Breaking the waves

Impact analysis of coastal afforestation for disaster risk reduction in Viet Nam

Japanese
Red Cross Society

International Federation
of Red Cross and Red Crescent Societies

Breaking the waves.
Impact analysis of coastal afforestation for disaster risk reduction in Viet Nam.

This report shows the results of an evaluation of the Community-based Mangrove Reforestation and Disaster Preparedness Programme, implemented by **Viet Nam Red Cross** between 1994 and 2010. Its sister report ("Planting protection. Community-based Mangrove Reforestation and Disaster Preparedness Programme of the Viet Nam Red Cross") covers additional aspects of the implementation between 2006 and 2010. All greenhouse gas emissions of 7,080 kg CO_2e caused by the flights for this evaluation have been offset by Banyaneer.

The Community-based Mangrove Reforestation and Disaster Preparedness Programme was also funded by **Danish Red Cross (1994-2005).**

Danish Red Cross

Cover photo: Fitri Rahmadana/Banyaneer

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ABBREVIATIONS

ActMang	Action for Mangroves
CBA	Cost-benefit analysis
CBDRR	Community-based disaster risk reduction
CBMR/DPP	Community-based Mangrove Reforestation and Disaster Preparedness Programme
CCA	Climate Change Adaptation
CCFSC	Central Committee for Storm and Flood Control
CCM	Climate Change Mitigation
CO_2	Carbon dioxide
DANIDA	Danish International Development Agency
DARD	Department of Agriculture and Rural Development (provincial level)
DET	Department of Education and Training
DIPECHO	Disaster Preparedness Programme of the European Commission Humanitarian Aid & Civil Protection Office (ECHO)
DP	Disaster preparedness
DRC	Danish Red Cross
DRM	Disaster risk management
DRR	Disaster risk reduction
GHG	Greenhouse gases
ha	Hectare
HVCA	Hazard, Vulnerability and Capacity Assessment
IFRC	International Federation of Red Cross and Red Crescent Societies
IUCN	International Union for the Conservation of Nature
JRC	Japanese Red Cross
MARD	Ministry of Agriculture and Rural Development
MERC/MERD	Mangrove Ecosystem Research Centre/Division
Mio	Million
MoNRE	Ministry of National Resources and the Environment
NGO	Non-governmental organization
PNS	Participating National Society
TEV	Total Economic Value
ToR	Terms of Reference
VCA	Vulnerability and Capacity Assessment
VND	Viet Nam Dong
VNRC	Viet Nam Red Cross
VNU	Viet Nam National University
UNDP	United Nations Development Program
USD	US Dollar

EXECUTIVE **SUMMARY**

Breaking the waves? Yes, but not only.

As this report shows, mangroves have also a role to play to enhance local livelihoods and help mitigate climate change. "Breaking the waves" presents a study of the impact, efficiency and sustainability of the "Community-based Mangrove Reforestation and Disaster Preparedness Programme" that has been implemented by Viet Nam Red Cross (VNRC) since 1994. This report and its sister publication ("Planting protection") are both results of a programme evaluation conducted in January 2011. While "Planting protection" focuses on the most recent programme phase of 2006-2010, this report looks at the bigger picture: what has the overall programme actually achieved?

8,885,000
Total programme expenditures (at original value) 1994-2010

The report starts off by setting the context. Realizing damaging results of the accelerated destruction of mangrove forests over previous decades, Thai Binh chapter proposed in 1993 to reverse the trend and reforest the intertidal eco-systems. Danish Red Cross (DRC) picked up the idea and supported a reforestation programme in Thai Binh from 1994 onwards. After initial setbacks, the programme got encouraging results, and by 1997, the programme was expanded to include another seven coastal provinces. Japanaese Red Cross (JRC) henceforth funded activities in six provinces through the International Federation of Red Cross and Red Crescent Societies (IFRC). From the early 2000s, the programme focus was broadened to include disaster preparedness training and also afforestation with bamboo and casuarina trees in communes along rivers. In 2005, DRC finished its part of the programme, and JRC has funded activities in all eight provinces since.

350,000
Number of direct beneficiaries of the programme

Overall, the programme has cost USD 8.88 Mio - with these funds, 9,462 ha of forest (8,961 of them mangroves) have been created in 166 communes - about 100 km of dyke line have thereby been protected. The mangroves planted by VNRC represent no less than 4.27% of all mangroves in Viet Nam today, and almost a quarter of those in the eight programme provinces. Aside from afforestation, the programme also saw more than 300,000 students, teachers, volunteers and commune wards trained in disaster preparedness. Around 350,000 direct beneficiaries were reached, and the amount of indirect beneficiaries who are now better protected by mangroves and other trees is estimated to be around 2 Mio.

8,961
Number of hectares of mangroves that exist today as a result of the programme

Having presented the programme overview, the report proceeds with a description of evaluation objectives and the methodology that underpinned the research. Deploying a mixed-method approach of qualitative (focus group discussions, key informant interviews, site visits) and quantitative (data set analysis, household survey) tools, it gathered information chiefly through field visits to 26 communes in six of the eight provinces. Research on impact and efficiency was guided by a literature review - appendix A contains an overview of respective articles.

100
Estimated length of sea dyke protected by those mangroves

The report finds that the programme has had a significant impact both towards a reduction of disaster risk and an enhancement of communities' livelihoods. Comparing the damage caused by similar typhoons before and after the intervention, it finds that damages to dykes have been reduced by USD 80,000 to USD 295,000 in

843
Costs in US Dollar at present value to create one ha of mangroves

18.64
Lowest benefit-cost ratio identified, not counting ecological benefits

68.92
Highest benefit-cost ratio identified, not counting ecological benefits

166
Number of communes in which trees were planted through the programme

222
Number of communes in which disaster preparedness training courses were conducted

324,700
Number of students trained in disaster preparedness to date (by 10,141 teachers)

6,012
Number of commune wards and Red Cross members trained in disaster preparedness

the studied communes - these savings represent less than the costs for mangrove planting. However, much more substantial savings due to avoided risk are found for the communities at large - with savings of up to USD 15 Mio in communes, the protective impact value in the few cases studied alone already exceed the costs of the entire programme.

Mangroves have also led to an increase of yield from aqua culture product collection (e.g. shells, oysters) by 209 - 789% - providing more income for coastal communities, in particular its poorer members. 60% of respondents from mangrove communes ascribe a positive impact of the programme on their income, and there are strong indications that the programme was able to lift people out of poverty (a firm causality can however not be established). Bamboo plantation has also shown to bear high potential to raise incomes, however, the overall impact has been relatively minor mainly due to the small lots allocated to each planter.

Having identified impact, the report proceeds to an analysis of efficiency by deploying a cost-benefit analysis. It assumes a timeframe for costs and benefits up until 2025 and uses a discount rate of 7.23% (reflecting average inflation over recent years). Per hectare costs for planting are found to be USD 843, and with the inclusion of protection fees covered by the government, costs come to around USD 950.

Ascribing annual probabilities to major disasters, the report calculates the overall avoided risk up until 2025. It shows avoided risks of up to USD 37 Mio in one commune, and finds that the programme's protective benefits by far exceed its costs in each of the commune studied. Assets located between mangroves and dykes (shrimp farms, boats) benefit in particular.

The direct economic benefits (e.g from aqua product collection, honey bee farming) are also found to be substantial, although much smaller than protective benefits. Direct economic benefits are found to be between USD 344,000 and USD 6.7 Mio in the communes studied.

By far the biggest benefit identified concerns the mangroves' carbon value. Extrapolating from locally conducted research on accumulated carbon and CO_2 absorption capacity, the report finds that the mangroves planted by VNRC will have absorbed at least 16.3 Mio t CO_2 by 2025. Assuming price of USD 20 per t of CO_2 emissions and having applied the discount rate of 7.23%, this represents a value of USD 218.81 Mio.

Significantly, the report shows that mangrove reforestation has been extremely efficient: even if only one of the three benefits were counted (protective/direct economic/ecological), the benefit-cost ratio (BCR) would remain positive in the studied communes. The report provides two BCR: BCR 1, which excludes ecological benefits, amounts to 3 - 68 in the communes studied. Including ecological benefits - which have yet to be materialized - BCR2 comes to values between 28 and 104.

Regarding the prospects for sustainability, the report recognizes the formal protection of mangroves and the commitment of the Vietnamese government as well as a very strong sense of local ownership as important factors for a positive outlook. However, it also identifies various internal and external challenges that will need to be addressed. The two basic messages are that, *first*, mangroves, bamboo and casuarina trees cannot be seen as being there for good but rather require long-term work on protection, future planning and awareness. *Second*, the current lack of an exit strategy endangers the sustainability of some of the achievements, in particular as VNRC chapters remain financially dependent on outside support to implement many of their activities.

The report includes case studies of five communes, which present findings in greater detail and make the calculation of costs and benefits more transparent. One case study looks at a commune in which no planting, but a holistic approach to risk management was implemented (including re-settlement, water and sanitation and micro-finance).

"Breaking the waves" concludes that not only has the programme paid off extremely well, the mangrove afforestation in particular has also been a highly efficient way to reach its protective, direct economic and ecological benefits. However, challenges to sustainability need to be tackled in an appropriate manner.

Given the immense value of mangroves, VNRC would be well advised to care for them even more effectively. The potential funding through the Clean Development Mechanism or through voluntary carbon-offsets should be tapped to ensure future protection, possible expansion and to reduce the financial reliance of chapters on outside support. The Vietnamese government may also wish to re-consider its own mangrove programmes and dyke upgrades in order to make even better use of its funds.

While mangrove afforestation is shown as both effective and efficient, the report warns that neither should VNRC centre its DRM strategy on it - because mangroves do not help to reduce many other risk factors - nor should the wider development and DRM community assume that results found in Northern Viet Nam can be easily replicated in other areas. It takes perseverance, good local conditions and strong ownership, amongst others, to implement a mangrove afforestation programme as successful as the one analyzed in this report.

425,000

Number of Vietnamese people whose greenhouse gas emissions are absorbed each year by the VNRC-planted mangroves

218,810,000

Present USD value of CO_2 emissions that will be absorbed by the programme between 1997 and 2025 (at USD 20/t CO_2)

INTRODUCTION

Mangroves? The Red Cross? Few people would normally associate the largest humanitarian organization in the world with afforestation. And yet, afforestation is what the Viet Nam Red Cross (VNRC) got engaged in. Launched in 1994 at the initiative of VNRC's Thai Binh chapter, the subject of this evaluation - now called Community-Based Mangrove Reforestation and Disaster Preparedness Programme - has since evolved into a broad scheme to protect dykes and coastal communities from typhoons and floods in the eight northernmost coastal provinces of Viet Nam. Complementing the planting activities, the programme also incorporated several aspects geared to enhance the disaster preparedness of communities. In the set-up and implementation of the programme, VNRC has been supported by Danish Red Cross (DRC), the International Federation of Red Cross and Red Crescent Societies (IFRC) and Japanese Red Cross (JRC).

Seventeen years after its launch, this evaluation looks at the programme's achievements. Have the mangroves as well as bamboo and casuarina trees (that were planted from 2002 onwards) actually protected dykes and communes? Have the communes' vulnerable members been able to improve their livelihoods? Have communes become better prepared for disasters? What is the role of mangroves in the context of climate change - both in helping to mitigate it and to adapt to it? Have there been any adverse effects of the programme? And what conclusions can be drawn for future programming?

The 2011 evaluation [1] answers these and other questions in two reports. The first report focusses on the achievements of the overall programme - the subject matter of this report. In particular, it focusses on impact, efficiency and the prospects for sustainability. For the analysis of efficiency, the report includes a cost-benefit analysis of interventions in selected communes.

The second component of the evaluation gives particular attention to the most recent programme phase (2006-2010, see Report B: Planting protection). It analyses recent achievements, identifies challenges, and provides recommendations for possible future extensions. Report B also looks more closely at bamboo and casuarina planting.

This report consists of eight chapters. The report begins with an overview of the programme and its history, as basic knowledge of the background is essential to understand its analysis. The following chapter highlights the background of this evaluation - both its objectives and the methodology that was applied. An expanded description of the methodology is laid out in appendix A - the interested reader can find all underlying assumptions and considerations upon which the analysis is built.

Chapters 3-7 include the findings of the evaluation: chapter 3 provides a summary of key findings. Chapter 4 describes the identified impact towards a reduction of disaster risk and towards enhanced livelihoods. Chapter 5 looks at efficiency as determined through a cost-benefit analysis that assumes an actual life-cycle of mangrove forests of 25 years. Chapter 6 analyses the prospects of sustainability of the programmes key components.

Further detailed analysis of impact and efficiency in six selected communes is given in chapter 7. Each case describes the calculation of benefits and costs and aim to make the way the analysis came to its findings as transparent as possible.

The report ends with a concluding chapter that discusses implications of the findings to VNRC and its donors, the Vietnamese government and the wider development and disaster risk management community, not least what role mangrove afforestation can play in future programming - in Viet Nam and elsewhere.

1. The evaluation was conducted between January 5th and 25th and involved a field trip to six out of the eight provinces covered by the programme. The team consisted of Patrick Bolte (Team leader and report author, Germany), Floyd Barnaby (DRR analyst, Malaysia), M. Fitri Rahmadana (Cost-benefit analyst, Indonesia) and Nguyen Thi Kim Cuc (Mangrove analyst, Viet Nam) and was supported by several drivers and interpreters. Dang Thi Khanh Linh gave invaluable logistical and administrative support.

1. PROGRAMME **OVERVIEW**

Mangrove trees and shrubs are unique in that they have adapted to the salinity of seawater. Typically growing in the mudflats of deltas that contain organic matter and that are inundated with each high tide (intertidal zones), mangroves perform several ecological functions: amongst others, they provide nutrients for oysters, shrimps and fish that live in the surrounding brackish waters, serve as a habitat for bird life, and convert carbon dioxide (CO_2) into oxygen (See Hanh 2010). In doing so, they store accumulated carbon and thus contribute to the mitigation of climate change. By decreasing the speed of water flows, they also limit the height of waves that meet dykes (See Massel et al. 1999) and are said to accelerate the sedimentation process (See Mazda: 1997)[2].

Mangroves in Viet Nam

Mangrove forests form an integral part of the native ecosystem of coastal Viet Nam. In the country's north, the Red River delta in particular had always been home to an extensive mangrove ecosystem. It was only since the 1960s that mangrove forests were cut down to make way for economic activities. This process of destruction was accelerated in the wake of Doi Moi, the economic liberalization paradigm announced by the government in 1986: more and more individual entrepreneurs and companies began to establish shrimp farms where mangroves had thus far existed. By the early 1990s, extensive mudflat areas were either vacant or filled with active or abandoned shrimp farms (usually, these farms return a high yield only in the first 3-4 years but then experience decreased output as pollution takes its toll).

