

### Evaluation Reports of the Baseline Projects

This Annex provides the evaluations reports used to inform the design of the **Improving the resilience of vulnerable coastal communities to climate change related impacts in Viet Nam** proposal. Specially, the Annex includes three documents:

- **Annex VIII.a. Final Report - Implementation results of pilot program to support poor households improve safety conditions for accommodation, coping with floods in North and Central coastal provinces, 2013**

This is the evaluation report for the pilot programme of 700 houses, upon which the ongoing government housing programme is built. The programme is viewed as successful, with recommendations for further funding and expansion. Recommendations include to increase subsidies, and to provide preferential borrowing rates, to ensure continued support to poor households.

Note: The attached is a translation. The original document in Vietnamese is available upon request.

- **Annex VIII.b. 5-year Review – Community-Based Disaster Risk Management Programme, 2015**

The review provides an update of progress for the period 2009-2015. The report further highlights challenges and details how the next phase of the programme will address those challenges in the upcoming implementation phase (e.g. financial mechanism to increase autonomy of provinces and cities at the same time remove barriers of financial constraints for localities). The report also encourages greater engagement with the private sector, which the proposal will support through output 3.

Note: The attached is a translation. The original document in Vietnamese is available upon request.

- **Annex VIII.c. Restoration of Coastal Mangrove Forest in Viet Nam Study Report, 2012**

This report includes a thorough study of the current mangrove coverage in Viet Nam and related pressures. Importantly, it also includes an assessment of previous mangrove regeneration efforts and provides recommendations to improve the mangrove regeneration success rate of efforts going forward. The report stresses that robust mangrove forests have a diverse structure in both vertical and horizontal sides, as well as in species composition. To ensure successful regeneration, the report suggests improvement through tree breeding (nurseries to ensure a certain level of growth before planting), site selection and planting methods. These enhancements are captured in the mangrove regeneration approach of the GCF project.



## **Annex VIII– Evaluation Reports of the Baseline Projects**

GREEN CLIMATE FUND FUNDING PROPOSAL



**Annex VIII.a. Final Report - Implementation results of pilot program to support poor households improve safety conditions for accommodation, coping with floods in North and Central coastal provinces, 2013**

**MINISTRY OF CONSTRUCTION**

**FINAL REPORT**

**Results of pilot measures supporting poor households to improve safety home, responding to floods in Northern Central and Central Coast according to Decision No. 716/QD-TTg dated 14/6/2012 of the Prime Minister**

*Phú Yên, 08/4/2013*



**MINISTRY OF CONSTRUCTION**

**SOCIALIST REPUBLIC OF VIET NAM**

**Independent - Freedom - Happiness**

*Phú Yên, dated 08 April 2013*

## **FINAL REPORT**

### **Results of pilot measures supporting poor households to improve safety home, responding to floods in Northern Central and Central Coast according to Decision No. 716/QĐ-TTg dated 14/6/2012 of the Prime Minister**

The Northern Central and Central Coast consist of 14 provinces, cities from Thanh Hoa to Binh Thuan with the total natural area of 95,792 km<sup>2</sup> and more than 19 millions people. Due to their geographical location and natural conditions the Northern Central and Central Coast are places where natural disasters, especially storms and floods often occur. Recent years, because of climate change natural disasters often occur with high frequency, strong intensity, unpredictable development and do not follow rules. During raining and typhoon seasons, floods happen continuously in large scale and long duration; "flood overlaps flood" phenomenon is not rare in the local regions. Natural disasters cause heavy losses of people and properties for local residents and at the same time hinder the implementation of socio-economic development tasks in the localities. Synthesis of local reports shows that during a short time of the last 5-6 years, floods have caused more than 1,500 casualties; lot of properties, important production materials and food ... have been destroyed; in which more than 500,000 houses have been damaged and more than 42,000 houses have been collapsed with other essential assets. More than 500 communes have been deeply inundated over 1.5m, of which many communes have been totally disconnected and isolated, making it difficult for rescue and support by the authorities.

During many past years, the Party and the State regularly paid attention to natural disaster prevention and control. The State promulgated various programmes, policies on natural disaster prevention, control and reduction as well as policies to support and overcome consequences caused by natural disasters. Implementing programmes, policies on natural disaster prevention and control the localities in the Northern Central and Central Coast have been deployed various measures such as: forest plantation, relocation of households from flooding areas into safe places; construction of public works as office buildings, schools, clinics with their floors higher than flooding level for local people to live temporarily when floods occur; households make mezzanines for store assets...In addition, during the raining and typhoon seasons the Central Committee for Flood and Storm Control and local authorities



regularly inform raining and flooding situations, persuade, including apply administrative measures for local people to implement prevention, control and reduction measures like: moving assets and cattle to higher places; evacuating elderly and children to safe sites; reinforcing houses... However, due to risk level of floods and limited prevention and control capacity of local people's houses including the local people's mindset, every year there are casualties caused by natural disasters in the region and together with that the people's assets, production materials and food are also damaged by natural disasters and cause very serious losses. People's houses that built after many years of labour and savings are swept away only after a flood. Every year, the State and local authorities have to spend much time, effort and money to carry out relief to people affected by natural disasters. After each big flood the state budget for disaster relief may reach thousands of billions Vietnamese dong.

To totally solve issues of prevention, control and reduction of damages caused by floods for local people in the regions, particularly poor people and facilitate people to have stable and safe lives as directed by the Prime Minister, the Ministry of Construction has coordinated with other concerned ministries, branches and localities to study and develop a project proposal: supporting poor households to improve safety home, responding to floods in the Northern Central and Central Coast. The project proposal has studied, suggested many groups of measures; in which there is a measure supporting poor households to improve safety home through models of building flood prevention and avoidance cabins. Since the model is new, first time to implement, it is necessary to test in practice; moreover the State resources are limited and the Prime Ministry directed to pilot the supporting measures in some districts, communes heavily affected and draw lessons prior to replicate in a large scale.

Following the Prime Minister's direction, the Ministry of Construction has coordinated with other concerned ministries, branches and localities to develop and submit to the Prime Minister for issuing Decision No. 716/QĐ-TTg dated 14/6/2012 on piloting measures supporting poor households to improve safety home, responding to floods in the Northern Central and Central Coast.

According to the above mentioned Decision a pilot of building flood prevention and avoidance cabins will be implemented for 700 poor households in 14 communes heavily affected by floods in seven provinces: Thanh Hoá, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Nam, Quảng Ngãi, Phú Yên (two communes in each province, 50 poor households selected by the localities in each commune).

Required criteria for building flood prevention and avoidance cabins include usable floors are higher than flood level in the construction location, minimum anti-flood floor area must be 10m<sup>2</sup>; main structures as foundations, frames, floors are the same as of normal permanent houses; minimum construction cost will be VND 30 millions/a flood prevention and control cabin.

In order to have funds for building a flood prevention and avoidance cabin, each poor household will be supported VND 10 millions/household from the central state budget; provided VND 10 millions/household with preferential loan from the Social Policy Bank; in addition, VND 10



millions/household will be mobilized from other funding sources such as communities and households' contributions.

