strengthening and diversification of livelihoods through aquaculture using mangroves has provided considerable new income (RECOFTC, 2012; Sen et al., 2012). See Box 1.

Another project, namely: the Integrated Coastal Management Programme (ICMP), began to be carried out in the Vietnamese Mekong River Delta for the period of 2011 – 2017. The ICMP project was commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and supported by the Australian Government's Department of Foreign Affairs and Trade (DFAT) as a Co-Financier. There are three approaches in this project: (i) Implementing the rehabilitation of mangrove forests and using the mangrove ecosystem to protect the coast; (ii) Supporting the local coastal farmers in coping with and adapting to disaster risks and climate change impacts and (iii) Promoting cooperation across borders for coastal protection and climate-resilient development. (see Box 2).

### **Box 1: Maintaining mangroves for their disaster protective function in Da Loc**

Starting in 1989, the Japanese Red Cross, Save the Children and Vietnam government collaborated in planting 350 hectares of mangrove seedlings in offshore area bordering Da Loc. The mangrove plants selected are *Kandelia candel* (cây Trảng) and *Sonneratia sp.* (cây Bần). Only 15-20% of the tree planting survived within a year of planting.

In 2005, Typhoon Damrey inflicted serious damage on Da Loc. The sea dyke failed to protect the commune except where mangroves remained to buffer the storm. In these sheltered areas, agricultural land suffered less seawater intrusion, whereas elsewhere sea water swept several kilometers inland, destroying settlements and livestock, and taking human lives. The long term impacts on agriculture and freshwater supplies are still felt.

(Source: Sen et al., 2012)



## Lessons Learnt on Mangrove Communities

Under the impacts of regional natural disaster risks and global climate change phenomena as well as land use change activities, Vietnam in general and the Mekong River Delta, in particular, are facing many challenges and difficulties at present and in the future, as increasing higher temperatures, abnormal rainfall, tropical storms, sea level rise, salinity intrusion and varying water flow regimes. The mangrove forests along the coast are in dramatic decline. One of the non-structure solutions as a key approach for disaster risk reduction and climate change mitigation is to increase forests and vegetable cover areas, including coastal mangrove replantation and sustainable forest management. It is found that the development of a mangrove community able to manage the coastal Delta ecosystems in a manner that is resilient to climate change is possible.

### Box 2: Selected impacts of ICMP in Phase I (2011 – 2014)

- Along 99% of the coastline of Soc Trang and Bac Lieu, the coastal dyke is no longer directly affected by waves.
- More than 600 hectares of mangrove forests have been rehabilitated.
- Some 22 new livelihood models have been introduced in 8,500 households. These models reduce environmental pressure and can raise incomes by up to 60%.
- Two policy packages have been devised on forest management and irrigation management, which are expected to benefit 8.7 million people.

(Source: GIZ, 2014)

Recognizing the importance of mangrove forests in coastal ecosystem and their roles as natural tropical storm barricades, the Vietnamese government has enforced many national programs for forest restoration and development during the last four decades. Coastal forest rehabilitation and wetlands conservation from the North to the South of the country has had some achievements over the past 20 years. Since the 1990s, the Government of Viet Nam has been allocating land use rights over almost 9 million hectares of state forest land to households, communities, and economic entities. In this way, the Government seeks to involve local people in protecting forests, developing plantations and improving living standards (To Xuan Phuc et al., 2013).

However, there were challenges and barriers for the large scale inland forests plantations and coastal mangrove wetlands rehabilitation of Central Government, such as Programme 327 (aimed at “re-greening the barren hills” with the national budget at approximately US\$273 million), or 5MHRP. The total planted forest area did not reach their expected targets. All projects were managed as a top down bureaucratic approach. Objectives and procedures were unclear to the poor community members, especially to the vulnerable minority groups. There was a lack of benefit-sharing mechanisms; the project was simply imposed on poor households without considering fully their needs and livelihoods. In coastal areas, shrimp farming for export encouraged by local governments, leading to mangrove destruction. In some cases, due to the change of local leaders, some contracts and commitments about mangrove protection between NGOs and local authorities have been violated.



## Summary and Conclusion

In the case of Vietnam, there are many laws and regulations on the protection of the forests and mangroves and its forest restoration policy headed in the right direction. However, it is a pity that legal enforcement and implementation seem lax. Although mangrove forests do not guarantee to provide a higher income for local people when compared to the potential of shrimp harvesting incomes, in the long term sustainable development approaches, i.e., mangrove forests, may mitigate significantly the negative impacts of climate change and other natural disaster risks as bigger storm surges.

There is need to establish a clear framework on participatory decision making processes, including building benefit-sharing mechanisms acceptable to communities. Parallels, upgrading awareness and capacity knowledge for the poor/minority people in communities and control of all the commitments and regulations on mangrove forest conservation and protection should be put in place soonest.

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and Mitigation Strategies**

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