1994: Reforestation begins

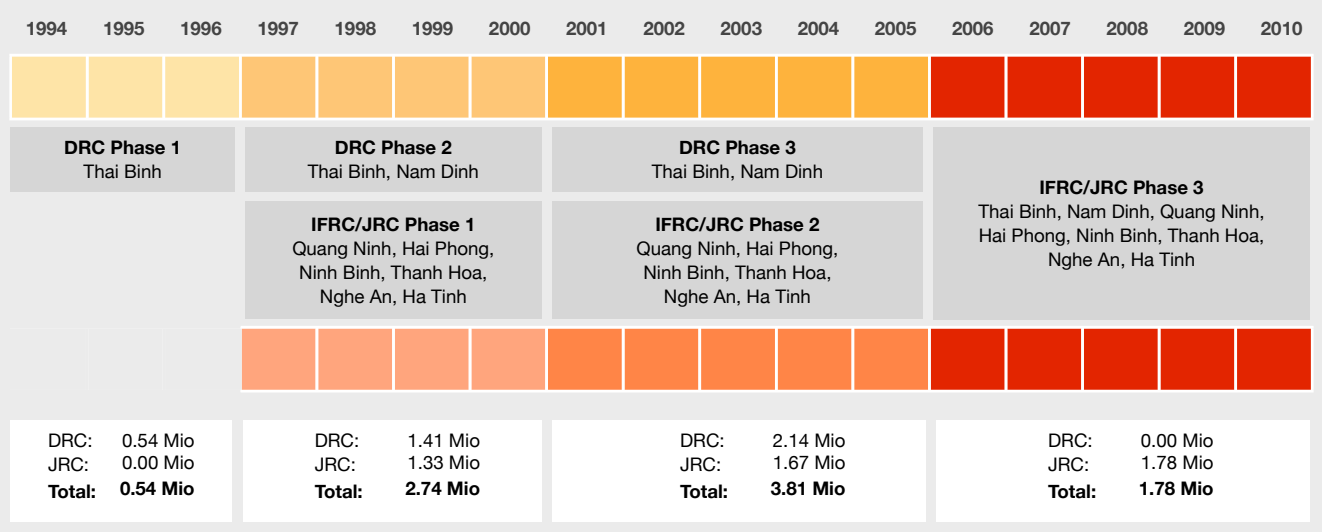
Mangrove reforestation had been attempted by the government's Ministry for Agriculture and Rural Development (MARD) as early as the 1960s. However, without

Map 1

Programme communes in which planting activities (mangroves, bamboo and casuarina) were implemented between 1994 and 2010 (marked red). Overall, 9,462 ha of trees were planted in the country's eight northernmost coastal provinces of Quang Ninh, Hai Phong, Thai Binh, Nam Dinh, Ninh Binh, Thanh Hoa, Nghe An and Ha Tinh.

2. However, the effect of mangroves on the speed of the sedimentation process is contested (see Spalding et al., 2010).

Figure 1: Programme timeline [3]



much research into effective planting and protection schemes, the success of this scheme was low as survival rates averaged only 25%. In 1993, the Thai Binh chapter proposed to give reforestation another try: realizing the importance of mangrove forests for both marine life and dyke protection, the chapter suggested launching a Red Cross programme to re-establish mangroves on deserted mudflats. Danish Red Cross (DRC) took up the idea and launched an ecological protection programme in Thai Binh in 1994. First attempts of replanting suffered high losses due to low survival rates of the young plants. As the former DRC Delegate in charge Jørgen Kristensen explains, "we didn't have a clue about mangroves". So the expertise of a research body affiliated with the Viet Nam National University (VNU) was brought in to provide technical advice. By the end of 1996, this co-operation began to show encouraging outcomes, as a higher share of young plants survived.

1997: Reforestation efforts expanded

In 1997, the chairman of Thai Binh chapter became the Director of VNRC's social welfare department. Given the encouraging experiences made in his province, he suggested widening the programme. DRC agreed to extend and expand coverage to Thai Binh's southern neighbour Nam Dinh, while Japanese Red Cross (JRC) went ahead to fund the extension to Quang Ninh, Hai Phong, Ninh Binh, Thanh Hoa, Nghe An and Ha Tinh. JRC decided to take the role of a donor and left implementation support to IFRC. Between 1997 and 2000, the DRC and IFRC/JRC programmes were run independently from each other: each programme had its own programme management board, and management styles, objectives and mindsets differed significantly. DRC had begun to invest in capacity-building - both of the Red Cross and the research body mentioned above (Mangrove Ecosystems Research Centre, MERC). DRC staff spent considerable time in the field ("up to 15 days a month", Interview Kristensen), established a rigid reporting system, and had a transparent but "hands on" approach (Interviews Ky, Tuan). The considerable funds (USD 1.41 Mio) acquired from Danida (Danish International Development Agency) enabled DRC and VNRC to implement a holistic and well-resourced programme. Meanwhile, the IFRC/JRC programme had to spread similar resources (USD 1.33 Mio) across six provinces. The extent of capacity-building was limited to the minimum required to effectively implement the programme, and the approach was generally "hands off" - leaving most decision-making and implementation to VNRC (Interviews Ky, Tuan).

3. The timeline indicates different phases, respective programme areas and budget volumes at original USD values. Source: Own calculation based on available financial data. For 1994-97, 1999 and 2002 approximations were used.

Figure 2: Overview of main focal areas during programme phases [4]

	1994 - 1996	1997 - 2000	2001 - 2005	2006 - 2010
VNRC/ DRC	• plantation of mangroves • limited capacity-building	• plantation of mangroves • strong capacity-building	• plantation of mangroves, bamboo, casuarina • broad risk assessment • holistic approach in selected communes • strong capacity-building	n.a.
VNRC/ IFRC/ JRC	n.a.	• plantation of mangroves • limited capacity-building	• plantation of mangroves, bamboo, casuarina • broad risk assessment • limited approach to risks • moderate capacity-building	• plantation of bamboo, mangroves, casuarina • broad risk assessment • limited approach to risks • moderate capacity-building

2001: Focus broadened

An external evaluation of the programmes in 2000 (See Macintosh 2000) suggested that both programmes be integrated into one - subsequently, the two Programme Management Boards at VNRC HQ were merged, and implementation plans were consolidated between the programmes. However, the essential approaches remained different in the level of support given to each province. To some extent, the IFRC/JRC programme now followed DRC in that it started to give more training to Red Cross staff and volunteers in disaster preparedness and vulnerability and capacity assessments (VCA). From 2002 onwards, the programmes also included communes not directly located at sea-dykes: Attempts were made to better protect river dykes from flood-induced erosion by planting bamboo trees on the usually thin stretch between river and dykes. Plantation of casuarina (and later eucalyptus) trees was also added, either as an additional wind-breaker in mangrove communes or as a way to protect those communes from wind and erosion in which mangrove plantation was not feasible.

Aside from this broadened plantation focus, the programmes now also took up more activities not directly linked to planting: First, a large-scale 'disaster preparedness in schools' component was introduced that has remained part of the programme ever since. Second, Red Cross staff and People Committee leaders were trained in disaster preparedness tools and planning. Danish Red Cross went even further and took a much more comprehensive approach to disaster risk reduction: following sound risk assessments conducted by the Thai Binh and Nam Dinh chapters, it consistently based its programming on these assessment findings. Between 2001 and 2005, it therefore included a wide array of tools, including micro-finance, water and sanitation, and even re-settlement of a particularly vulnerable community (in Hai Ly commune, Nam Dinh).

2006-2010: Continuation with just one donor

Given that the Viet Nam government was to formally protect mangroves (which it did in 2006) and pay for their maintenance (currently VND 150,000 or USD 7.50 per hectare and year), DRC ended its support to VNRC by the end of 2005. IFRC/JRC initially planned to continue only in its regular six provinces, but added the former DRC-

4. The information provided here are based on interviews with key persons involved in the programme (IFRC, DRC, VNRC HQ and chapters) and previous evaluation reports. They serve for comparison only to show trends and differences in approaches.

supported provinces in 2007 in response to their respective requests. Programme implementation in 2006-2010 continued roughly along the lines of the IFRC/JRC approach of the previous years (see figure 4). However, mangrove planting was now limited to gap-filling and diversification - bamboo and casuarina were the main focus.

Programme scale

Throughout the 17 years of its existence, around USD 8.88 Mio were spent on the programme (accumulated annual figures, un-annualised). Planters from 110 coastal communes planted and took care of mangroves along the sea-dykes, while planters from another 56 communes along river lines planted bamboo (see map 1). Overall, around 300 communes were reached through the 'DP in schools' and 'DP for leaders" components. Around 30,000 households were involved in planting activities, and the programme reached 350,000 beneficiaries throughout its existence. The mangroves existing today as a result of the programme cover more than 8,961 ha, representing 4.27% of all existing mangroves in Viet Nam today and 23.80% of mangroves in the eight programme provinces [5]. About 100 km of sea-dyke is lined and protected by VNRC-planted mangroves. The programme also led to the existence of 103.8 ha of bamboo and 398 ha of casuarina trees. The number of the programme's secondary or indirect beneficiaries includes the populations of those communes which are now better protected from the impact of typhoons and floods - while no exact figure could be identified for a number of reasons [6], it is estimated to be around 2 Mio people.

Map 2

Overview of the 222 programme communes in which community-based disaster risk management courses were conducted between 2006 and 2010 (marked green). No figures could be consolidated for earlier programme phases.

5. For a brief overview of mangroves existing in Viet Nam today, see Hawkins 2010:4.

6. For an exact measurement, one would need to assess the protective impact in all communes and identify the population sizes for all communes - achieving this would however require significantly more time than allocated for this evaluation.

Box 1: What was planted, and how

Kandelia candel (see photo) is the mangrove type most commonly planted as part of the programme. These plants grow to a height of three metres, are mature after about five years and grow around 35 years old. They feature propagules - ready-to-go seedlings that can be picked from any mature tree and planted without a need for costly purchases from nurseries. *K.candel* were planted with distances of 50 - 70 cm between them and form the backbone of the mangrove forests planted by the Red Cross. 11,515 ha of *K.candel* were planted by the programme. These figures include re-planting and gap-filling and thus do not represent the actual area planted with them. Young *K.candel* are particularly susceptible to be affected or destroyed by barnacles, strong waves and pollution. After initial difficulties, survival rates for *K.candel* averaged at around 60%.

Sonneratia caseolaris are much higher and typically grow to 7-11m in height. In most cases, *S. caseolaris* were interplanted between *K.candel* at distances of 3 m. *S. caseolaris* need to be purchased from nurseries; planting them is therefore more costly than *K. candel.* However, their greater height means that they can not only break particularly high waves but also wind. They are at particular threat from extended cold periods; 100 ha of *S. caseolaris* died in Ninh Binh in the winter of 2008. Similar damage is expected from the recent cold in January 2011. Overall, 5,300 ha of *S. caseolaris* were planted through the programme.

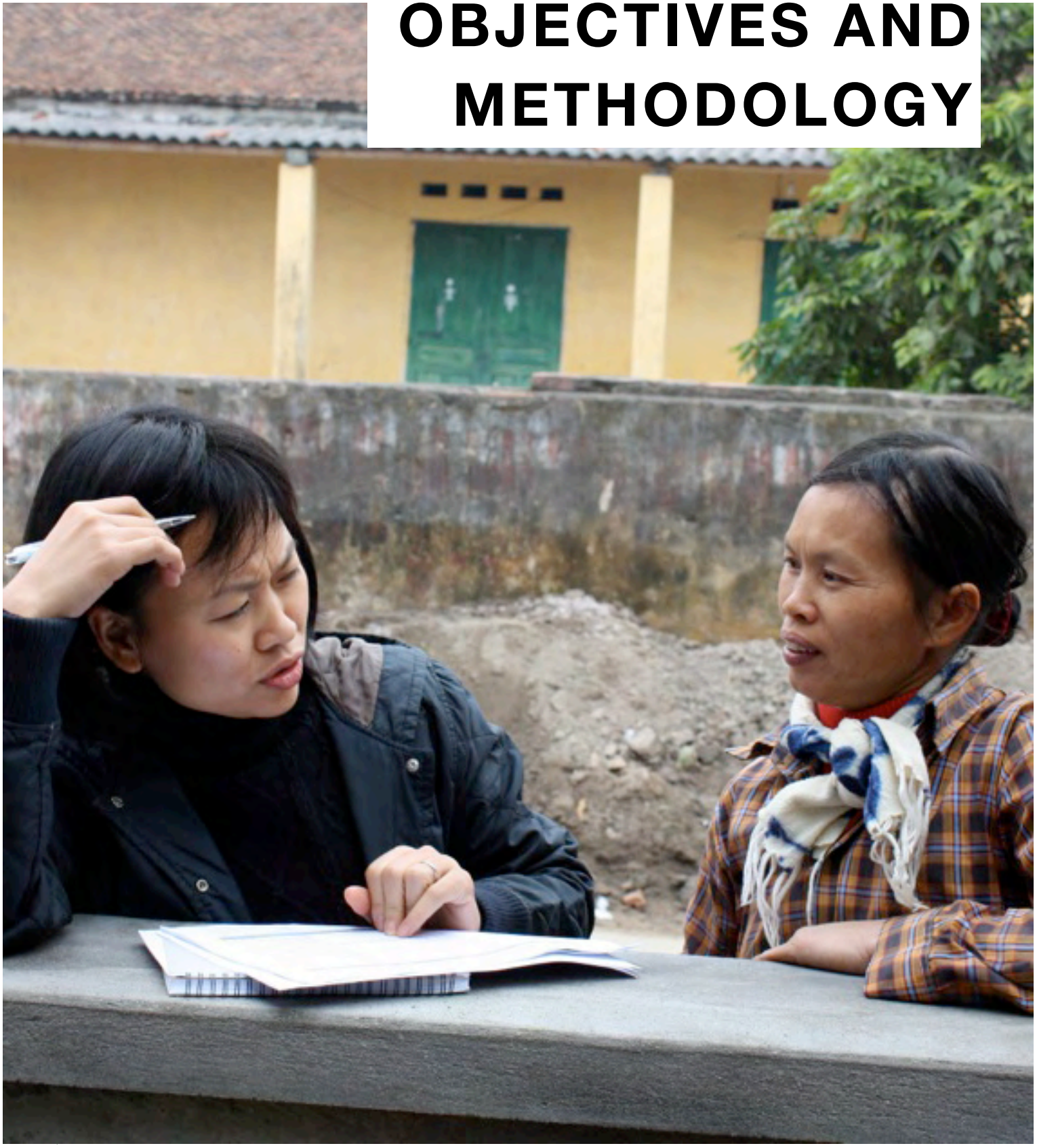
Rhizophora stylosa feature particularly strong roots; their propagules can be collected but usually need to be cared for in nurseries before they can be planted on mudflats. *R. stylosa* were planted to further diversify mangrove forests. 6,450 ha of *R. stylosa* were planted by the programme.

Avicennia marina is the third species used to interplant between *K.candel*. These plants were used sparsely and only in the JRC/IFRC-supported provinces between 2002 and 2005 (total of 152 ha).