## **I. Implementation status**

## **II. Implementation results**

### **1. Selection of communes and households to be supported**

The provinces selected 700 poor households to be supported, 100 households of each province in the total of 19 communes selected in 14 districts of seven provinces.

A list of selected communes as below:

- Thanh Hoá province has three communes: Vĩnh Hưng commune of Vĩnh Lộc district; Thạch Định and Thạch Trục communes of Thạch Thành district.
- Nghệ An province has two communes: Nam Cường commune of Nam Đàn district and Hưng Nhân commune of Hưng Nguyên district.
- Hà Tĩnh province has three communes: Sơn Tịnh commune of Hương Sơn district; Phương Mỹ and Hoà Hải communes of Hương Khê district.
- Quảng Bình province has two communes: Tân Ninh commune of Quảng Ninh district and Quảng Tiên commune of Quảng Trạch district.
- Quảng Nam province has three communes: Đại Lãnh commune of Đại Lộc district; Điện Hồng and Điện Phước communes of Điện Bàn district.
- Quảng Ngãi province has two communes: Hành Thiện commune of Nghĩa Hành district and Bình Minh commune of Bình Sơn district.
- Phú Yên province has four communes: An Định and An Dân communes of Tuy An district; North Xuân Sơn and South Xuân Sơn communes of Đồng Xuân districts.

The provinces of Thanh Hoá, Hà Tĩnh, Quảng Nam and Phú Yên selected more communes than prescribed since in these provinces there were no communes that have enough number of households being immediately available for support as recommended. To meet the progress, these provinces selected more households in the communes adjacent to the selected communes so that it ensured the prescribed household number.

## **2. Designs of the flood prevention and avoidance cabins**

The provinces designed the flood prevention and avoidance cabins. A minimum of design quantity was three. The designs ensured requirements on the prescribed area and quality, at the same time, they were suitable with the local reality. Among sample designs, the localities designed two samples with the construction cost of VND 30 millions/cabin (equivalent to prescribed minimum construction cost for a flood prevention and avoidance cabin). The localities widely organized the introduction of the samples to local people for reference and selection.

## **3. Construction of the flood prevention and avoidance cabins**

### ***a) Construction quantity***

To date, the localities selected 700/700 households to support, in which 697/700 households constructed the flood prevention and avoidance cabins reaching 99,6%. Below is the details:

- Thanh Hoá province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;
- Nghệ An province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;
- Hà Tĩnh province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;
- Quảng Bình province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;
- Quảng Nam province started the construction for 97/100 households. Construction completed for 97/100 households, reaching 97% (among three households that had not started the construction there was one household moved out of the province, two households were not able to contribute and mobilize funds and therefore they submitted application to withdraw from the list. The commune selected other three households to replace them and asked the district to approve for implementation);
- Quảng Ngãi province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;
- Phú Yên province started the construction for 100/100 households. Construction completed for 100/100 households, reaching 100%;

Hence, there are 6/7 provinces had completed the support as planned, in which three provinces had completed earliest namely Hà Tĩnh, Quảng Bình and Phú Yên.

***b) Construction quality:***

All the completed flood prevention and avoidance cabins have usable floors higher than the highest flood level in the construction location and have minimum area of 10m<sup>2</sup> or more. Their quality is the same as of the normal permanent houses (reinforced concrete frames, concrete or wooden floors, concrete or fibro-cement roofs, brick walls). Almost the cabin houses had the construction costs of VND 30-40 millions, some cabin houses had higher costs, upto VND 50-60 millions because households built in wider areas and with better finishing quality for using as a permanent house.

In general, while building flood prevention and avoidance cabins, the households referred to design samples made by the Provincial Construction Department. Based on the design samples, some households made improvement, addition on the construction area, architectural style, finishing level, etc... to meet specific conditions of each household, however, the constructed cabins still have meet two important criteria, namely construction quality and height of usable floor higher than the flood level. Majority of constructed cabins adjacent to existing houses, several cabins are built independently but still ensure convenient for moving when there are floods. Almost all flood prevention and avoidance cabins are newly constructed, a small amount of cabins are renovated, increased floors of the existing houses. Moreover, some better-off households constructed permanent two-storey houses to live in combination with flood avoidance. In addition to construction of cabins to prevent and avoid floods for many people, a lot of households constructed flood prevention and avoidance cabins with stairs to ensure that various kinds of cattle can move up by themselves to avoid floods.

**4. Fund mobilization and support fund disbursement**

***a) Mobilized funds:***

Synthesizing reports of the localities shows that VND 29.16 billions have been mobilized so far, including:

- Central budget: VND 7 billions;
- Local budget: VND 0.85 billions;
- Preferential loans: VND 7 billions;
- Households contributions and funds mobilized from communities: 14.31 billions.

***b) Disbursed funds:***

Total disbursed funds: VND 27.89 billions, in which:

- Central budget: VND 6.92 billions;
- Local budget: VND 0.75 billions;



- Preferential loans: VND 6.06 billions;
- Households contributions and funds mobilized from communities: 14.16 billions.

*(See the attached synthesis table of the implementation results by provinces).*

### **III. Assessments and comments on the implementation**

#### ***a) Advantages:***

- Concerned ministries, branches did very well in guiding, urging, and checking the implementation. The prescribed support central budget sources and loans were timely allocated to the localities.

- Almost all localities paid attention in directing, organizing the implementation, regularly checking and urging to achieve good results. Some localities allocated more funds from the local budgets to support poor households to build flood prevention and avoidance cabins. The commune authorities, village cadres actively communicated and disseminated policies, selected households to be supported; at the same time did a good job in persuading and guiding the poor households to build flood prevention and avoidance cabins.

- The unions and associations were actively involved in supporting, helping poor households to build the flood prevention and avoidance cabins, particularly the Fatherland Front, Veterans Associations, Farmers Associations. The Ho Chi Minh Communist Youth Unions in the localities were involved in supporting, helping poor households to build the flood prevention and avoidance cabins, brought practical results. During the building of the flood prevention and avoidance cabins, poor households received enthusiastic assistance with high effectiveness of local people in the communities, relatives in terms of materials and workdays.

- Households were actively involved in putting additional financial contribution for construction. Moreover, many households self exploited construction materials such as sand, gravels, self made bricks and founded out other materials to build the flood prevention and avoidance cabins.

- All the constructed flood prevention and avoidance cabins are met and exceeded prescribed construction area and quality; architectural styles and designs are rich and diversified, and in accordance with the customs and traditions and lifestyles of the people. The designed and built cabin houses are able to use also the first floor. A lot of households combined building the flood prevention and avoidance cabins with expanding living area of the families.

- Most households promoted proactive initiatives in self organizing the construction, hiring workers to build the flood prevention and avoidance cabins for their families. During the construction the



households received enthusiastic, detailed guidance and assistance of the local authorities, village cadres, associations and unions.

- The acceptance, disbursement followed right procedures.

#### **IV. Assessments and comments on mechanisms and policies**

##### ***a) Advantages***

- Through practical checking, recording opinions of people and village cadres who live on site and are the most knowledgeable with the reality; simultaneously synthesizing local opinions from the commune, district and provincial level, the Ministry of Construction has a number of comments, assessments on the mechanisms and policies as follows:

- The provisions in policies are suitable with the reality and are highly feasible. The regulations are in full, clear, specific, understandable, facilitating all levels, branches and people in the implementation.