Casuarina trees are relatively fast-growing plants that can reach heights of up to 35 m. Their high and slender appearence and high resilience to strong winds make them an ideal wind-breaker. Casuarina trees were planted mostly in areas unsuitable for mangroves, especially along coastal stretches of Nghe An and Ha Tinh. Their strong roots make them also a useful tool to reduce soil erosion. In some places, eucalyptus trees were interplanted with casuarina. Overall, 600 ha of casuarina and eucalyptus trees were planted.

Bamboo trees were planted from 2002 onwards along stretches between river banks and dykes. On the one hand, bamboo was planted to slow water flow during floods and thus protect dykes and agricultural fields and reduce soil erosion. The Red Cross followed and complemented bamboo planting by DARD, which has been planting bamboos in single lines directly in front of river dykes for more than a decade. On the other hand, bamboo trees can bring high yield from the sale of bamboo shoots and its wood - they have therefore a secondary function for income-generation. Planters however need to wait for at least three full years before they can begin harvesting. The Red Cross highlighted the agricultural function of bamboo by selecting a fast-growing, high-yield species which proved however less resilient than the type chosen by DARD. Overall, 134 ha of bamboo were planted.

2. EVALUATION OBJECTIVES AND METHODOLOGY



The programme has been evaluated at least three times - in 2000, 2003 and most recently in 2005. A planned mid-term evaluation for the 2006-2010 period was cancelled. As described in the introduction, this evaluation covers the period 2006-2010 on the one hand and the overall programme period on the other (1994 - 2010). This chapter lays out the evaluation's objectives and then describes the methodology applied to reach those objectives. Note that a more detailed description of the methodology is provided in appendix A.

Three specific objectives of this evaluation are laid out in the terms of reference (ToR):

(1) **To assess the performance and progress achieved (outputs) with respect to the objectives of the Community based Mangrove/Disaster Preparedness Programme Phase 3 (2006-2010).**
(2) **To assess the long term impact (outcomes) of the programme in the communities. It will assess the extent to which the programme has contributed to building more sustainable safety and resilience among the targeted communities during the period 1994-2010.**
(3) **To analyse the return on investments for both outputs and outcomes through a cost-benefit analysis, aiming to strengthen the cost efficiency of on-going and future programming by providing evidence-based lessons.**

Related to the overall period 1994-2010, which is covered by this report (for the 2006-2010 period, see report B: Planting protection), the ToR further specify that the evaluation is to measure a) impact, b) efficiency, and c) sustainability. Each issue is specified further:

Impact

The long period of the CBMR/DPP allows for the possibility of measuring outcomes, i.e how has the programme outputs over the years increased the resilience of communities directly or indirectly, intended or unintended? Evaluators will design a methodology to assess attribution of programme to observed changes in the communities.

Key questions for impact:

- **What has been the long term impact of the programme on disaster risk reduction and capacity building since 1994, in particular the impact of the programme on the coastal environment and socio-economic situation of targeted vulnerable groups to flood and typhoons, poor people selected to involve in project activities?**
- **Did the household or community level disaster preparedness change?**
- **Does the livelihood of the people improve from the mangroves?**
- **To what extent does the community use the early warning information to improve their disaster preparedness and response?**
- **Has the improved awareness lead to changed behaviour for disaster risk management?**
- **What external factors promoted or inhibited the achievement of programme objectives and expected results at all levels?**

Efficiency

A cost benefits approach to efficiency will be used to measure the extent to which CBMR/DPP's results have been delivered in the least costly manner possible. Evaluation will measure whether the results justified the cost, and if alternative approaches to achieving the same results could have been adopted.

Key questions for efficiency:

- How have the programme activities resulted in economic benefits in dyke repair/ maintenance, disaster losses and strengthened livelihoods in the targeted communities?
- What were the costs of investments to develop specific programme outputs (e.g. what is the cost of per hectare mangrove plantation and its maintenance)?
- Is the cost benefit ratio of inputs to outputs comparable to other national or international benchmarks?
- What are the administrative costs per beneficiary and how do they compare with other programmes in the country?
- Was there any extensions to the implementation period, if yes, what were the additional administrative costs that were incurred during the extension period?
- What is relative economic contribution of different programme components?
- What key factors help account for project efficiency performance?

Sustainability

Finally, sustainability of the CBMR/DPP will also be measured to check if the benefits of the programme are continued after programme is finished in a particular area. It will pay particular attention to longer-term sustainability of the local capacity and ownership of the programme without donor funding.

Key questions for sustainability:

- How is the organisational capacity built by the programme, including VNRC human resource capacity at all levels for planning, monitoring and evaluation?
- Have the benefits generated by the programme continued after programme closure? If yes, what factors contribute in maintaining the benefits?
- Do programme activities (like maintaining the mangrove plantation) still benefit from the engagement, participation and ownership of local communities?

A brief look at methodology

Considering (a) the programme outline, (b) the requirements for an assessment of impact, efficiency and sustainability, and (c) the available resources and time for the evaluation, an analytical framework was developed to carry out the task in a realistic, efficient, timely, sound and valid manner. While the full methodology and underlying assumptions are described in appendix A, a brief overview is presented here.

Impact analysis requires the measurement not only of the factual, but also of the counterfactual (what outcomes would have been found without a programme intervention). A solid design is needed to attribute certain changes in outcome to the programme. Due to limited time and data availability, the impact analysis was restricted to longitudinal comparisons (before/after), where possible alternate explanations for a change in outcome could be controlled.

Cost-benefit analysis, a tool ubiquitously used by economists, was deployed to measure efficiency. Compared to impact, which measured the change of outcomes attributable to the programme encountered until today, it needs to expand the time horizon (in this case up to 2025), as neither costs nor benefits are likely to cease at the present time but will extend into the future. For the assessment of protective benefits (avoided risk), annual probabilities were ascribed for typhoons and floods. Benefits (and disbenefits) were incorporated into the analysis that had been previously identified in literature (see figure 3 below).

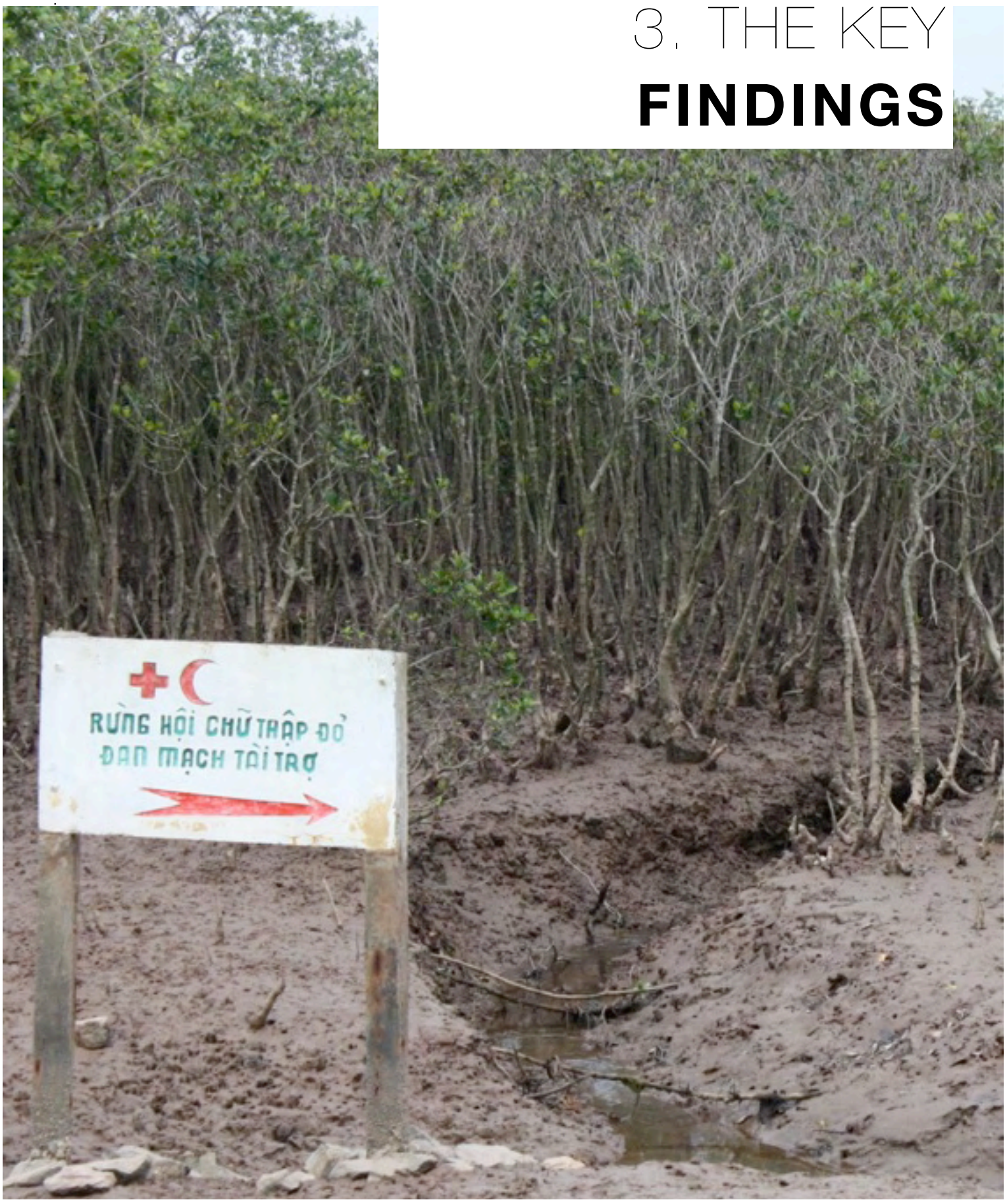
The evaluation deployed a mixed-method approach of qualitative (key informant interviews, focus group discussions, site visits) and quantitative tools (household survey, quantitative data review). Provinces and communes were sampled in a way that met pre-set criteria; where feasible, control communes were chosen for the impact analysis. The household survey covered 372 respondents (223 planters; 89 non-planters from programme communes; 60 from control communes), each of which answered a questionnaire covering 40 questions on various aspects of the programme.

The analysis of ecological benefits centered around the mangroves‘ function as a carbon sink; data gathered from research by Nguyen (Nguyen 2010) was extrapolated to determine the carbon value created by the programme.

Figure 3: Overview of potential benefits of mangroves

Category	Individual benefits of mangroves
Protective benefits	• Reduced costs in sea-dyke maintenance and repair (CFEE 2007) • Reduced disaster-induced material losses (public infrastructure, buildings, crops, livestock, aquaculture) (Dadouh-Guebas 2005, Danielsen 2005, Hawkins 2010) • Reduced disaster-induced non-material losses (injuries, deaths) • Reduced disaster-induced indirect (long-term) losses (e.g. reduced productivity due to saltwater intrusion or injuries) • Shoreline stabilization (reduction of soil erosion)
Direct economic benefits	• Planters’ income • Increased yield from collection of animals or animal products (shrimps, oysters, craps, fish, honey) (Lewis 2001, Hawkins 2010, Janssen 1997, Sathirathai 1997) • Increased yield from wood collection (fuelwood, charcoal) (Bann 1998)
Ecological benefits	• Carbon value (Nguyen 2007) • Nutrient retention (Bann 1998) • Sediment retention (Mazda 1997) • Biodiversity habitat (Bann 1998)
Disbenefits	• Reduced income due to mangrove plantation (e.g. through halting previously conducted economic activities)

3. THE KEY **FINDINGS**



Impact

• Mangroves have proved to protect dykes and coastal communes well - the added protection for private assets, in particular those located between mangroves and dykes, is found to be extremely valuable.

• A significant impact is also found for bamboo trees, which reduce soil erosion, damage to arable land and river dykes.

• The disaster preparedness training is seen as having been effective in that most communes have developed disaster preparedness plans, which they update annually. A quantifiable impact value however is not established.

• The impact on enhanced livelihood is undeniable - with an increase of yield from aqua product collection of up to 780%, it is especially the poor members of the commune who have benefitted from mangrove plantation. 60% of survey respondents from mangrove communes attribute a positive impact of the programme on their income.

• Concerning bamboo plantation, the impact on income is positive but significantly smaller than from mangroves - this is due to the small size of allotments to planters and a planter selection that was not based on planters' poverty levels.

• Overall, the impact value of protective benefits is markedly larger than that of direct economic benefits.

Efficiency

• The programme is seen as highly efficient in that it has generated benefits in great excess of it costs. Benefits are so sizable that the programme would have even had positive benefit-cost ratios if only one of the three benefit categories (protective, direct economic, ecological) had been taken into account.

• Mangrove afforestation is seen as a comparably more efficient way to protect coastal communes than other tools - such as the concretization of sea dykes - not only because it cheaper per se, but also because it offers benefits other tools fail to offer (direct economic and ecological benefits, protective benefits for assets located outside the sea-dyke).

• Out of the three benefit categories, the ecological benefits stand out: The present value of estimated minimum CO_2 emissions absorbed by the VNRC planted mangroves stands at USD 218 Mio, assuming a price of USD 20/ t CO_2e.

Sustainability

• The commitment of the government to mangrove protection is strong, and the government pays for the care of mangroves. The local ownership of of planters, VNRC and commune wards is seen as high. Both factors are seen as a lynchpin for the sustainability of the programme's achievements.

• There are however several challenges to sustainability: On the external side, ecological factors and the impact of climate change as well as long-term planning between VNRC, MARD and MoNRE will need to be managed better. On the internal side, VNRC needs to become more financially independent to be able to sustain all of its activities run through the programme thus far. It also needs to plan better to maintain and further improve the capabilities of staff and volunteers.

4. IMPACT

As described above, impact is the change in outcomes that can be directly attributed to the programme. This chapter looks at the actual changes of outcomes that have occurred until today as a result of the programme. It first looks at reduced disaster risk, then at the impact on livelihoods. Further detailed analysis can be found in chapter 7, which includes case studies of six communes.

4.1 Impact towards disaster mitigation

The study finds a protective impact of mangrove forests both for sea-dykes and private property. Comparing the damage caused by similar typhoons under similar conditions, it was found that avoided dyke damage amounted to between USD 80,000 and 295,000 in the communes studied. This is only a fraction of the costs associated with mangrove plantations - taken by itself, mangroves have hence not yet paid off for dyke protection. This equation changes significantly if avoided losses to private property and public infrastructure are taken into account: In Thai Do commune (see 7.1), avoided losses of USD 4,990,700 were identified - this included avoided losses to shrimp farms and paddy fields (which were spared saltwater inundation and a medium-term yield loss as an indirect benefit). In Giao An commune (see 7.2) with its extensive shrimp farms located between dyke and mangroves, avoided losses even amounted to USD 14,875,000 at present value. In general, avoided losses were found for shrimp farms, agricultural fields and sea-dykes - however, a protective impact for communities and their property landwards of dykes could not be identified. It comes thus not without irony that amongst the biggest beneficiaries are shrimp farmers, who had long been in opposition to mangrove planting.

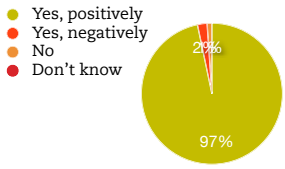
The protective impact value of the programme's mangrove planting component in the studied communes alone already exceeds the present value of the entire VNRC programme costs. Assuming an impact heterogeneity, the study refrains from extrapolating figures found in visited communes to the entirety of communes. However, it is safe to say that the avoided losses until today alone are by far greater than programme costs - the programme has thus been worth its investment.

A protective impact of bamboo trees that have been planted along river dykes since 2002 was also identified: Bamboo trees significantly reduced or even eliminated the need for dyke repairs. Dyke protection proved particularly effective in communes were trees were planted in two or more rows. Bamboo also brought down land erosion by as much as 50 % and helped protect agricultural land between dyke and bamboo trees. Avoided losses were found to be up to USD 4,500 per year (in the commune of An Hoa). It was also found that bamboo trees are vulnerable to parasites and flood-induced damage in the initial three years - however, once they had matured, they showed a strong resilience when facing floods.

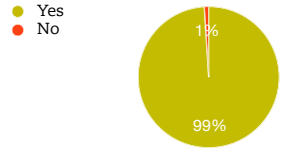
Concerning casuarina trees, which were mainly planted in the two southernmost programme provinces Nghe An and Ha Tinh (that do not have the same sizable mudflats found in the Red River Delta), a protective impact was only found in one sea coast commune (no such effect was found in the two river line communes, see case studies 4, 5 in Report B). In Ha Tinh's Thach Tri commune, only half the damage was caused by a level 10 typhoon in 2010 than by a level 9 typhoon in 1989. Significantly, the damage in 2010 occurred in an area of the commune which has no protection by casuarina trees. While it is concluded that casuarina trees have had a significant protective impact, this impact could not be quantified due to lack of available data.

A significant impact was identified in Hai Ly commune (Nam Dinh province; see 7.6). in terms of avoided losses, improved health and reduced vulnerability. Hai Ly is one of

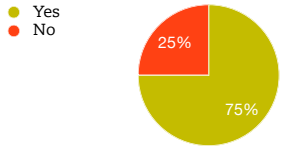
Do you feel that mangroves have affected marine life?
[All respondents in programme communes, N=204]



Do you think that mangroves, casuarina and bamboo contribute to the protection of dykes?
[All respondents in programme communes, N=312]

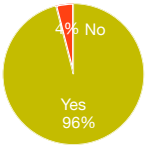


Did you feel this way before the programme?
[All respondents in programme communes, N=312]

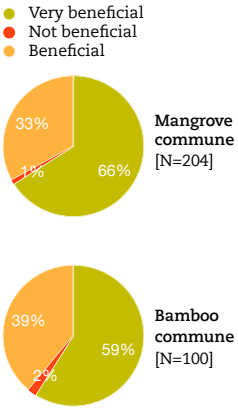


Selected charts showing household survey results in regard to the impact of the programme (continued overleaf).

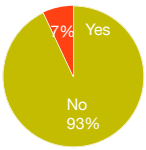
Do you feel better protected and prepared for typhoons and floods compared to the time before the programme began?
[All respondents in programme communes, N=312]



Do you think the programme was beneficial to the community?



Were there any harmful effects of the programme?
[All respondents in programme communes, N=312]



two communes where a comprehensive risk management was implemented through the programme - the intervention here included resettlement, water and sanitation, micro-finance and disaster preparedness training. While time limitations did not allow for a more thorough analysis, the case would be well-suited for an in-depth impact and cost-benefit analysis of the various intervention components.

Disaster preparedness training

Disaster preparedness training in schools, for Red Cross members and commune leaders was another large component of the overall programme. Since 2000, 10,141 teachers were trained in disaster preparedness, who have since passed on knowledge on disaster preparedness tools and strategies to at least 324,700 year 4 and 5 students through curricular and extracurricular activities. While the DP in schools component was found to be effective by teachers and Department of Education and Training (DET) officials, the impact was not possible to quantify. The same must be said about the training of 6,012 commune wards and Red Cross volunteers - it was generally found however that as a result of these training courses, communes now have and regularly update disaster preparedness and management plans. The programme also had a positive impact on VNRC capacity and membership in programme communes, branches and chapters.

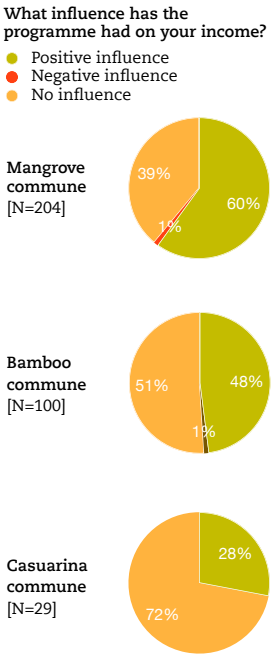
Concerning the perception of the protective impact of the programme, 96% of the 312 respondents in programme communes feel better prepared and protected for typhoons and floods compared to the time before the programme began.

4.2 Impact towards enhanced livelihood

The second category of impact concerns livelihood. In the case of mangroves, per hectare yield from the collection of shrimps, crabs, molluscs and other aquacultures was increased by between 209 and 789% compared to bare mudflats. The present value of these gains is found to be between USD 190.000 and USD 3.54 Mio in the communes studied - in four out of the five communes analyzed, these gains in themselves exceed the planting-related costs in those communes. The calculation takes the fact into account that during the first three years after mangrove planting, no aquaculture product collection is allowed to avoid accidental damage to young plants. In Kim Son district of Ninh Binh, aquaculture product collection from the mangrove forest itself is still not allowed - however, income through aquaculture collection in adjoining mudflats rose regardless.

That the increase in yield correlates with enhanced incomes and livelihoods can at least be shown for those persons that initially planted the mangroves: while it is estimated that at least 75% of these planters were on the official poverty list at the start of the programme, only 18% of them were officially poor in 2011 (compared to 13% amongst non-planters). Overall, 60% of 204 respondents in mangrove communes attributed a positive impact of the programme on their income (while 38% stated there had been no impact and 1% said there had been a negative impact). Aside from the increased yield from aqua product collection, the mangrove forests also enabled the establishment of honey bee farms - in one commune, around USD 270,000 have been made thus far from honey production.

In the case of bamboo plantation, this study brings about four impact-related findings: *First*, bamboo has a high potential to generate a high yield from the sale of wood and bamboo shoots of up to USD 1,750 per ha and year [7]. *Second*, the first harvest can be made after three years - choosing bamboo over other crops thus presents a disbenefit in the initial period. *Third*, the average size held by each planter - 0.2 ha - is too small to make a significant impact on income. *Fourth*, the selection of bamboo planters in the programme was by and large based on their rights to land in front of a river dyke, not on poverty. The impact of bamboo on livelihood must therefore be seen as relatively minor.



7. However, as the case of a farmer in Nghia Dong (Nam Dinh) shows, per hectare income can be almost doubled if synergetically combined with fish and chicken-farming - for details, see case study 2 in Report B.

5. **EFFICIENCY**

While the previous chapter looked at the actual impact - the changed outcomes that can be attributed to the programme until today, this chapter turns to efficiency. Efficiency is measured through a cost-benefit analysis. To do so, the time horizon needs to be widened into the future: Benefits (as well as costs) do not cease to exist at the end of the programme, but are likely to prevail into the future. As a general assumption, we base our calculations on the time up to 2025. This chapter begins with an analysis of costs, proceeds with an overview of protective, direct economic and ecological benefits, and concludes with the calculation of benefit/cost ratios.

5.1 Costs

Throughout 1994 to 2010, USD 8.88 have been spent on the programme by Danish Red Cross and Japanese Red Cross - at present value, this represents USD 15.1 Mio. As no detailed budgets are available for the entire programme period, it is estimated that around 50% of that amount were directly or indirectly related to plantation of mangroves. The resulting USD 7.55 Mio were then divided by the 8,961 hectares of mangrove forest that exist today as a result of the programme - providing an average cost per hectare of USD 843.09. For each of the case studies, this amount was multiplied by the number of ha that exist in a commune to determine the planting-related programme costs. Needless to say, the figure can only be an approximation, as costs would have varied depending on survival rates and the proportions of different mangrove species planted [8]. To calculate the overall costs of a mangrove forest up to 2025, the protection fees paid by DARD since 2006 (at USD 7.50/ha) are added at annualised rates. The overall costs per ha are thus established at USD 946 - 953, depending on the year of planting.

The programme's per-hectare costs compare very favourably with similar mangrove reforestation programmes (Lewis 2001, Interview DARD Hai Phong). Government projects cost at least USD 1,500 per ha, in some cases much more (up to USD 15,000). Three factors explain the relatively low cost for planting: *First*, almost half (49.2%) of the mangroves planted were *K. candel*, for which no nursery costs are incurred. *Second*, planting was community-based - fees for planting were therefore arguably lower than if outsiders had to be recruited.

Third, the emphasis on awareness appears to have paid off - most of the community members now understand the importance of mangroves and are dedicated to their protection. In some cases, they even re-planted with their own resources. The initial suitability assessments conducted by MERC also appears to have kept wastage at low levels. A more general aspect behind cost efficiency is that conditions for mangroves in the planted areas were more or less ideal - seaward expansion of forests in mudflats that are at lower levels in relation to the sea-level requires much higher investments, as high as USD 9,000 per hectare (Interview Anh). As opposed to several projects run by the government with World Bank support, the programme also did not have to pay out compensation for the acquisition of shrimp farms.

5.2 Benefits

5.2.1 Protective benefits

Protective benefits are the estimated losses that would have been induced by typhoons and floods in the absence of the programme intervention. Assuming a ten-year frequency between major typhoons in the studied communes, protective benefits to sea-dykes are assessed to be between USD 199,600 (Giao An) and USD 676,800 (Dai Hop. Taken by themselves, costs exceed savings in dyke repairs in two out of three

8. While survival rates varied widely over time and between communes visited, it was found that the more experienced and prepared the local Red Cross was (e.g. prior research conducted into soil and water flow conditions), the likelier was a high survival rate.

Figure 4: Estimated benefits and costs in selected communes

Commune	Dai Hop	Thai Do	Nam Tinh	Giao An	Dien Bich
District	Kien Thuy	Thai Thuy	Tien Hai	Giao Thuy	Dien Chau
Province	Hai Phong	Thai Binh	Thai Binh	Nam Dinh	Nghe An
Population	10,955	6,087	7,240	10,496	10,521
Sea coastline (km)	3.9	5.5	5.9	3.2	3.5
Dyke line (km)	4.0	7.5	5.9	3.2	3.5
Timeframe of planting	1998-2005	1994-2005	1997-2005	1997 - 2005	1998-2005
Planting input (ha)	835.0	1,010.0	1,287.0	2,403.0	145.00
Planting output (ha)	450.0	900.0	380.0	678.0	100.00
Planting-related costs, USD	425,866	858,373	362,424	646,641	95,374
Protective benefits, USD	676,868[C]	15,330,243	n.a.[D]	37,818,545	n.a. [E]
Direct economic benefits	628,094	672,436	4,799,476	6,748,533	344,931
Ecological benefits	10,989,000	32,730,828	12,307,055	23,308,814	3,437,879
Total identified benefits	12,293,962	48,733,507	17,106,531	68,375,892	3,782,810
Benefit/cost ratio 1 [A]	**3.06**[C]	**18.64**	**13.24**[D]	**68.92**	**3.61**[E]
Benefit/cost ratio 2 [B]	**28.86**[C]	**56.77**	**47.20**[D]	**104.96**	**39.66**[E]

Notes: A: Excludes ecological benefits. B: Includes ecological benefits. C: Protective benefits concern only the reduced damages to the sea-dyke. D: Protective benefits were identified but could not be validly attributed to the programme. E: Protective benefits were identified but could not be quantified.

cases. This picture changes dramatically however when other avoided losses to shrimp farms, farmland and other property and infrastructure are incorporated into the calculation: Overall avoided losses are identified to be at up USD 37,818,000 - in all studied cases, the overall protective benefits exceed costs and thus show that mangroves have been a sound investment for the protection of coastal communes.

5.2.2 Direct economic benefits

Despite the massive yield increase from mangrove forests described above, direct economic benefits are comparatively small when put into perspective with the scale of protective benefits. Nonetheless, in five out of six communes the direct economic benefits exceed costs - in most cases, mangrove planting would thus make economic sense even in the absence of any protective benefits. Direct economic benefits amount to between USD 344,900 (Dien Bich) and USD 6,748,500 (Giao An).

5.2.3 Ecological benefits

As explained in chapter 2, the only ecological benefits assessed concern the function of mangroves as a carbon sink. While not much research into mangroves' carbon value has been completed yet, a study conducted by Nguyen Thi Honh Hanh provides a compelling analysis that is used as the basis for this report (See Nguyen 2010). Nguyen researched the carbon value of Kandelia forests that were 1, 5, 6, 8 and 9 years of age. She looked into both the existing carbon value of these forests as well as into their CO_2 absorption capacity.

Carbon value is calculated by adding the carbon stored in the trees and the carbon stored in soil and then subtracting the CO_2 emissions of these forests through soil respiration. Nguyen found that one hectare of a nine-year old mangrove forest contained 48.02 t of carbon in trees, the equivalent of 176.26 t of CO_2 . The top 100 cm

of soil contained 92.18 t of carbon, which compares to 50.76 t stored in a bare mudflat. The (positive) impact of mangroves on carbon storage in soil is thus 41.42 t per hectare, the equivalent of 152.01 t of CO_2. The CO_2 emissions from one hectare of mangrove forest were found to be minor at only 1.32 t CO_2. The overall CO_2 equivalent accumulated in one hectare of mangroves is 326.95 t. In addition, a nine-year old forest can absorb another 99.59 t of CO_2 per year.

What do we make of this? In the context of this programme, we need to point out two caveats before drawing conclusions: *First*, Nguyen's study looked at areas that were exclusively covered by Kandelia trees (about 2-4 meters in height). The VNRC programme however mixed different species and also included higher-growing Sonneratia (up to 11 m). While the values determined by Nguyen can serve as guidance, it must be assumed that the actual amount of carbon stored in the VNRC-planted forests is likely to be higher. The *second* caveat is that no research exists as of yet that looks into the development of CO_2 absorption capacity of forests older than nine years. It can be reasonably assumed that their capacity increases further but goes into decline as trees approach the end of their life cycle. Given the lack of research, this study treats the absorption capacity development as linear based on their 9-year capacity. Considering that we only look at 25 years (of a 35 year life-cycle), this must be seen as a conservative treatment.