- The support level, loan level, additional fund mobilization level from communities are in compliance with the policy objectives. With the prescribed support level, the households ensured building the flood prevention and avoidance cabins according to the set out criteria.

- The model of building the flood prevention and avoidance cabins were assessed by the local authorities and people as better than other models with many advantages, ensuring suitability with the reality in the current conditions.

- This is a people-favoured policy, agreed and supported by people, highly appreciated by association, unions and local authorities. The policy really goes into the lives of people.

##### ***b) Issues to be studied, amended for more appropriate when wide implementation***

Also through practice it reveals that there are some regulations that need to be studied and reviewed to ensure they will be more appropriate when implementation in a wide scale. Specifically:

- According to the policies provisions, households with houses submerged more than 3.6m must be relocated. However, in reality, displacement of people is very difficult, hence it is necessary to study supporting these households (except in case of force majeure such as landslide, flood and flash flood...)

- The provisions on support level, loan level and other mobilization level are basically meet the requirements of building flood prevention and avoidance cabins according to the prescribed criteria. However, in the disadvantaged areas and in particularly difficult villages (hamlets), the above levels are still low because in these places costs for material transportation are higher. Therefore, it is necessary to



study for increasing the support level for those residing in disadvantaged areas and in particularly difficult villages (hamlets).

#### **V. Effectiveness assessment of the pilot implementation program**

Although the pilot implementation in building the flood prevention and avoidance cabins for only 700 poor households the Program brought very high effectiveness, showed in the following aspects:

*First*, helping 700 poor households in the heavily affected by floods in the seven provinces to have safe, convenient havens. The households that were supported to construct the flood prevention and avoidance cabins are totally assured to work, production, economic development, building strong and prosperous homeland. The State and local authorities will not have to support overcoming damages caused by floods for these households and concentrate to other necessary tasks.

*Second*, guiding the poor households to self organize the construction evoked the spirit of initiative and creativity of the poor. Results achieved by poor households help them gain more confidence in their lives. People are very excited and confident in the Party and regime.

*Three*, supporting and assisting by communities and relatives evokes the spirit of mutual love, unity, solidarity, mutual help and contributed to strengthening the national unity bloc, ensuring political security, social order in rural areas, remote, deep areas and ethnic minority areas.

*Four*, implementing the pilot program helped ministries, branches and localities got useful lessons learned from the development of supportive mechanism and policies to the implementation, so that the implementation in a large scale would have higher effectiveness.

#### **VI. Lessons learnt from the pilot implementation**

Checking and surveying the practical implementation as well as synthesizing local opinions drew preliminary experiences as below:

##### ***a) Mechanism and policy development***

- Have to investigate, survey, review carefully households to be policy target beneficiaries in order to ensure the suitability; assess, classify in detail the heavily affected regions and scope to be supported.
- Policy provisions must be in full, specific, clear, easily understandable and easily implemented.
- When develop supportive mechanisms and policies the following principle “State supports, community helps, people involve in contribution and self organize the implementation” should be ensured to enhance proactivity and responsibility of people.



- Need to study, propose models for flood avoidance ensuring high effectiveness and feasibility, suitability to real conditions and the State economic conditions. Beside flood avoidance, the models should have combination capacity to control impacts of other natural disasters such as wind, typhoon.

***b) Implementation***

- Must have the whole political system involved; in which interest, centralized direction of the Party Committees, People's Councils and People's Committees of all levels have key meanings; promote the role of organizations and unions in communicating, mobilizing and helping the poor households.

- Do well the implementation from the central to the provincial, district and commune levels. Establish Implementation Steering Committees at all levels, divide and allocate clearly and specifically tasks to each organization, unit and individual. Assign supervising, monitoring, urging tasks to staff responsible for every district, commune and village. Regularly review, evaluate the implementation.

- Carry out well performance of grasping and disseminating policies to all levels, all branches and people; simultaneously, organize communication, mobilization and persuading people to actively participate in implementing effectively the policy together with the State.

- Implement well the guidance, check, urging and monitoring of the performance. All levels and branches need to timely remove difficulties, obstacles and facilitate the localities and people performing.

**VII. Synthesis of the local suggestions**

Through the implementation, the localities have the following comments:

a) Propose the Prime Minister's approval for continuing the implementation in large scale of supportive policy for poor households to improve safety home, responding to floods in the Northern Central and Central Coast;

b) Increase the support level and preferential loan level to match with the real situations; at the same time allocate program management fees for localities to ensure effective implementation in line with the set out objectives and requirements;

c) Nearly poor households also face difficulties in self financing to build flood prevention and avoidance cabins, therefore propose to expand target beneficiaries to nearly poor households;

d) Need to combine, integrate the house supporting policy with the policy to support in building flood prevention and avoidance cabins for poor households so that people have opportunities in integrating, combining various fund sources to increase supporting effectiveness.



### **VIII. Study of mechanism and policy development when implementation in the large scale**

To prepare for the implementation in the large scale in all provinces and cities of the Northern Central and Central Coast, the Ministry of Construction studies, drafts mechanisms and policies supporting poor households to build flood prevention and avoidance cabins based on lessons learned from the pilot implementation. On the occasion of this Summary Conference, the Ministry of Construction reports proposed contents of the supporting mechanisms and policies, participants are requested to consider and make comments so that the Ministry of Construction would finalize prior to submit to the Prime Minister for consideration and decision (See attached Draft of supporting mechanisms and policies).

Basically, the Ministry of Construction suggests to apply supporting mechanisms and policies as mentioned in the Decision No. 716/QĐ-TTg. However, there are some modified and supplemented provisions to ensure more suitability with the reality. Specifically, there are several modifications in comparison with the provisions in Decision No. 716/QĐ-TTg as follows:

#### ***a) Target beneficiaries:***

- Support poor households which do not have permanent houses with the usable floor higher than flood level from 1.5m up from the house background (*Decision No. 716/QĐ-TTg prescribes supporting poor households which do not have permanent houses with the usable floor higher than flood level from 1.5m to 3.6m from the house background*). Checking in reality showed that for households submerged in >3.6m, it is very difficult to relocate, hence, it is proposed to put these households into the target beneficiaries of the program.

- For the target beneficiaries of nearly poor households, currently there are a high number of poor households so it is proposed to concentrate the support to the poor households first and hence it would not support to nearly poor households. The implementation of supporting to nearly poor households will be studied by concerned ministries, branches and localities in a coordinated manner and be proposed to the Prime Minister for consideration and decision after the completion of supporting the poor households.

#### ***b) Applicable scope***

Households to be supported must reside in the rural areas or in villages, hamlets belonging to wards and commune towns or communes belonging to district towns and cities of provinces with living means mainly from agriculture, forestry and aquaculture within 14 provinces and cities of the Northern Central and Central Coast, namely: Thanh Hoá, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Trị, Thừa Thiên - Huế, Đà Nẵng, Quảng Nam, Quảng Ngãi, Bình Định, Phú Yên, Khánh Hòa, Ninh Thuận, Bình Thuận.



*(Decision 716/QĐ-TTg prescribes supporting pilot in seven provinces, namely Thanh Hoá, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Nam, Quảng Ngãi, Phú Yên).*

***c) Support level and loan level:***

- The support level is VND 10 million/household. The support level is VND 12 million/household for households residing in the difficult areas; the support level is VND 14 million/household for households residing in villages and hamlets of very difficult areas.

- Increasing the preferential loan level from VND 10 million/household up to VND 15 million/household for all target beneficiaries households.

*(Decision 716/QĐ-TTg prescribes only one support level from the central budget of VND 10 million dongs/household, and one preferential loan level of VND 10 million dongs/household).*

***d) Fund sources for implementation:***

Applied the document No. 677/TTg-KTTH dated 22/5/2012 of the Prime Minister regarding mechanism supporting from the central budget for local budget in period 2011-2015 as follows:

- The central budget supports 100% of financial need for localities that are not able to self balance budget, including: Thanh Hóa, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Trị, Thừa Thiên – Huế, Quảng Nam, Quảng Ngãi, Bình Định, Phú Yên, Ninh Thuận, Bình Thuận.

- The central budget supports 50% of financial need for localities that have regulatory percentage of revenues sharing <50% with the central budget, including: Đà Nẵng city and Khánh Hòa province.

*(Decision 716/QĐ-TTg does not prescribe the above mentioned support level but the central budget supports all financial needs to localities with the prescribed amount).*

***e) Disbursement of support funds and loans:***

The first disbursement is 70% of the support funds and loans for households that have completed the foundation or floor higher the flood level (for households increased the floor of the existing house); the remaining 30% is disbursed when households have completed roofing.

*(Decision 716/QĐ-TTg does not prescribe disbursement percentage based on the completion level of the work).*

**IX. Recommendations**

**1. To the Prime Minister**

The results from the implementation of piloting measures to support poor households to improve safety home, responding to floods in Northern Central and Central Coast according to Decision No.



716/QD-TTg shows that the Program achieved set out objectives and requirements, were much highly appreciated by the local authorities and people on suitability, feasibility and effectiveness. Therefore, it is requested the Prime Minister to allow for continuing the implementation in a large scale in flood areas of the Northern Central and Central Coast in order to assist poor households in having safe, stable lives and reducing damages caused by natural disasters.

## **2. To concerned ministries and branches**

- Proposing concerned ministries and branches to continue coordinating closely with the Ministry of Construction in the finalization of support mechanisms, policies to submit to the Prime Minister for consideration and promulgation for the implementation in the large scale.

## **3. To the localities**

- Proposing the provinces involved in the pilot implementation program to organize and draw lessons learned from the implementation, continue in reviewing target beneficiaries, prepare conditions to continue the implementation in a large scale when the policy being issued.

- Proposing provinces not involved in the pilot implementation program to organize study tours, learn from localities that were involved in the program and prepare to be ready to implement supporting poor households in their localities when the policy being issued./.

**MINISTRY OF CONSTRUCTION**



## **Annex VIII– Evaluation Reports of the Baseline Projects**

GREEN CLIMATE FUND FUNDING PROPOSAL



### **Annex VIII.b. 5-year Review – Community-Based Disaster Risk Management Programme, 2015**





## Annex VIII– Evaluation Reports of the Baseline Projects

GREEN CLIMATE FUND FUNDING PROPOSAL

**MINISTRY OF AGRICULTURE AND  
RURAL DEVELOPMENT**

**SOCIALIST REPUBLIC OF VIETNAM**  
*Independent - Freedom - Happiness*

No.: /TCTL-GNTT

*Hà Nội, ngày tháng năm 2015*

### **REPORT**

**Results of the project proposal implementation: “Community awareness raising and community-based disaster risk management”, period 2010-2015**

## **A. BACKGROUND OF THE PROJECT PROPOSAL**

### **I. Project proposal objectives and scope**

1. Project proposal entitled “Community awareness raising and community-based disaster risk management” approved by the Prime Minister in Decision 1002/QĐ-TTg dated 13 July 2009 with objectives: (i) To complete the mechanism and policy of community-based disaster risk management (CBDRM); (ii) To strengthen capacity for cadres of authorities at all levels directly involved in the natural disaster prevention and control, and (iii) All villages and communes in high risk areas for disaster occurrence will be able to develop natural disaster prevention and preparedness plans.

2. Implementation duration and scope: the project proposal has started from 2009 and will finish in 2020, and it is expected to implement in about 6,000 communes where often affected by natural disaster in the whole country.

### **II. Project proposal contents**

Project proposal contents consist of two main components:

1. Component 1: strengthen capacity on the management and implementation of CBDRM activities for cadres of authorities at all levels

This component objective is to ensure 100% cadres at all levels directly involved in CBDRM be trained, strengthened capacity and qualification on CBDRM.

1. Component 2: enhance communication and education, strengthen capacity for community on disaster risk management.



This component objective is to strengthen capacity for community on natural disaster reduction; more than 70% population of communes in often disaster occurrence areas be disseminated knowledge of storm and flood prevention and control, and natural disaster reduction.

### **III. Tasks to be implemented to 2015**

1. Develop legal normative documents, guide in a unified and appropriate manner on the management, deploy the implementation of the community-based disaster management at all levels and within the communities;
2. Build a unified training system on the community-based disaster management at all levels;
3. Develop training materials on the community-based disaster management activities (including packages of training materials for trainers and trainees);
4. Organize training courses on steps to implement the community-based disaster management for trainers of the community-based disaster management at all levels;
5. Make disaster and vulnerability maps for each community: maps to be made by the community itself based on the guidance of the community-based disaster management implementation group in the community.
6. Community-based disaster management communication activities.

## **B. IMPLEMENTATION RESULTS**

### **I. Directions of the Ministry of Agriculture and Rural Development**

#### **1. Development of legal normative documents, unified guidelines on the management and implementation**

a) In order to have foundation for plan development to deploy the project proposal and submit to the Prime Minister for approval of the project proposal's yearly and five year plans, the Ministry and Agriculture and Rural Development (MARD) issued official document No. 4270/BNN-ĐĐ dated 24 Dec. 2010 requesting the Ministry of Education and Training, provinces and cities to direct concerned agencies in preparing the project proposal implementation plans. However, to the end of August 2012 there were only 39 provinces, cities completed the plans and sent to MARD.

b) Based on the implementation plans and proposal of the Ministry of Education and Training, provinces, MARD synthesized and asked for comments of the Ministries of Finance, Planning and Investment for the draft plan to 2015 of the project proposal. The Prime Minister approved in Decision No. 333/QĐ-TTg dated 18 Feb. 2013; in which MARD was assigned to continue guiding the remaining 24 provinces to prepare the plans and submit them to the Government for consideration and approval.



c) Currently, MARD is leading in the development of a Circular “Guideline on contents to implement the Project proposal of “Community awareness raising and community-based disaster risk management”. The Ministry has issued Document No. 5115/BNN-TCTL dated 29 Jun. 2015 and sent it to concerned provinces, cities, ministries and branches for comments to the draft Circular prior to the promulgation. At the same time, the Ministry also sent to provinces and cities a document regarding the proposal of communes that often suffer from natural disasters for synthesis and unified promulgation of a list of 6,000 communes, based on that localities would deploy the project proposal implementation.