Considering these caveats, we can say that the minimum CO_2 equivalent absorbed by one hectare of VNRC-planted existing mangrove forest is 326.95 t (almost the equivalent of a fully-loaded Boeing 747). Assuming a price of USD 20.00 per t CO_2 e - around which the real price currently fluctuates - the monetary value of one hectare of a nine-year old forest is USD 6,539. As the programme has led to the existence of 8,961 ha of mangrove forest, the overall value is at least USD 58,59 Mio (most planted mangroves are older than nine years). In addition, each hectare is expected to absorb another 99.59 t of CO_2 per year - 1,493.85 t between 2011 and 2025. With the 2011 value of USD 1991.80/ha, the annualised value of this future absorption is USD 17,880 per hectare. For the entire mangrove forest planted by VNRC, this means another USD 160.22 Mio in value.

Overall, the VNRC-planted mangrove forest will have absorbed at least 16.3 Mio t of CO_2 by 2025 and has a carbon value of an astonishing USD 218.81 Mio. Each year, it thereby compensates for the average CO_2 e emissions of 425,000 Vietnamese people (2005 levels, without land-use change).

While these astonishing figures open up a new avenue for afforestation funding through the clean development mechanism, one question remains: what happens at the end of the forest's life cycle, i.e when it is logged down and converted into arable or residential land? For the carbon stored in the trees, the answer depends on how the wood is used. If it is used as firewood or turned into charcoal, the carbon re-enters the atmosphere as CO_2; if it is used for construction, it remains stored. For the carbon stored in the soil, a fair share is emitted through increased soil respiration - however, the rate depends on the type of future use.

5.3 Benefit/cost ratios

The study calculates two types of benefit/cost ratios: BCR 1 only includes protective and direct economic benefits, as these represent the real benefit that will materialize over time. BCR 2 also incorporates ecological benefits into its calculation. Ecological benefits show an added value whose materialization is however uncertain thus far.

The key finding is that a positive BCR1 is found for all studied communes, despite the fact that some benefits could not be quantified. For cases where complete data are available, BCR 1 stands at 18.61 (Thai Do) and 68.92 (Giao An). Even though a considerable degree of uncertainty is associated with any cost-benefit analysis, it is safe to say that the programme intervention has been highly efficient, in that the identified benefits by far exceed the costs.

Benefit/cost ratio 2 is found to be significantly higher and stands at between 28.86 (Dai Hop) and 104.96 (Giao An).

Mangroves versus dyke upgrades

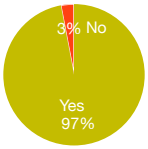
Mangroves thus are shown to be a tremendously efficient tool, especially in that they kill three proverbial birds with one stone. Let us compare the costs and benefits of mangroves with those of the successively implemented upgrade of national sea dykes. According to a DARD figures, the costs of this upgrade amount to VND 16 Bio (USD 800,000) per km of dyke line. These costs cover both the concretization and the raising of dyke height by 1 m - the latter in anticipation of the forecasted sea-level rise. Costs are not disambiguated between concretization and level-raising - so let us cautiously assume that only 25% of these costs fell onto concretization (USD 200,000).

As expressed by a DARD representative, concretization was not necessary where wide and dense mangrove forests already lined a dyke. Based on discussions led throughout the field trip with a variety of organizations, it can be reasonably assumed that a dense mangrove forest with a width and length of 1 km each has a similar protective function for dyke as well as a commune and its assets located *behind* the dyke. Such a mangrove forest of 100 ha in size would cost only USD 84, 300 - less than half of the assumed costs of concretization.

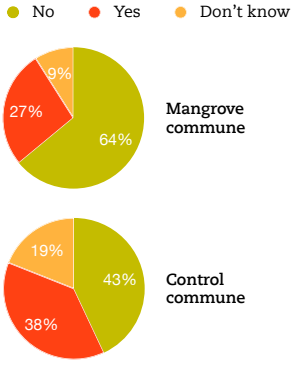
What about the benefits? Assuming that the benefits for dyke and communes behind it is roughly the same, mangroves feature three advantages over dyke concretization: *First*, mangroves have the potential to also protect assets in front of the dyke, such as boats and shrimp farms. In fact, the team heard that shrimp farming was not only better protected from typhoons but could even be expanded. *Second*, mangroves bring direct economic benefits in particular to poorer commune members, who often live off the mangroves - dyke concretization can bring no similar benefit. *Third*, the same can be said for ecological benefits: no concretized dyke can offer the same carbon sink function as a mangrove forest.

6. PROSPECT FOR **SUSTAINABILITY**

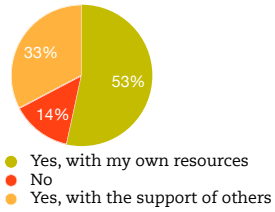
Do you feel committed to the protection and care of your mangrove area after the end of the programme?
[All planters in mangrove communes, N=155]



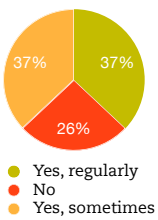
If you were given the chance to convert a coastal area of mangrove forest into an economically more productive area, would you?
[All respondents in mangrove communes, N=204
All respondents in mangrove control commune, N=43]



Where plants did not survive, were you able to replant?
[All planters in programme communes, N=223]



Do you attend meetings relating to the programme?
[All respondents in programme communes, N=312]



Selected charts showing household survey results in regard to the sustainability of programme achievements

There are financial, structural, legal, managerial and behavioural aspects to sustainability - this chapter highlights these aspects for each of the plantation and non-plantation components of the programme.

6.1 Mangroves

The bare fact that the advocacy by VNRC, MERC and others led the government to formally protect mangrove forests, disallowing the cutting of mangroves for other purposes, is a commendable achievement and a lynchpin for the sustainability of the mangroves planted by the Red Cross. It has put to an end the conflict between mangroves and shrimp farms, in the path of which thousands of mangrove hectares had been destroyed in the past. That the government has been paying guardians for the care and maintenance of mangrove forests is a re-affirmation of its commitment to mangroves. It also has made planting of mangroves at a width of at least 300 m in front of all national dykes mandatory wherever suitable mudflats exist. Another key element to sustainability is local ownership and awareness of the mangroves' function - both are found to be high. Many planters and VNRC volunteers showed their forests not without pride and enthusiasm.

In spite of this tremendous achievement, six challenges to the sustainability of mangroves are identified: *First*, several national projects override the protection. A planned international airport and a new seaport in Hai Phong, for instance, will bring the destruction of mangroves (although not planted by the Red Cross) with them. The imperfect coordination between the Ministry of Natural Resources and the Environment (MoNRE) on the one hand, which is in charge of land-use planning, and MARD on the other, which is in charge of forest resources, is a general concern in this regard (Hawkins 2010:6).

Second, despite the formal protection, there is a clear economic incentive for the use of mudflats as shrimp farms rather than mangroves since direct economic benefits from shrimp farms is more than twice as high as from mangroves. While awareness on the importance of mangrove protection is high in programme communes (see charts), such awareness needs to be sustained into the future.

Third, several mature mangrove forests have now grown too dense to allow for natural regeneration. As *K. candel* in a specific location were planted simultaneously, they are all at the same height; their high density does not allow for falling propagules to grow into mature plants. This, in turn, will limit the life-cycle to the age of the initially planted *K. candel* and also prevent access for communities to collect aqua culture products.

Fourth, the sedimentation process in deltas (the speed of which is increased by mangroves due to the slowing of water flows) means that mudflats grow seawards; this will eventually lead to new dyke-building and land reclamation. Land grows particularly fast in Ninh Binh at 80 - 100m per year; on average, a new dyke is built very 15 years. Whether land grows at such speed or not, careful long-term planning is needed to ensure that new mangroves are planted before a new dyke to provide similar future protection. Casuarina forests thus far planted by the Red Cross will inevitably cease to exist once they stop being tidally inundated. The forests can therefore not be seen as being there for good.

A *fifth* challenge to sustainability concerns the survival of individual plants: while mature plants are generally more resilient than young ones, there have been several cases in which mature plants have died. The most severe case encountered by the

team is a stretch of 100 ha of S. *caseolaris* and several ha of *R. stylosa* which died after an extended and unusually cold winter in 2008. Furthermore, mangroves that were planted over the past five years on the seaward fringe of mangrove forests are especially threatened, in particular by the typhoons and storms they mean to give protection from.

Finally, there is a scientific debate over the impact of climate change on mangroves, especially the forecasted sea-level rise. While it is thus not yet clear whether and to what extent this will cause damage to mangroves, alertness and further research are required in this regard.

All of these challenges pose a strong argument for a continuous and proactive approach to awareness-raising, enhanced protection mechanisms and research as well as long-term collaborative planning with government agencies. Several guardians and planters feel currently unsupported when facing technical challenges. On the positive side, it should be noted that in some cases, natural regeneration has led to the expansion of mangrove forests - i.e., propagules have turned into mature plants on the fringes of existing forests. A well-managed mangrove forest can thus grow bigger without any active planting input. The most significant case of such natural expansion was found in Dai Hop (Hai Phong province), where a section of the mangrove forest grew from 80 ha to 120 ha through natural regeneration.

6.2 Bamboo and casuarina

Bamboo trees that have survived floods during their infancy have generally shown a high ability to sustain themselves, as the trees planted by DARD in the early 2000s show. The threshold beyond which plants are seen damage-resilient was identified to be around the age of three.

As the evaluation however covered several communes in which trees were planted more recently, three key threats to younger plants are identified: First, trees planted directly next to the river bank will be washed away together with the eroding soil they are planted in - although they appear to slow down the erosion process, they are unlikely to bring it to a complete halt. The second threat concerns theft and logging: as the trees reach maturity, they become valuable not only for their bamboo shoots, but also for their wood. In several cases, theft of both shoots and wood were reported by planters as challenges. The third issue concerns parasites that can damage or kill trees - this appears to be of particular concern for young trees. In the case of casuarina trees, the main threat identified by the team is soil erosion that they mean to prevent: as the soil is swept away, so are the trees. Trees planted in river communes are also at risk of being damaged by flash floods.

6.3 Disaster preparedness in schools

The DP in schools component consisted of the training of primary school teachers who then trained their year 4-5 students as part of the normal classroom teaching; of youth camps with selected students; and of student competitions on disaster preparedness planning and tools. Using teachers as multiplicators is both cost-effective (to reach a large audience) and sustainable, as long as no additional costs are incurred.

However, this part of the programme was conceptualized as a one-off activity; the fact that neither refresher courses for teachers and additional courses for new teachers

nor replacement teaching material were planned for the long term diminishes the sustainability outlook of this component. Youth camps and competitions, which are said to have been highly effective, are likely to suffer in particular from this shortcoming due to their relative costliness. The programme has not achieved a full integration of disaster preparedness into formal curricula and budget allocations. Although various DET representatives affirmed that they would continue DP in schools in one way or another if no further Red Cross support was granted, the quality and quantity of such a continuation is uncertain.

A positive spin-off of the DP in schools is however recognized, as it is seen as having contributed to a change in the way government sees and approaches risk management. Given the positive experiences made through this component, the government now endeavours to approach risk management in a community-based manner - the planned national risk assessment and a community-based DRM programme across 6,000 communes is a key embodiment of this new approach (Interviews Tao, Tomar).

6.4 Capacity-building and the lack of an exit strategy

While all chapters now have several trainers to train branches and communes in disaster preparedness, a pattern of missed long-term vision is identified in the fields of capacity-building and the training of local leaders. It is sensible to conduct a DP training for leaders or project planning for Red Cross staff, but what about refresher courses and added courses to compensate for staff turnover? Crucially, who will pay for these courses?

Chapters are found to be highly dependent on provincial governments for core funding and strongly reliant on IFRC/PNS support for most of the activities they conduct. This is understandable given that after more than ten years of IFRC/JRC support most staff members would not know anything else than this pattern of support. What is regrettable however is that not even at VNRC, IFRC and JRC has there been a timely realization that there is a lack of an exit strategy (from an IFRC/JRC perspective) or a sustainability plan (from a VNRC perspective). Such a strategy or plan should have aimed to ensure that all major programme components could have been continued and achievements sustained beyond 2010 without additional JRC funding. Tools to such an end should have been early lobbying to DET for the budget allocations for DP in schools, to DARD for allocations for DP for leaders, and more fundraising and resource development to self-sustain activities not covered by the government. In the case of mangrove protection, lobbying efforts to the government have brought positive results, as described above. The high sense of programme ownership amongst RC staff, even enthusiasm, is another positive aspect that can be built on further.

If the long-term sustainability of chapters‘ capacities and activities was the goal - rather than having an eternal umbilical cord - more should have been done earlier to steer towards that goal. With the present situation, several adjustments and bug fixes will need to be made before all of the programme achievements can be judged as sustainable.

7. CASE **STUDIES**

The general findings described previously are further illustrated throughout this chapter, as it gives a closer look at six communes: In particular, the protective and direct economic benefits encountered are described in detail. Five of theses cases concern communes in which activities were centered around mangrove plantation. The sixth case shows a different type of intervention - a holistic disaster risk approach that included re-settlement, micro-finance and water/sanitation.

7.1 Dai Hop (Hai Phong province)

Dai Hop is a commune of 11,000 people located on the coastline of Hai Phong's Kien Thuy district. The Red Cross initially planted mangroves in 1998 and 1999 on deserted mudflats and continued gap-filling until 2005. Overall planting input was 835 ha (350 ha *K. candel*, 380 ha *S. caseolaris*, 105 ha *R. stylosa*) on an area of 390 ha. Through natural regeneration and limited additional planting by DARD (in 2007 and 2010 on the seaward fringe), the commune's mangrove forest covers 450 ha today; stretching along the entire dyke line of 3.9 km at a width of 1-1.5 km. The forest shows maturity today at up to 4 meters height for *K. candel* and up to 11 meters for *S. caseolaris*, as well as high density to the point that thinning may be advisable (see chapter 6). Commune and Red Cross representatives show pride in their achievement, pointing to the beauty of the forest.

Impact

As no nearby commune exists that would have similar coastline characteristics but no mangroves, the impact study needs to rely on a simple longitudinal analysis. A suitable comparison for the identification of protective impact is established between two level 9 typhoons that hit Dai Hop in 1987 and 2005 under similar conditions. In 1987, the storm caused serious damage to a 3 km-stretch of the sea-dyke that needed to be repaired at a cost of VND 6 Bio (at present value/ USD 300,000). The same dyke remained totally unharmed by the 2005 storm, being now protected by a mangrove forest of more than 1 km in width. However, a small outer mini-dyke suffered some damage and needed to be fixed at an estimated maximum cost of VND 100 Mio (USD 5,000). As wind speed and tidal levels were almost identical for the two storms, the difference in dyke damage of VND 5.9 Bio (USD 295,000) can be attributed to the mangrove plantation and thus seen as a positive impact of the programme. It needs to be noted though that over the 18 years between the storms, the mudflat would have expanded significantly by up to one kilometre (partially as a result of the higher sediment retention due to the mangroves).