## **2. Develop training materials on the community-based disaster management activities**

In order to unify the implementation of the project proposal in the whole country, MARD developed and promulgated guidances, including:

- A document sent to the Ministry of Education and Training, provinces, central cities guiding the implementation of the project proposal plan according to Decision No. 333/QĐ-TTg of the Prime Minister. Implementation contents follow closely the direction of the Government in the period to 2015.

- Documents guiding the implementation of the project proposal entitled “Community awareness raising and community-based disaster risk management” attached to Decision No. 666/QĐ-TCTL-ĐĐ dated 22 Aug. 2011 to guide provinces and cities in organizing human resources for the implementation.

- Technical materials on “Disaster risk management and response to climate change”; “Community-based disaster risk management-for commune level”; “Community-based disaster risk assessment-for commune level”.

- Promulgation of a Manual on the implementation of community-based disaster risk management within the project “Disaster Management” (VN-Haz/WB5) in Decision No. 3211/QĐ-BNN-TCTL dated 18 Jul. 2014.

- A set of project proposal monitoring and evaluation indicators to unify roles and responsibilities of management agencies at all levels, implementation procedures; templates for information collection, project proposal implementation report and evaluation templates

- Printed and delivered to local authorities and trainers at the provincial level of 63 Provinces and cities: 4,380 Guidelines on the project proposal implementation; 2,331 booklet "Community based disaster risk management - for the commune level"; 2,331 Guide book "Community based disaster risk assessment

- for the commune level"; 2,079 brochure “A set of project proposal implementation monitoring and evaluation indicators”

### **3. Organization of training and communication activities**

#### a) Training trainers at all levels

- Based on the decision approving the quantity of trainers which need to be trained of 63 provinces and cities, MARD organized for trainers at the provincial level. To December 2014, there were **1,132/1,439** trainers of the provincial level trained, reaching **79%** (*Annex 1 attached*). Trained officials become the core teams to implement project proposal in lower levels.

- Pilot training for trainers at the district level, training cadres of the commune level: training for 15 districts with 106 officials and 59 commune cadres of Kien Giang province; training contents at the commune level included vulnerability assessment, community capacity and mapping disaster risks drawn by the people themselves.

#### b) Communication activities

- In 2012 and 2013, the Ministry collaborated to develop ten television skits, 18 scientific documentaries on natural disaster prevention and control with objectives to communicate, disseminate knowledge on natural disaster management for communities. Movies were broadcasted on dedicated channel for natural disaster prevention and control of Viet Nam Television and Vietnam Radio VOV.

- In 2014, MARD took the leading role and collaborated in organizing to develop and produce 20 short films. The film contents focused on disseminating and guiding people to cope with storms and floods. The Ministry collaborated with the News Department of Viet Nam Television in broadcasting natural disaster prevention and control issues on VTV1. Currently, the said contents have been copied to diskettes and handed to provinces and cities to disseminate and communicate to communities and people in the whole country.

### **2. Collaboration with concerned agencies to implement the project proposal**

Within the project proposal implementation framework, MARD signed cooperation records in line with functions and working fields of each concerned agency in supporting the project proposal:

- Collaborating with the Vietnam Red Cross at the central level to implement main activities, including: support to train trainers at all levels; consulting the process to prepare training materials and tools for training at the community level; developing contents of communication training and organizing communication in order to provide natural disaster prevention and control knowledge as well as contents related to communities.

- Collaborating with the Women's Union at the central level to integrate gender issues into activities, promoting capacity strengthening, awareness raising on natural disasters for entities which are easily vulnerable, especially women.



- Collaborating with the Viet Nam Chamber of Commerce and Industry (VCCI) in organizing awareness raising activities for the business community to strengthen capacity in responding to natural disasters and maintaining continuous production, business and ensuring the sustainable development.

- Currently, the Ministry is carrying out the necessary procedures to have the Regulation to coordinate with the Ministry of Labour - Invalids and Social Affairs in the implementation of the project proposal for the disabled in order to guide provinces and cities to assist people with disabilities in participating effectively the project proposal activities in the community.

## **II. Directions of the Ministry of Education and Training**

According to the contents of Decision No. 1002/QĐ-TTg and Decision No. 333/QĐ-TTg of the Prime Minister, the Ministry of Education and Training carried out the following activities:

1. Approving knowledge framework on natural disaster prevention and control and response to climate change for all educational levels, and completing seven sets of training materials on natural disaster prevention and control and response to climate change for all educational levels: preschool, primary, lower secondary, upper secondary, vocational, colleges and universities. Currently, the Ministry of Education and Training is organizing training courses for the cadres in the educational sector about the above-mentioned materials.

2. Completing tool sets for the collection, processing of information on disaster risk management of the educational sector and material for guiding, preparing for the implementation of the tool set in the entire educational sector, serving contingency plan development, response and overcome of natural disaster consequences in educational entities;

3. Completing the development of a software for the collection, processing of information on disaster risk management of the educational sector and development of response plans in the Departments of Education and Training, Sections of Education and Training, and educational entities in the entire country.

4. Completing need surveys and assessment of professional state management agencies and training capacity of university educational entities on human resources for serving natural disaster prevention and control.

5. Completing the review of the legal normative document system, mechanisms, policies related to natural disaster prevention and control.

### **III. Implementation results of provinces and cities**

Implementing the Prime Minister’s decision, MARD’s guidance, the Ministry of Education and Training, localities carried out the following activities:

1. 63/63 provinces, cities approved the project proposal implementation plans for period to 2015, in which there are funds allocated from the local budget and requested support from the central budget.

2. Provincial People’s Committees approved lists of officials to be involved in the training courses for trainers at the provincial level. These trainers will become core groups to implement the project proposal activities at the lower levels and communities.

3. Although funds from central budget have not been allocated but several provinces have arranged finance from the local budget, mobilized grants from NGOs, used ODA funds to implement the project proposal activities. Main activities include training, drilling natural disaster prevention and control, communication, making commune natural disaster prevention and control plans (*A list of provinces with activities in Annex 2 attached*).

According to an incomplete, updated report of localities and NGOs, to December 2014, community-based disaster risk management activities were carried out in 1,667 communes, as a result, millions of people in the communes are beneficiaries of various project proposal activities (*attached Annex 3*).

### **IV. Other results**

#### **1. Application of technologies to support the project proposal implementation**

- Equipping server system and developing software to collect and process information on disaster risk management serving monitoring and evaluation of project proposal implementation in the whole country.

- Establishing a website to manage trainers’ information, posted on the website [www.dmc.gov.vn](http://www.dmc.gov.vn).

- At the same time with monitoring and evaluation according to the traditional method of bottom up reporting, MARD is directing the agencies under the Ministry promoting technological development using Geographical Information Map to monitor and evaluate the project proposal implementation at all levels, particularly at the community level.

#### **2. Support from donors and NGOs**

##### *2.1. Support of programs and projects:*

a) United Nations Development Program (UNDP)

- Project entitled “Strengthening Institutional Capacity for Disaster Risk Management in Vietnam, including climate change related disasters” (SCDM) phase 1 and 2 has implemented in 20 provinces. The project supports on enhancing institutions and strengthening capacity to implement the project proposal. Specifically: support to develop a law on disaster prevention and control; support to develop guidance materials, Indicator set and the Material guiding monitoring and evaluation of the project proposal implementation; support to train trainers at central level on CBDRM; organization of training cadres at commune level to implement CBDRM with 814 trainers of 51 communes often affected by disasters in 20 project provinces; guiding to prepare disaster prevention and control plans.

b) World Bank (WB)

- Disaster Management Project (WB5) has component 3 on CBDRM. The project is implemented in 10 project province of the central coast: Thanh Hóa, Nghệ An, Hà Tĩnh, Quảng Bình, Quảng Trị, Đà Nẵng, Quảng Nam, Quảng Ngãi, Bình Định and Ninh Thuận.

- The project phase 1 is implemented in 27 communes of five provinces, namely Thanh Hóa, Nghệ An, Hà Tĩnh, Quảng Nam, Bình Định: carried out 140/251 training courses; outputs are commune disaster prevention and control plan. Phase 2 continues to implement in 73 remaining communes of ten provinces.

c) Japanese International Cooperation Agency (JICA)

- Project entitled “Enhancing adaptation capacity to disaster in the central Viet Nam” phase 1 is implemented in three central provinces: Thừa Thiên Huế, Quảng Nam, Quảng Ngãi. Project activities focuses on CBDRM, capacity development, adaptation to climate change and small scale works against river erosion.

- For CBDRM activities, the project uses “hands-on” approach to implement. Japanese experts directly implement and coordinate with communes to implement activities in communities. The project is implemented in nine communes of three provinces. One of the project outputs is to issue a reference booklet on CBDRM.

- The project phase 2 continues to implement the community awareness raising component for three communes of three project provinces, namely Nghệ An, Hà Tĩnh and Quảng Bình. This content is implemented in 2015.

d) Donors as AUSAID, DIPECHO, ADB, ect... are funding directly for state agencies and NGOs to have specific activities in their funded projects like implementing awareness raising and community-based disaster management.

According incomplete statistics, there are **67 projects** implemented by NGOs working on community-based disaster management in **704 communes of 43 provinces, cities** concentrated mainly in the central and south Viet Nam. These projects are contributing significantly to common efforts and





creating good models, especially lessons on building partnership of the co-implementation among international organizations, government and people (*Annex 4 attached*).

### *2.2. Building information sharing and coordination mechanisms*

- Establishing a CBDRM technical working group at central level (CBDRM TWG): collaborating with social organizations (Red Cross, Women Union) and NGOs working in disaster management (as CARE, Oxfam, Plan, Save the Children, CECI, Action Aid, World Vision, Malteser International, ...) to establish a CBDRM technical working group at central level (in short CBDRM TWG). The group objective is to assist concerned units in discussing, sharing working plans of each unit, together removing obstacles, developing technical support measures to implement the project proposal.

- Sharing lessons learned: during the recent years, NGOs (as CARE, Oxfam, Plan, Save the Children, CECI, Action Aid, World Vision, Malteser International, ...) have significantly contributed in implementing CBDRM activities. MARD has been and is carrying out well state management tasks in the coordination of activities ensuring meeting the Government's requirements in order to assist localities in preparing working plans and implementing the project proposal.

- The Emergency Preparedness Working Group (APWG) within APEC cooperation framework agreed to include Vietnam's initiative to conduct a "CBDRM workshop" into the group's working plan in period 2014-2015.

- In addition, Viet Nam also made the remarkable results and attracted the attention on CBDRM in the process of participation in regional cooperation blocks like cooperating with South East Asia countries (ASEAN), the Asia-Europe Meeting (ASEM), the United Nations International Strategy for Disaster Reduction (UNISDR), ...

### *2.3. Participation of private and business sectors:*

Participation of private and business sectors in supporting the project proposal is still limited. However, with the promotion of the Chamber of Commerce and Industry of Vietnam (VCCI) and Provincial Committees for Flood and Storm Control, several localities have started to implement cooperative activities among local authorities, businesses and people in communication, training and capacity strengthening for people in the provinces.

## **IV. RESULTS OF FUND USING FOR THE PROJECT PROPOSAL IMPLEMENTATION**

According to Decision No.1002/2009/QĐ-TTg, funds for the project proposal implementation shall be mobilized from the State budget (55%); ODA grant (40%) and people's contribution (5%). To June 2015, the fund use status from all sources is below:



## 1. Funds from the State budget

Total funds from the State budget allocated to the project proposal activities are VND 24.5 billions (reaching 4.8%), specifically:

### a) Central budget

- *During 2009 - 2012:*

The Central budget allocated **VND 7.4 billions** for the Ministry of Agriculture and Rural Development (MARD), specifically as below:

+ Year 2011 (VND 4.9 billions);

+ Year 2012 (VND 2.5 billions).

Used for activities: training, developing guidance documents, communication activities.

- *According to Decision No. 333/QĐ-TTg dated 18/02/2013:*

The central budget allocated:

+ **VND 7.3 billions** for MARD, specifically: Year 2013 (VND 2.8 billions), 2014 (VND 2.5 billions) and 2015 (VND 2 billions); used for activities: training, developing guidance documents, communication activities.

+ **VND 10 billions** for the Ministry of Education and Training: used for establishing a team of trainers specializing on disaster prevention and control at all levels; funds were allocated for 2013 and 2014.

+ **VND 133.5 billions** for provinces and cities: Funds are not allocated.

- *ODA loans:*

The World Bank, through project Disaster Management WB5, provided a loan valued **USD 18.5 millions** (equivalent to more than VND 380 billions) to implement the project in ten central coast provinces. To June 2015, **VND 13 billions** (reaching 15%) was disbursed.

*(Attached Annex 5 shows results of the central budget use)*

### b) Local budget

According to reports from **34** provinces and cities, during period 2009-2014 provinces arranged funds from local budget allocated to activities related to project proposal contents. Total budget arranged was VND 79.14 billions. *(Annex 6 attached).*

## 2. Funds from ODA grants

According to incomplete statistics, total funds from grants directly supporting to the project proposal implementation at all levels is **VND 45 billions** (reaching 12.9%), specifically as below:

a) From the Japanese International Cooperation Agency (JICA)

Period 2009-2012: Supported **VND 11.5 billions** for activities: Training on community-based disaster management at commune level; building small scale disaster prevention and control works.

b) From the United Nations Development Program (UNDP)

- Phase 1: Supported about VND 12.7 billions for activities: preparing guidance materials on community based disaster management; training at community level: procuring equipment for flood and storm control.

- Phase 2: Supported about **VND 20.8 billions** for activities: Developing legal normative documents; preparing materials; integrated training at commune level.

c) From other organizations

During period 2009-2014, according to statistics, 34 provinces, cities mobilized **VND 225.4 billions** from ODA grants

*(However, statistical data did not specify how many percent was directly supported to CBDRM).*

## **C. SOME EXISTING PROBLEMS AND REASONS**

Beside the remarkable achieved results, there are existing problems, which have limited the results of the project proposal implementation.