Aside from a reduction in dyke damage, the commune also reported that several boats were destroyed in 1987, while all remained unharmed in 2005, being moored between mangroves and dyke. While boat losses could not be quantified and are therefore excluded from the analysis, it is safe to assume that these would have been significant (especially when the value of these boats and indirect losses [9] are combined).

As for direct economic benefits, the household survey revealed that the average income per hectare and year stands at VND 3.14 Mio - multiplied by the 450 ha that makes VND 1.413 Bio (USD 70,650). This stands against VND 1.5 Mio that can be generated from an empty mudflat. The difference between these incomes can be attributed to the programme (VND 738 Mio or USD 36,900 per year). Not counting the first three years after planting, and actually subtracting the empty mudflat income for this time (because collection of aquaculture is forbidden in this phase), the annualised impact value for 2001 - 2010 stands at USD 296,835.

9. Such as loss of income from fishing until boats have been replaced.

Concerning ecological benefits, the amount of CO_2 thus far absorbed by the mangroves is estimated to be at least 625.72 t per ha or 281,574 t overall - representing a value of USD 5,631,480.

Efficiency

As explained in chapter 5, the key tool to measure efficiency is the benefit/cost ratio (BCR). The BCR is analyzed in three steps: summarizing costs, summarizing benefits, and then dividing benefits by costs. One should also remember that the assumed life cycle of the mangroves is 25 years.

The planting-related programme costs at present value are the area (of 450 ha) multiplied by the average costs per hectare (of USD 839.09) - this comes to USD 379,390. In addition, the costs carried by DARD need to be added for the time 2006 (when DARD started paying protection fees) to 2025 - this comes to USD 46,476. The total costs related to planting and care in Dai Hop thus stand at USD 425,866.

Concerning benefits, let us look at the protective dimension first: As displayed above, the savings in dyke repairs between the 1987 and 2005 storms are USD 295,000. It is now assumed that a similar storm hits Dai Hop on average every ten years; the ascribed annual probability is therefore set at 10%. The avoided risk per year is thus USD 29,500 at present value. When annualised for each year between 2001 (assuming that mangroves became effectively protective at the age of three years) and 2025, this leads to an overall avoided risk value for dyke repairs of USD 676,868. As noted above, further avoided risk for private property and public infrastructure was found but could not be monetized and is therefore excluded from this case study.

Direct economic benefits were found to be USD 36,900 per year; which makes USD 628,094 for the period up to 2025 (having subtracted the initial three-year disbenefit). Ecological benefits are calculated by multiplying the hectares (450 ha) with the overall carbon value of each hectare up to 2025 (USD 24,420) - this comes to USD 10,989,000.

Benefit/cost ratio 1 (that excludes ecological benefits thus stands at 3.06, while BCR 2 stands at is 28.86. Even though the avoided damages to private property and public infrastructure could not be quantified for Dai Hop, the ratios show that the investment in mangroves was sound - it would even have been if only either dyke repairs or only direct economic benefits had been counted.

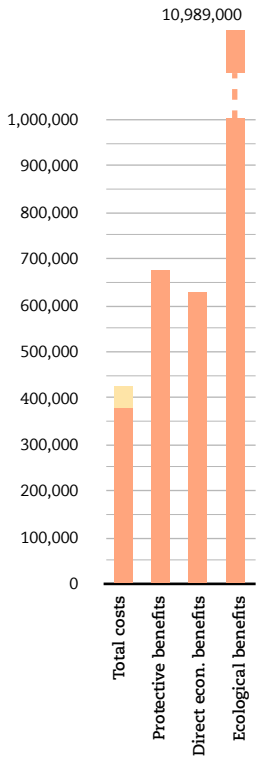


Chart showing costs and benefits in Dai Hop in US Dollar up until 2025.

7.2 Thai Do (Thai Binh province)

A commune of 6,000 in Thai Binh's Thai Thuy district, Thai Do was one of the first communes in which mangroves were planted by VNRC. With the support of Danish Red Cross, an overall planting input of 1,010 ha was achieved (655 ha *K. candel*, 275 ha *S. caseolaris*, 80 ha *R. stylosa*). Today, 900 ha of a dense mangrove forest stand testimony to the programme along the 5.5 km long coast line. The commune is located on the northern bank of a river mouth; in proximity to this mouth is an area of 240 ha of shrimp farms, now nestled between dyke and mangroves. The width of the mangrove forest is up to 1.6 km but as little as 300m between shrimp farms and sea.

Impact

Similar to Dai Hop, no nearby control commune could be identified that would fit the given criteria - the impact analysis thus has no choice but to rely on a longitudinal comparison - two level 11 typhoons in 1996 and 2006 serve as a reference. In 1996, when the mudflats were mostly bare and only partially sparsely covered with newly planted mangroves, the typhoon caused severe damage to the sea-dyke, and 4 km of it needed to be repaired at a present-value cost of USD 400,000. In 2006, the dyke damage was much less severe; a mere 1.6 km stretch needed to be repaired at a present-value cost of USD 180,000. The difference in damage of USD 220,000 can be attributed to the programme.

Damage towards private property was even more significantly reduced: whereas 90% of shrimp farm value was destroyed in 1996 (present value of damage: USD 5,739,500), only 25% were swept away ten years later (present value of damage: USD 793,260). Furthermore, whereas 200 ha of paddy fi elds had been inundated in 1996 with saltwater (and not only destroyed existing paddies but also diminishing yield by an estimated average of 50% over four years), the same paddies remained unharmed in 2006. A damage of USD 44,460 was thus avoided. In financial terms, the overall saving due to reduced damages between 1996 and 2006 was USD 4,990,700 at present value. The overall protective impact of the programme amounted to USD 5,210,700.

Regarding the impact on livelihood, the household survey found that the average income per hectare and year stands at VND 2.41 Mio - multiplied by the 900 ha that makes VND 2.13 Bio (USD 106,850). This stands against VND 1.5 Mio that can be generated from an empty mudflat. The difference between these incomes can be attributed to the programme (VND 823.5 Mio or USD 41,175 per year). Not counting the first three years after planting, and actually subtracting the empty mudflat income for this time (because collection of aquaculture is forbidden in this phase), the annualised impact for 1998 - 2010 stands at USD 502,801.

Concerning the environmental impact to date, the mean planting date of 1997 is assumed - this means that each hectare would have absorbed 824.75 t CO_2. The overall CO_2 absorption between 1997 and 2010 is 742,255 t - representing a value of USD 14,845,500.

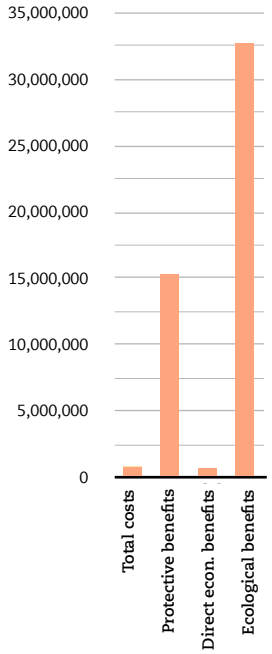


Chart showing costs and benefits in Thai Do in US Dollar up until 2025.

Efficiency

For the cost-benefit analysis, let us have a look at the costs first: the costs carried by the programme are USD 843.09 multiplied by the existing acreage of 900 ha, which comes to USD 758,781. In addition, the DARD will come up for USD 99,592 until 2025 - the overall costs related to the planting and protection of the Thai Do mangrove forest thus come to USD 858,373.

Assuming a ten-year frequency of typhoons the same level as the ones encountered in 1996 and 2006, the annualised savings in dyke repairs between 1998 and 2025 come to USD 647.255, and the avoided damage to private property to USD 14,682,988. The overall protective value of the mangrove forest thus stands at USD 15,330,243.

The direct economic benefits described above come to a total of USD 672,436 for the period 1994 - 2025. Concerning ecological benefits, 2,012,400 t CO_2 will have been absorbed by the Thai Do mangrove forest by 2025 - at annualized rates, this represents a value of USD 32,730,828. BCR 1 thus comes to 18.64, and BCR 2 to 56.77.

7.3 Nam Thinh (Thai Binh province)

Mangrove planting was started in Nam Thinh in 1997, and up until 2005, total planting input was 1,287 ha (520 ha *K. candel*, 365 ha *S. caseolaris*, 402 ha *R. stylosa*). Today, about 380 ha of mature mangrove forest exist as a result of the programme. In addition, 100 ha still exist that had been in Nam Thinh since times prior to the programme. Another 240 ha prevail that have been planted by DARD after 2005 - overall mangrove coverage is 720 ha along the 5.9 km dyke.

Impact

The facts that (a) mangroves existed prior to the programme, (b) that DARD also planted mangroves (between 2007 and 2010) and (c) that the sea dyke was upgraded from a height of 4.2 to 5.2 m in 2003/4 render a clear attribution of a protective impact to the programme impossible. There is also a lack of data for damage - however, as much as a trend can be established: In 1986, a major part of the sea dyke was destroyed after a typhoon, and 300 ha of shrimp and fi sh farms were severely damaged. In 1992, a combination of strong wind and high tide caused considerable destruction of the dyke and aquaculture farms yet again. Since 2000, the commune has not encountered any significant damage, and has even been able to expand shrimp farms between dyke and mangroves. A Tien Hai district official not only attributed this trend to the protective effect, he even rendered the nationally planned concretization of the dyke that has been implemented in Nam Thinh between 2007 and 2010 as unnecessary.

While the protective effect can not be quantified in Nam Thinh, the commune is an interesting case to study the economic effects: Household survey respondents said that they made on average VND 11.84 Mio (USD 592) per ha and year or USD 224,960 across the 380 ha that exist as a result of the VNRC programme. Compared to the VND 1.5 Mio (USD 75) that can be made per ha and year, this is an almost eightfold increase in yield. Even after the subtraction of the disbenefit during the initial three-year period, this means that the net direct economic impact of the programme at present value stands at USD 3,001,702. Concerning the ecological impact, the VNRC-planted mangoves have thus far absorbed 275,617 t CO_2, the present value of which would be USD 5,512,356.

Efficiency

The programme costs for Nam Thinh amounted to USD 320,374; with the inclusion of costs carried by DARD until 2025 of USD 42,050, total costs for planting and protection stand at USD 362,424. As mentioned above, protective benefits could not be quantified for Nam Thinh. Direct economic benefits will have amounted to USD 4,799,476 by 2025 at present value.

Meanwhile, the carbon absorbed by 2025 will amount to 843,280 t CO_2, with a present value of USD 12,307,055. BCR 1 therefore comes to 13.24 - even without counting the protective benefits. BCR 2, which includes ecological benefits, stands at an astonishing 47.2.

7.4 Giao An (Nam Dinh province)

Giao An is the northernmost coastal commune of Nam Dinh province. Located on the southern bank of the Red River mouth, opposite to Nam Thinh commune (described above), the commune with a population of 10,496 has a coast line of 3.2 km (all protected by a dyke). Before 1997, the extensive mudflat was bare. VNRC started to plant in 1997 and had an overall input of 2,403 ha (1,091 ha *K. candel*, 332 ha *S. caseolaris*, 980 ha *R. stylosa*). Today, 678 ha of dense and mature mangrove forest exist as a result of VNRC planting. In addition, DARD and a Japanese NGO also planted mangroves, so the total mangrove forest now amounts to 761 ha, which is at its narrowest point 1 km in width. The mangroves not only cover the mudflats immediately in front of the dyke, but also an adjoining sandbank that stretches further south and thus gives also some protection to the bay in the neighbouring Giao Hai commune. There are sizable shrimp farms in both Giao An and Giao Hai, now located between mangroves and the dyke.

Impact

Substantial protective benefits were identified in Giao An: Comparing similar storms in 1996 and in 2005, there is a clear reduction in dyke damage: whereas 2 km of the sea-dyke needed to be fixed in 1996 at an approximate present value cost of USD 80,000, it remained totally unharmed in 2005. A far greater saving was however found in the case of shrimp farms. In 1996, the typhoon caused almost total destruction of ponds and shrimps. The direct loss was close to USD 15 Mio. In 2005 however, shrimp farms were much better protected and suffered losses of a mere USD 125.000. The protective impact of the programme thus far - avoided losses - stands therefore at USD 14,955,000.

With regard to direct economic benefits, the household survey revealed that the average yield per ha and year is VND 7.2 Mio (compared to VND 1.5 from a bare mudflat). Discounting the initial three years, this brings the net economic benefits from aqua product collection for 1997 - 2010 to USD 3.54 Mio. In addition, around 25 t of honey are made per year from honey bees in the mangrove forest, and the estimated net profit stands at USD 449,681. Concerning ecological benefits, the report finds that 559,282 t CO_2 were absorbed up until 2010, with a present value of USD 11,185,644.

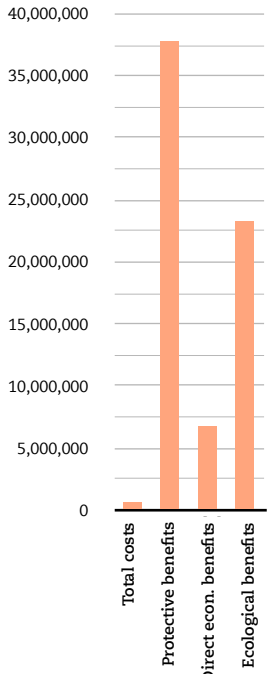


Chart showing costs and benefits in Giao An in US Dollar up until 2025.

Efficiency

The costs for the Giao An mangrove forest carried by the programme amount to USD 571,615 - in addition, DARD will have paid USD 75,026 for the protection of the forest by 2025. The overall costs thus stand at USD 646,641.

Assuming a ten-year frequency between major storms, the value of avoided risk to dyke damage comes to USD 199,636. The much larger value is however attributed to avoided damage to shrimp farms, which are found to be USD 37,618,909. The overall protective benefit until 2025 is thus USD 37,818,545. Overall direct economic benefits from aqua-product collection and honey are USD 6,748,533. The ecological benefits are seen at USD 23,308,814 for the present value of absorbed 1,572,112 t CO_2. BCR 1 thus comes to 68.92, and BCR 2 (which includes ecological benefits) to 104.96.

7.5 Dien Bich (Nghe An province)

Dien Bich is a commune in Nghe An's Dien Chau district that is at particularly high risk. On the eastern side, it is half encircled by sea - in the west, it is bordered by a flood dam that in the past has often failed to withstand water masses during floods. To add to the commune's vulnerability, about one third of its land mass with a population of 1,200 in three villages is below sea level. VNRC planted mangroves in Dien Bich along the outer side of the sea dyke in 1998 and 1999 (total input 145 ha; 70 ha *K. candel*, 75 ha *R. stylosa*) - today, around 100 ha of mudflats are covered by mangroves as a result of the programme. In 2009, DARD upgraded and partially concretized the sea-dyke.