### **1. Attentions of all levels to the project proposal**

a) The project proposal objective is to move towards and create people participation in disaster risk management, there still lack institutions and core human resources; legal framework has not been formed, hence it must learn in practices at the same time develop guidance during the implementation. Therefore, in initial years, there was confusion in the implementation in several localities;

b) Many localities have not paid adequate attention in directing, supervising agencies, departments and branches to implement the project proposal. Most provinces, cities have not established technical support (working) group at all levels as guided by MARD for organizing the implementation.

c) Did not proactively arrange resources or used external supports to implement the project proposal; did not integrate the project proposal contents in programs, projects in the localities; advisory bodies lacked information on disaster prevention and control activities in their localities and hence partly affecting to advisory and reporting tasks;

d) Synthesis, replication of technical and technological measures in supporting communities have not done synchronically; guidance on integrating different resources in localities to implement the project proposal contents has not done.

## **2. Training, documentation and communication**

a) Organization of training, management, quality monitoring and use of provincial trainers was challenged due to part-time work and physical changes - switching positions.

b) During the recent time, communication achieved high effectiveness, communication contents were rich, diversified and understandable. The communicated contents raised awareness of cadres and people in the whole country. However, the continuation of exploitation and use of communication products in community level have not done synchronically;

c) Many branches, organizations carried out communication activities like developing documents, brochures, movies on disasters. However, recently, documents are dispersed and need to be managed, synthesized and shared by state authorities.

d) Communication for remote and deep areas, for vulnerable groups as disabled, elderly and children, and by ethnic languages is still limited.

e) The project proposal monitoring and evaluation have not been enhanced due to lack of conditions for extensive training for staff at all levels on guidance documentation, issued by MARD.

## **3. Funds for the project proposal implementation**

a) Support from central budget for provinces, cities based on Decision 333/QĐ-TTg has not been implemented due to budget difficulty, while the local budget was constrained and so the project proposal implementation in provinces was limited; it was very challenging in developing trainers at district and community levels, as well as in carrying out other tasks in line with Decision 333/2013/QĐ-TTg of the Prime Minister.

b) Financial mechanism: It was not clearly assign responsibilities of provinces, cities in proactively arranging funds from local budget to implement the project proposal, so that there was tendency to wait for support from superiors.

c) Funds from ODA loans is big (From project WB5 is VND 380 billions direct support to the project proposal) but the implementation is within only ten central coast.

## **4. Several targets, provisions set out in Decision 1002/QĐ-TTg are hard to apply in reality**

After the first five year implementation, MARD synthesized some project proposal problems as below:

- Several activities, targets were hard to implement due to lack of legal framework regulations, specifically: financial support for people participation in community based disaster risk management and assessment; trainees do not have salaries from the state budget; monitoring and evaluation of the project



proposal implementation; investment management of building small scale disaster prevention, control and reduction works.

Target “ensure by 2020, 100% staff working on disaster prevention and control trained, capacity and qualification on disaster prevention, control and reduction strengthened” is not feasible due to often change of staff quantity in localities.

- In Article 2 of the Decision prescribed MARD responsibility “Identify objectives, approve contents, calculate necessary funds and propose implementation measures for every year and five years; coordinate with the Ministry of Planning and Investment, Ministry of Finance in preparing funds and propose financial arrangements for ministries, branches and provinces, cities, submit to the Prime Minister for approval”. The submission to the Prime Minister for approval of yearly plan would reduce the autonomy of the ministries, branches and localities in implementing the project proposal.

## **D. PROPOSALS AND RECOMMENDATIONS**

### **I. To the Prime Minister**

1. Based on the above mentioned obstacles, MARD suggests that the Prime Minister leads a meeting with concerned ministries, branches to review, assess in order to supplement, amend some contents of Decision 1002/QĐ-TTg dated 13 Jul. 2009 and solve the existing problems, limitations occurred during the project proposal implementation.

2. Currently, MARD is leading in preparing the second five year plan (2016-2020) of the project proposal implementation. In the draft plan, MARD proposes a financial mechanism to increase autonomy of provinces and cities at the same time remove barriers of financial constraints for localities. The suggested contents include allowing to combined use of funds from the Disaster Prevention Fund to implement the project proposal and provide targeted support to difficult provinces that are not able to balance their budgets.

3. After the five year plan approved, in order to proactively implement the yearly plan, MARD suggests that the Prime Minister assigns MARD, Provincial/City People’s Committee to approve yearly plans to implement the project proposal.

### **II. Recommendations and suggestions under the authority of the ministries and provinces**

#### **1. Plan review, preparation and approval**

People’s Committees at provincial level need to review, assess the project proposal implementation results in the past period to prepare and approve project proposal plans for the next period (2016-2020), proactively integrate and combine with other concerned national programs for improving effectiveness and reducing investment expenses, mobilizing grants. At the same time, it is necessary to



specifically assign a leading agency, advisory agency, standing agency at all levels to organize the project proposal implementation.

## 2. Financial issues

### a) At local level:

- Organize the implementation of Decree 94/2014/NĐ-TTg prescribing the establishment of the Disaster Prevention Fund at provincial level: Suggest the Prime Minister to direct and allow use of 30% in communes to implement CBDRM activities;

- Based on the approved project proposal implementation plans, People's Committees at all levels prepare financial plan and send to authorized levels and concerned parties; At the same time, proactively approach and mobilize domestic and foreign grants, voluntary contributions from agencies, organizations, individual in legal forms.

### b) At Central level

- MARD promulgates a Circular guiding the project proposal implementation, which includes the integration of fund use from the Disaster Prevention Fund at provincial level. This is an important financial source usable to implement several contents of the project proposal when the Fund is in operation; develops financial support regimes to maintain and develop trained trainers at provincial level;

- MARD continues to issue documents guiding provinces, cities in preparing the project proposal Implementation Plan for period 2016-2020 in order to synthesize and report to the Prime Minister for approval;

- Based on achieved results in the period to 2015, MARD proposes the Prime Minister to supplement budget for the Ministry in period 2016-2020 in order to continue the tasks of guidance, dissemination and communication under the MARD authority.

- Concerned ministries and branches: Based on the project proposal contents, direct the preparation of plans and resources arrangement to organize the implementation.

## 3. Training and communication

- Directing training and communication management agencies to continue in disseminating training and communication contents from concerned ministries and branches;

- Establishing a team to guide the monitoring and evaluation of the project proposal implementation at all levels.

- Enhancing coordination with ministries, branches in integrating training and communication contents in programs, projects managed by the ministries, branches that have contents related to the project



proposal.

4. Development and application of tools to carry out, manage, share information, monitor and evaluate the project proposal implementation

- Research and develop guidelines to integrate, combine between community awareness raising program and community early warning program.

- Complete and put into operation a software supporting monitoring and evaluation of the project proposal implementation at all levels.

- Step by step complete a database on disasters, disaster risks and disaster prevention plans in localities.

- Strengthen scientific research, acquire new and effective CBDRM technologies, models.

5. Strengthen coordination with businesses, NGOs, international organizations

- Strengthen public-private cooperation between the state agencies and businesses in disaster prevention tasks.

- Strengthen international bilateral and multilateral cooperation facilitating favourable conditions to share experiences, enlist the support of regional countries, international organizations and donors.

- Develop Implementation Plan of participatory community-based disaster management. Share information and propose technical assistance from development organizations, donors and business community.