Impact

The hazard history for Dien Bich shows that the commune regularly suffers from its exposed position: The sea-dyke broke in 1982, 1987 and 1989 - each time, major parts of the commune and the low-lying area in particular were inundated. Unfortunately, data of damage are only available for more recent years: Two level 12 storms in 2005 and 2010 caused damage of USD 113,400 and USD 58,000 respectively; however, since the dyke was upgraded in 2009, and since part of the damage was caused by the overflowing flood basin to the commune's west, no clear attribution of a protective function of the mangroves to the reduced losses can be made.

Concerning direct economic benefits, it was found that the average yield increased from VND 1.5 Mio per ha and year to VND 4.93 Mio. This implies that the net impact up until 2010 was USD 190,972. With regards to ecological benefits, it is estimated that up until 2010, the mangroves absorbed 82,490 t CO_2, representing a present value of USD 1,649,800.

Efficiency

The costs related to the mangrove planting carried by the programme stand at USD 84,309 - in addition, DARD will have paid another USD 11,065 for protection by 2025. The total costs thus stand at USD 95,374.

As described above, no clear protective benefit could be quantified for Dien Bich. Direct economic benefits stand at USD 344,931, and ecological benefits at USD 3,437,879 (assuming that 149,385 t CO_2 will have been absorbed by 2025). BCR 1 is identified at 3.61 and BCR 2 at 39.66, not including potential protective benefits.

7.6 Hai Ly (Nam Dinh province)

The case of Hai Ly is not about mangroves - this commune in Nam Dinh's Hai Hau district of 10,500 people is noteworthy for a different reason. It is located on the central coast of Nam Dinh, which is not in direct proximity to river deltas but rather between them. Hai Ly faces the threat of land erosion, and the speed of erosion is increasing to the extent that around 500 meters of land have been taken by the sea since 2005. Owing to its lack of mudflats suitable for mangrove plantation, Hai Ly was initially sidelined by the programme. In 2001, however, the Nam Dinh chapter - having been previously trained in VCAs - identified Hai Ly as a commune at extremely high risk, and suggested a solution that went against the conventional programme design. Based on a comprehensive vulnerability assessment, a comprehensive solution was implemented throughout 2002 and 2003. This included the resettlement of 96 households from an area outside the sea dyke (45 houses were funded by DRC, 51 by the government), a new school, the upgrading of 111 houses, the construction of latrines for 260 households, first aid and DRR training (for schools and commune leaders), and establishment of a micro-loan scheme.

Impact

The impact of the intervention was tremendous: two years after its completion, typhoon Damrey ate into the land and destroyed all 96 homes that had been abandoned in the course of resettlement. While it would be highly speculative to assume that the lives of the 350 residents were saved - as most would have been evacuated prior to the storm's landfall - , these residents showed enormous gratitude that they were spared the destruction and despair that they would have encountered had they not been relocated.

The water and sanitation component also proved to have an enormous impact: A visit to the health centre showed that whereas 50-60% of commune members had come to the post each year in former years with cases of severe diarrhoea, now only 5-10% were affected by it. The annual incidence of water-borne eye diseases had also declined from 60-70 to only 10. The health worker said that community members were now much more aware of health and sanitation issues as well as pollution. Concerning the impact on livelihood, two issues were identified: First, interviewed commune members said that because they had less sick (and unproductive) days and did not have to spend as much money as before on treatments, their standard of living had improved. Second, the micro-loan scheme showed a positive effect: families that are on the official poverty list could ask for a one-year loan for selected activities (livelihood, sanitation, health) from the 200 Mio fund if they showed a plan on how to repay the loan. Up until 2010, around 500 micro-loans were disbursed - all of them were paid back at an interest rate of 1.2%. In some cases, the micro-loan scheme was able to lift people out of poverty. Nguyen Van Thuan, for instance, had been a poor labourer prior to the programme intervention. In 2004, he took a loan of VND 6 Mio and used it as seed money to buy four pigs. When the pigs had offspring, he sold some of them to repay his loan. Over time, he was able to expand further and build a new house - now he makes VND 35 Mio a year, enough to support his family of three.

While the programme has not completely eradicated poverty (especially the old and sick remain vulnerable) nor covered all needs (access to clean water remains a problem in some areas), the impact in Hai Ly is clearly positive: the programme has reduced risk and enhanced preparedness, livelihood and sanitation. Unfortunately, time data availability was insufficient to quantify impact and establish the cost-benefit ratio. It may be sensible to conduct a comprehensive follow-up study in Hai Ly to determine what went well and what did not - and to establish the impact and the efficiency of individual intervention components.

8. CONCLUSION

Mangrove afforestation has thus far been everything but an an archetypical Red Cross activity. Yet, the vision of Viet Nam Red Cross and the support of Danish Red Cross, Japanese Red Cross and IFRC enabled the implementation of a programme that saw the plantation and care of trees for disaster mitigation as a central element.

The programme has paid off extremely well

The programme has paid off - as described in this report, it has achieved truly remarkable results. It has had positive impacts towards disaster mitigation, in that it led to avoided losses (dyke damage, private property, public infrastructure). It has enhanced livelihoods of the vulnerable, as they are now able to gain more income from the sale of products of the mangrove forests. And it has left communities better prepared for future disasters. In short: the programme has left coastal communes better off. Notably, the identified impact value of the programme has already exceeded its costs - even without the consideration of the forests' carbon value.

Mangrove afforestation has been highly efficient

Mangroves have been planted by the programme in a cost-efficient manner; per hectare costs of USD 843 compare very favourably to similar programmes by other actors. Mangrove afforestation in a manner conducted by the programme is also shown as an extremely cost-effective way for disaster mitigation, enhancement of livelihoods and the creation of carbon sinks. In most cases, the benefit-cost ratio would remain positive even if only one of the three benefits were taken into account.

Mangroves play a vital role as a carbon sink

Out of the three, the carbon value deserves special mentioning: by the end of 2025, the mangrove forests will have absorbed at least 16.3 Mio t CO_2, representing a present value of USD 218.81 Mio.

Challenges to sustainability can be overcome if addressed appropriately

In the light of its tremendous impact, the programme is seen as a success despite several shortcomings: these include weaknesses in the management and monitoring of the programme over the past five years as well as some cases of planting interventions that failed to create any substantial benefits (see Report B: Planting Protection). Several internal and external challenges to the sustainability of many achievements have also been highlighted. Given the strong sense of ownership and the firm commitment of the Vietnamese government, however, a sound basis exists to tackle them appropriately (a set of concrete recommendations is provided in Report B).

There are several implications to this report's findings - for VNRC and its donors, to the Vietnamese government, and for the wider DRM and CCA communities.

Implications for VNRC

To VNRC and its donors, the report shows how valuable mangroves are - mangrove afforestation is a cost-efficient way to mitigate disaster risk, especially when coupled with disaster preparedness and awareness components. The immense value of the forests imply that they need to be even better protected in the future. Mangrove afforestation may also be considered in other suitable areas of the country. At the same time, mangroves and other trees cannot be used to address other factors that underpin vulnerability. VNRC's DRM strategy should thus not be dominated by plantation activities, but consider the full toolkit to tackle all risks (such as water and

sanitation, micro-finance, health etc). Risk assessments need to be conducted in an open-ended way, not with a particular solution in mind. Given the achievements and capacity gained through the programme, VNRC can also be confident in approaching the government to seek even closer collaboration and improved support.

Two particular issues of shared interest are the further improvement of disaster risk management and adaptation to the adverse effects of climate change, as well as the integration of ongoing and future afforestation programmes under the Clean Development Mechanism (CDM)[10], through which substantial funding could be generated. An alternative or complementary approach to gain further funding for VNRC plantation activities is to tap the market of voluntary carbon offsets: the number of NGOs and companies managing and investing these funds donated by individuals and companies is growing rapidly. Both avenues - CDM and voluntary carbon offset market - are likely to require more specific research and certification. IFRC and donors may be well-suited to provide links to these funding sources.

Implications for the government

For the government, two main implications emerge from the report's findings: First, many technical and managerial lessons can be learnt to either improve its own afforestation programmes or to outsource them to VNRC. Second, the government may wish to consider the efficiency of its tools for disaster mitigation. In particular, the further concretization of sea-dykes may not be necessary in locations where the dyke is already protected by a wide, dense and mature mangrove forest. Where mangrove afforestation is feasible, it may consider planting of mangroves rather than concretizing dykes as this is not only cheaper but also brings further benefits to the community and the environment with it (see 5.3).

Implications for the DRM community

Finally, to the wider development and DRM communities, the report shows that mangrove afforestation can be an efficient and effective tool for disaster mitigation and enhanced livelihood as well as for the mitigation of climate change. However, some caution is urged to curb the growing interest in mangroves, especially as an instrument for climate change adaptation: planting mangroves is not easy. It requires suitable soil conditions, local expertise, research, a long-term focus, and an appropriate integration of local communities. Where planting conditions are less ideal than those found in the Red River Delta, costs can be substantially higher.

Getting mangrove afforestation right is thus not without complications. The fact that VNRC managed to bring about the substantial benefits described in this report despite these difficulties deserves respect. The mangroves they planted with their own hands are now breaking the waves.

10. For a feasibility study of afforestation funding through the CDM, see Doets 2006. The study shows that while set-up and transaction costs are substantial (at least USD 40,000 for small and 100,000 for large projects) afforestation funding through CDM is generally feasible, provided that a set of criteria are met.

APPENDIX

A. METHODOLOGY: AN EXPANDED LOOK

While chapter 3 has provided a brief overview on the methodology underpinning this report, further considerations and details are laid out in this expanded look to make the interested reader fully understand how the report came to its findings. This appendix gives this background in four steps: It begins by highlighting issues concerning the study of impact and proceeds with a presentation of tools for cost-benefit analysis. It then lays out the research design and concludes with the look at the research in practice.

A.1 Analyzing impact

Impact evaluation is the counterfactual analysis of the impact of an intervention on final welfare outcomes (White 2006:2). It looks for changes in outcomes that are directly attributable to a programme. Compared to a mere outcome analysis - which would assess whether the targets have been reached, an impact evaluation thus goes further in that it also needs to establish the way outcomes would have altered without the programme (ibid:3). This requires counterfactual analysis - a comparison between what happened and what would have happened in the absence of an intervention.

The key challenge in impact evaluations is that the latter cannot be directly observed but must be approximated through reference to a comparison group. A comparison can be either conducted longitudinally, horizontally or, ideally, through a combination of both dimensions. In a longitudinal approach, a set of variables is assessed before and after an intervention. If all other variables remained the same - meaning that a programme intervention was the only alteration, a change in outcomes could be directly attributed to the intervention. However, such perfect *ceteris paribus* conditions are non-existent in the real world, and especially in the context of rapidly developing Viet Nam, many other variables need to be controlled. A simple longitudinal approach is a weak design to show impact, because in order to show a causal relationship between intervention and outcomes convincingly, the evaluation must demonstrate that any likely alternate explanations for the outcomes are irrelevant. However, simple longitudinal or non-experimental designs are often the only feasible option, if no control groups exists.

A horizontal approach meanwhile compares the situation in a group that was exposed to a programme intervention with one that was not. For instance, one would ask the question as to what damage was caused in a commune protected by mangroves with one that was not protected. While this approach overcomes problems related to changed conditions over time, it faces the challenge to identify such a control commune for which all key variables are the same as in the programme commune (e.g. height of the dyke, extension of mudflats,elevation etc.). Taken on its own, a horizontal design is therefore fraught with similar weaknesses as the longitudinal approach.

By far the most solid design is therefore a combination of both dimensions in an experimental approach: what was the situation before the intervention in both the programme and in the control commune, and what is the situation now after the intervention in both communes? Such triangulation of data from both dimensions was therefore selected as an ideal design for this evaluation.

The design followed the six key principles of theory-based impact evaluation put forward by White (White 2009): (1) Map out the causal chain (programme theory) [10], (2) understand context [11], (3) anticipate heterogeneity [12], (4) rigorously evaluate impact using a credible counterfactual [13], (5) rigorously analyze the factual, and (6) use mixed methods.

A.2 Analyzing efficiency

As for the assessment of impact, there is an established tool at hand for the analysis of efficiency: cost-benefit analysis (CBA) is commonly used by economists to help make decisions as to whether a proposed investment shall be pursued or not (ex ante). In the development context, cost-benefit analyses are also used to assess efficiency of past and present programmes (ex post). Its basic idea is simple: Identify and quantify all expected or witnessed benefits B as well as all related costs C and then divide B/C to calculate the benefit/cost ratio (BCR).[14] Generally, where the benefits are greater than costs (B > C and thus BCR >1.0), there is a positive benefit-cost ratio and thus a case for a suggested or implemented intervention. Many OECD countries regularly conduct or require CBAs for their development assistance, including in the field of disaster risk management. The World Bank is regarded to be the "chief practitioner" of CBA - unless a BCR above 1.0 can be reasonably expected, no funds will be released (Mechler 2008:1). In the context of disaster risk management (DRM), cost-benefit analyses have been utilized infrequently in the past. However, there is a clear trend towards its application amongst DRM practitioners in order to argue for proactive disaster risk reduction or preparedness rather than reactive disaster response: while the former has been shown to be generally more efficient, it is estimated that around 90% of DRM funding is still allocated for the latter (Tearfund 2006).

There are several limitations to the CBA approach: *First*, it looks at the overall costs and benefits rather than on their distribution. To identify the distribution of benefits (e.g. who were the winners and the losers?), other qualitative methods need to complement a CBA. *Second*, a CBA faces difficulties when it comes to assessing non-market impacts such as those on health and the environment. Questions such as the value of a saved human life require difficult ethical judgements; in this context, CBAs should be used with caution. CBAs also tend to overlook environmental externalities; Bann proposes a way to internalize these externalities (See Bann 1998). *Third*, future benefits need to be discounted in relation to current benefits. But applying high discount rates, as it is often suggested in a development context, expresses a strong preference for the present while potentially shifting large burdens to future generations (Mechler 2008:6). A *final* limitation concerns time and scale: as a cost-benefit analysis involves estimates, the usefulness and robustness of a CBA generally declines as time and scale increases (ibid:7). Generally, cost-benefit analysis must be understood as an approximation rather than an expression of the exact economic value of a given investment. It is also important to note that underlying assumptions need to be made explicit in order to make a CBA valuable.

A limited number of CBA studies have been conducted in the field of disaster risk management in general (See DARA 2010 for an overview) and mangrove reforestation in particular (Bann 1998, Hawkins 2010, Janssen 1997, Meinardi 2010, Sathirathai 1997). These studies inform this evaluation as benchmarks for comparison and also provide guidance to develop the research design, in particular the identification of costs and potential benefits.

10. The causal chain is embedded in the programme logframe and links inputs to outputs, outcomes and impact. It thus explains how the programme is meant to function.

11. Context refers to the social, economic, environmental setting the programme is embedded in.

12. Impact heterogeneity means that an intervention may have different levels and forms of impact - this needs to be anticipated and adequately analyzed. A good understanding of context is crucial in this regard.

13. For a credible counterfactual, issues of selection bias, spillover (the control group is affected by the intervention) and contamination (the control group is affected by other interventions) need to be resolved.

14. Alternative concepts to BCR are the identification of the net present value (NPV) and rate of return. See Mechler 2008 for a detailed explanation.

A.2.1 Costs

The costs associated with the programme intervention include those carried by the donor (administrative overhead, training, awareness-raising, planting and protection and care) as well as those carried by the Department for Agriculture and Rural Development (DARD), which has been covering protection fees since 2006. The time horizon is set up to 2025 - although the normal life cycle for mangroves is 35 years, a shorter time horizon is selected due to the high land growth rate in the Red River Delta, which means that mudflats (with or without mangroves) are converted to arable land in intervals shorter than 35 years.

A.2.2. Benefits

The potential benefits of mangroves can be classified into protective benefits, direct economic benefits and ecological benefits. Unfortunately, no studies exist so far that incorporate all of these aspects. While most studies include direct economic benefits, they marginalize or ignore either protective or ecological benefits *(for a list of identified benefits, see figure 3 on page 13)*.

A.2.2.1 Assessing protective benefits

As opposed to a demonstrable impact, the benefits of the intervention stretch beyond the present and reach across the expected life-cycle of a mangrove forest - in our case up until 2025. But while it may be comparatively easy to identify project-related impacts on reduced losses (by comparing present-value losses in commune X after a typhoon before the intervention and thereafter and/or the losses incurred in comparable communes, where X is protected by mangroves and Y is not, *see above*), the overall assessment of protective benefits also requires the quantification of future risk. For the purpose of this study, the protective benefits are calculated as follows:

First, the protective impact value (V_{pi}) is established by subtracting the net present value of damages induced by a typhoon in a mangrove-protected commune (V_x) from the net present value of damages induced by a typhoon under similar conditions except for the fact that the this commune was not protected by mangroves (V_y).

$$V_{pi} = V_y - V_x$$

Second, an annual probability P_a for a similar typhoon hitting a commune is ascribed by analyzing data on hazard incidence. The average recurrence is turned to an annual probability: If a typhoon hits every five years, the annual probability P_a is 20%. Third, the value of annual risk savings V_a is calculated by multiplying V_{pi} with P_a:

$$V_a = V_{pi} \times P_a$$

Finally, the value of annual risk savings is multiplied by the discount rate for each year; the resulting amounts are then added up to establish the overall protective benefit value V_{pb}. The discount rate used throughout this study is 7.23% - reflecting the average annual inflation rate between 1997 and 2010.

A.2.2.2 Assessing direct economic benefits

The assessment of direct economic benefits is comparatively uncomplicated: the household survey can deliver data as to how much income is generated per hectare - both from one hectare of mangrove forests and one hectare of an empty mudflat.

With both values adjusted to present value, the difference is then taken, which in turn is adjusted at the discount rate for each individual year. In adding up resulting values for each year and multiplying the resulting sum with the number of hectares in a given commune, the overall direct economic benefit **Vdeb** is then generated.

A.2.2.3 Assessing ecological benefits

There are four main ecological benefits associated with mangrove forests: their function as a carbon sink, the retention of nutrients, the retention of sediment, and their role as a biodiversity habitat. As all of them are per se non-market factors, they need to be monetized in order to allow for their inclusion in a cost-benefit analysis. For the assessment of the carbon value, Nguyen has conducted research of the carbon stored in a forest and of the carbon dioxide absorbed each year (See Nguyen 2010). In the context of a carbon market and the clean development mechanism, an actual price can be put on the carbon value (for the existing carbon stored and the approximated absorption of CO_2 during the life-cycle of the mangrove forest).

For the retention of nutrients, a related goods approach is chosen to determine its value (see Bann 1998): the enhanced nutrients retention is the chief reason for higher quantity of marine life that can be collected and sold. Nutrient retention is therefore attributed to direct use benefits and not valued separately.

For the retention of sediments, which is said to lead to an accelerated accretion of arable land, one would need to determine the exact difference mangroves make to land accretion and then multiply this size by the market value. However, while studies exist that prove the general effect of mangroves towards increased sediment retention (Mazda 1997), no data were available in Viet Nam that would quantify this effect. Sediment retention is therefore excluded from the cost-benefit equation; however, it is acknowledged that this effect must be considered as an additional benefit.

The same is said for the creation of a biodiversity habitat through the mangroves - unless it means that species can now exist that can be caught and sold, this benefit is similarly excluded from the analysis. The overall ecological benefits **Veco** that are assessed in this analysis are thus related to the trees‘ carbon value only - for that, a mean planting is estimated and the amount of absorbed CO_2 calculated by extrapolation from the research conducted by Nguyen (2010). For future carbon sequestration, a linear continuation in future years is assumed, and the monetary value for future years is discounted at the rate of 7.23%. It is acknowledged that this is a conservative estimate, since real absorption rates are expected to be higher. However, in the absence of much more detailed research on this matter, it represents the only viable method.

A.3 Analyzing sustainability

The final subject of this evaluation - sustainability - needs to be analyzed through qualitative means. As sustainability is understood as the capacity of the programme to generate benefits that endure far beyond its termination, underlying factors for such longevity need to be focussed on. These include financial, organizational, formal, behavioural and managerial aspects. A widely acknowledged key component of sustainability is a sense of local ownership. Research for this evaluation thus needs to cover these issues, ideally through a combination of a household survey, focus group discussions and key informant interviews.

A.4 Preparing the research design

Taking into consideration (a) the programme outline, (b) the requirements for an assessment of impact, efficiency and sustainability, and (c) the available resources and time for the evaluation, an analytical framework was developed to carry out the task in a realistic, efficient, timely, sound and valid manner. As demonstrated above, data would have to be collected not only for the factual, but also the counterfactual - thus, control groups and longitudinal comparisons would need to be included. Furthermore, the various protective, direct economic and ecological benefits would need to be quantified and monetized at present value. In addition to quantitative research methods, qualitative tools are needed for all aspects: impact (anticipate impact heterogeneity), efficiency (identify and include disbenefits), and sustainability.

Considering these requirements, a mixed-method approach was chosen that included a household survey and analysis of available relevant data sets on the quantitative side and key informant interviews, focus group discussions and site visits on the qualitative side.

Any evaluation process essentially consists of three steps: preparation, data collection, and data analysis. Preparation for this evaluation began in mid-December as soon as key documents (such as previous evaluation reports, project proposals, logframes) were submitted to the evaluation team for review. Based on this information, the objectives listed in the ToR, and a review of relevant literature as described above, the research design was developed. Two key issues concerned sampling and questionnaires.

For sampling of provinces that would be visited, the evaluation team generally followed the IFRC recommendation (to visit Hai Phong, Nam Dinh, Ninh Binh, Nghe An and Ha Tinh) but added Thai Binh due to its crucial role as the programme initiator. Communes were selected in such a way that the sample would include both those that had been involved for at least ten years (for the impact evaluation) as well as those that joined the programme during the past five years (for the Phase 3 evaluation).

A further consideration was that all types of plantation (mangrove, bamboo, casuarina) had to be reflected by the sample. More than half of the visited communes were independently selected by the evaluation team, while the remainder was chosen by respective chapters. The sample of locations also included several non-programme communes as control groups. The sampling of respondents for the household survey followed a formula according to which 50% of respondents were to be planters in programme communes, 25% non-planters from programme communes, and 25% control group respondents. The original sample target size of 600 was reduced to 360, as 600 proved to be unfeasible within the given timeframe. Thus, on average the sample target size per province amounted to 60.

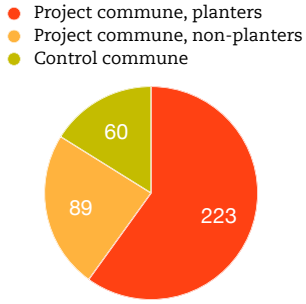
The second key issue during the preparation phase concerned the questionnaire. This covered a set of 40 questions (most of them multiple-choice). The original questionnaire had been longer and was adapted after the first day of surveying. The questionnaire covered issues such as beneficiary selection, training, awareness and perceived outcomes.

For focus group discussions, a set of core questions was selected. To obtain quantitative data efficiently, chapters, districts and communes were also requested to fill out a brief questionnaire prior to the actual field visit.

A.5 The research in practice

Gathering of primary data consisted of key informant interviews and the field trip to the six provinces outlined above. Key informant interviews were conducted with individuals who have been closely involved with the programme and/or who could supply additional information on government policy - some of these interviews proved vital to capture the full history of the programme. The visits to each province started off with focus group discussion with chapter staff and government departments involved in the programme (DARD, DET and CCFSC). Whenever government staff were present, these were interviewed first in order to allow them attend other business and to enable a more open discussion with chapter staff. Following province-level meetings, the team would then be accompanied by chapter staff to individual communes.

A typical commune visit began with a focus group discussion amongst Red Cross staff and People's Commune representatives, went on to site visits of planted areas and concluded with household survey interviews. Whenever feasible, the team split into two groups to capture data more efficiently. Household survey interviews were conducted by all Vietnamese-speaking team members, in most cases in the absence of Red Cross staff. It should be noted however that planters were gathered by the communal Red Cross branches. Non-planters were visited individually in their house or place of work. Care was taken to ensure that non-planters came from areas within the communes that were in close proximity to the coastline or river bank and were thus exposed to hazards to a similar extent as planters (who are always based close to planted areas). Furthermore, a deliberate attempt was made to facilitate a gender balance amongst respondents. Overall, the household survey exceeded its target of 360 and included 372 respondents *(see chart)*. However, the 25% target of control group respondents could not be reached. This is because plantation in suitable areas (where conditions are sufficiently similar to planted areas) is close to complete: for mangroves, there are hardly any deserted mudflats left. While this fact indicates a successful coverage of the programme, it posed a methodological challenge for horizontal comparisons planned for the impact analysis.



Distribution of the 372 household survey respondents

Quantitative data collected from the household survey were analyzed by the cost-benefit analyst during the trip, using SPSS (Statistical Package for the Social Sciences). Financial data were gathered from DRC and IFRC and compiled into a single format. Qualitative data gathered from focus group discussions and key informant interviews as well as additional remarks made by household survey respondents were recorded in a single entry form with categories for the main issues of this evaluation. In most cases, data from multiple sources were triangulated to add validity. Preliminary findings and recommendations were presented to IFRC, VNRC and the eight chapters during a lessons learnt workshop in Hanoi on January 24th - comments and feedback have been incorporated in this report.

The report was produced by the team leader with input and feedback from all team members.

Figure 4: Overview of communes evaluated

Chapter Commune (district)	Function for evaluation	Timeframe of main intervention	Number of survey respondents		
			Male	Female	Total
Hai Phong			27	19	46
An Hoa (Vinh Bao)	Bamboo/river bank	2007	1	3	4
Quyet Tien (Tien Lang)	Bamboo/river bank	2007	1	1	2
Dai Hop (Kien Thuy)	Mangrove/sea coast	1999-2005	8	9	17
Quang Hung (An Lao)	Bamboo/river bank	2004-2010	4	2	6
Tan Thanh (Kien Thuy)	Mangrove/sea coast	1997-2005	11	3	14
Thai Binh			49	12	61
Thai Do (Thai Thuy)	Mangrove/sea coast	1994-2005	10	4	14
Nam Thinh (Tien Hai)	Mangrove/sea coast	1997-2005	17	2	19
Viet Hung (Vu Thu)	Bamboo/river bank	2007	22	6	28
Nam Dinh			26	26	52
Giao An (Giao Thuy)	Mangrove/sea coast	1997-2005	10	8	18
Giao Hai (Giao Thuy)	Control/sea coast	n.a.	6	10	16
Hai Ly (Hai Hau)	Resettlement, etc	2002-2005	*n.a. (qualitative interviews only)*		
Nghia Dong (Nghia Hung)	Bamboo/river bank	2006-2010	10	8	18
Ninh Binh			32	39	71
Khanh Tien (Yen Khanh)	Bamboo/river bank	2007	*Focus group discussion only*		
Kim Trung (Kim Son)	Mangrove/sea coast	1997-2010	8	11	19
Kim My (Kim Son)	Mangrove/sea coast	1997-2010	8	10	18
Kim Hai (Kim Son)	Mangrove/sea coast	1997-2010	10	9	19
Binh Minh (Kim Son)	Mangrove/sea coast	1997-2005	*Focus group discussion only*		
Kim Dong (Kim Son)	Mangrove/sea coast	1997-2010	6	9	15
Nghe An			80	19	99
Dien Kim (Dien Chau)	Mangrove/sea coast	1999-2005	15	0	15
Dien Bich (Dien Chau)	Mangrove/sea coast	1999-2005	12	6	18
Dien Ngoc (Dien Chau)	Control/sea coast	n.a.	18	9	27
Hung Nhan (Hung Nguyen)	Bamboo/river bank	2006-2010	19	2	21
Hung Loi (Hung Nguyen)	Control/river bank	n.a.	16	2	18
Ha Tinh			32	11	43
Xuan Giang (Nghi Xuan)	Casuarina/river bank	2007	7	2	9
Thach Tri (Thach Ha)	Casuarina/sea coast	2006-2010	9	7	16
Thach Van (Thach Ha)	Control/sea coast	n.a.	16	2	18
		Total	***246*** *(66%)*	***126*** *(34%)*	**372**

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NOTE

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The Fundamental Principles of the International Red Cross and Red Crescent Movement

Humanity / The International Red Cross and Red Crescent Movement, born of a desire to bring assistance without discrimination to the wounded on the battlefield, endeavours, in its international and national capacity, to prevent and alleviate human suffering wherever it may be found. Its purpose is to protect life and health and to ensure respect for the human being. It promotes mutual understanding, friendship, co-operation and lasting peace amongst all peoples.

Impartiality / It makes no discrimination as to nationality, race, religious beliefs, class or political opinions. It endeavours to relieve the suffering of individuals, being guided solely by their needs, and to give priority to the most urgent cases of distress.

Neutrality / In order to enjoy the confidence of all, the Movement may not take sides in hostilities or engage at any time in controversies of a political, racial, religious or ideological nature.

Independence / The Movement is independent. The National Societies, while auxiliaries in the humanitarian services of their governments and subject to the laws of their respective countries, must always maintain their autonomy so that they may be able at all times to act in accordance with the principles of the Movement.

Voluntary service / It is a voluntary relief movement not prompted in any manner by desire for gain.

Unity / There can be only one Red Cross or Red Crescent Society in any one country. It must be open to all. It must carry on its humanitarian work throughout its territory.

Universality / The International Red Cross and Red Crescent Movement, in which all societies have equal status and share equal responsibilities and duties in helping each other, is worldwide.

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The International Federation of Red Cross and Red Crescent Societies promotes the humanitarian activities of National Societies among vulnerable people.

By coordinating international disaster relief and encouraging development support it seeks to prevent and alleviate human suffering.

The International Federation, the National Societies and the International Committee of the Red Cross together constitute the International Red Cross and Red Crescent Movement.

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