6. Consolidate advisory bodies at all levels

During the consolidation of institutions for disaster prevention at all levels according to the Law on natural disaster prevention and control, local authorities at all levels need to direct in consolidating advisory body to implement the project proposal.

**MINISTRY OF AGRICULTURE  
AND RURAL DEVELOPMENT**



## **Annex VIII – Evaluation Reports of the Baseline Projects**

GREEN CLIMATE FUND FUNDING PROPOSAL

**Annex VIII.c. Restoration of Coastal Mangrove Forest in Viet Nam Study Report, 2012**

**CONSERVATION AND DEVELOPMENT OF THE KIEN  
GIANG BIOSPHERE RESERVE PROJECT**

**RESTORATION OF COASTAL MANGROVE  
FOREST IN VIETNAM**  
(Study report, January 2012)

**(DRAFT)**

**Hanoi, February 2012**



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661	Five million ha reforestation program
ACTMANG	Japanese organisation acting for mangrove restoration
GIZ	German Tổ chức Hợp tác quốc tế Đức
Oxfam UK&I	UK and Ireland organization for Poverty combating
PAM	World Food program
QCCT	Improved intensive farming
UNDP	United Nation Development Program

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**Survey Team**

## Introduction

Vietnam has 3,200 km of coastline. The coastal ecosystem has been heavily affected by climate change, resulting in an increase in the coastal erosion, dike erosion, sanitation of agricultural land and villages.

Mangroves play an essential role in maintaining uniformity of the environment, coping with climate change and generating income. Mangroves create barriers against the intrusion of sea water and impacts of rising sea levels, as well as provide essential habitat for fish, crabs, aquatic animals and organism in estuaries.

Acknowledging the importance of mangroves, the Vietnamese government has carried out many activities to restore the forests through the program "Mangrove Restoration and Development in the period of 2008-2015".

In fact, it was very difficult to establish mangrove areas and rate of established forest was only about 50 %. Reasons for the failure were low seedling quality, a lack of protection of seedlings from the physical effects in the early stage of growth, a lack of species diversity selection and suitable planting methods in each specific site.

There is currently no systematic survey on the current status of activities of restoring mangroves to determine the most effective restoration.

ICEM project recommended starting a research to examine and review current activities of restoring mangroves and verify the reasons for success or failure in afforestation on a range of ecological zones.

This study aims to provide practical support for overall planning to restore mangroves of the Vietnamese government (Decision No. 405) by providing information for policy (Decree 99/2010 on payments for environmental services and support the provinces on technical guidelines for reforestation activities. The objectives of the study are to:

- To provide an overview of the scope of mangroves restoration activities in Vietnam;
- To evaluate the causes of success and failure in restoring the forests;
- To propose activities to restore mangroves in different regions.

Survey location:

North region: Quang Ninh , Hai Phong, Thai Binh , Nam Dinh, Thanh Hoa and Ha Tinh provinces from 03/01/2012- 18/01/2012

Mekong delta: Kien Giang, Ca Mau, Bac Lieu, Soc Trang and Ben Tre provinces from 03-13/01/2012.



# **I. Current status of mangroves in Vietnam**

## ***1.1. Area and distribution***

### ***1.1.1. Zoning coastal mangroves and tidal zones in Vietnam***

Vietnam has 29 provinces and cities with coastal mangrove forests and tidal zones along from Mong Cai to Ha Tien province. Of which:

Northern coastal region has 5 provinces of Quang Ninh, Hai Phong, Thai Binh , Nam Dinh and Ninh Binh.

Central coast region has 14 provinces from Thanh Hoa to Binh Thuan.

Southeastern and the Southwest coastal areas has 10 provinces of Ba Ria Vung Tau, Dong Nai, Ho Chi Minh city, Ben Tre , Tien Giang , Tra Vinh, Soc Trang, Bac Lieu , Ca Mau and Kien Giang.

Generally, climate in the coastal areas of Vietnam are humid tropical with annual average temperature of 22.2 ° C (Tien Yen - Quang Ninh) to 26.5 ° C (Ca Mau), and average precipitation of 1500 - 2.000 mm/year. Some areas have relatively high annual rainfall, reaching 2.749 mm/year (Mong Cai), 2.929 mm/year (Ky Anh - Ha Tinh), 2.867 mm/year (Hue province). Conversely, some areas have low rainfall: 794 mm/year in Nha Ho, 1.152 mm/year in Phan Thiet province.

In the areas where rainfall is usually well below 1.200 mm/year, have no natural mangrove distribution. Total annual rainfall in the whole territory of Vietnam reached 630 km<sup>3</sup>.

The northern Vietnam is located in the transition zone between tropical and subtropical climate, influenced by the northeast monsoon that brings cold air masses in spells, becoming humid tropical domain and causing cold winters. In winters, air temperature falls to below 20oC and 15oC on many days, leading to coastal water temperature in many places less than 20 ° C, which affect the growth and distribution of various types of mangroves.

Rivers network in Vietnam is quite thick. There are 2,500 rivers of more than 10km in length. River grid density changes from 0.5- 2km / km<sup>2</sup>. The rivers flow annually into the East Sea about 800 - 900km<sup>3</sup> of water. Excluding flows from outside, the flows generated in the territory of Vietnam is about 300km<sup>3</sup> (Nguyen Viet Pho, 1984). Vietnam has two the largest river- the Mekong and Red River with flows up to 70 % of the total flow of the rivers in the country. The Mekong and Red River bring to the sea about 200 million tons of silt each year. Thus, the Red River and the Mekong River estuaries encroach into the East Sea 40- 100m every year (VM. Fridland, 1964, Nguyen Viet Pho, 1978). On the alluvial dilute mud with much sea

water and being geological processes rather than formation of soil, the pioneer mangroves that fix alluvial ground appear.

Based on differences in the natural geographical conditions, the vegetation of coastal mangrove forests and tidal zone in 3 countries of the North, Central and South can be divided into 6 regions and 12 sub-regions.

**Table 1: Zoning coastal mangroves and tidal zones of Vietnam**

Country	Region	Sub-region	Note
A. North Coast	I. Northeast (Quang Ninh)	1. Móng Cái – Cửa Ông. 2. Cửa Ông – Cửa Lục. 3. Cửa Lục - Đồ Sơn	
	II. Northern Delta	4. Đồ Sơn – Văn Úc. 5. Văn Úc – Lạch Trường	Thai Binh river system Red river system
B. Central Coast	III. North Central Coast	6. Lạch Trường – Ròn 7. Ròn – Hải Vân	
	IV. South Central Coast	8. Hải Vân – Vũng Tàu	
C. South Coast	V. Southeast	9. Vũng Tàu – Soài Rạp	Ba Nạ 586km Vũng Tàu – TP HCM
	VI. Southern Delta	10. Soài Rạp – Mỹ Thạnh 11. Mỹ Thạnh – Bán Háp (mũi Cà Mau) 12. Bán Háp – Hà Tiên (Mũi Nai )	The Mekong Delta, South west of Ca Mau peninsula West of Ca Mau peninsula

*[Phan Nguyen Hong, 1999]*

### 1.1.2. Area and distribution of mangroves in the whole of Vietnam.

#### **a. Distribution by forested and non-forested area**

According to figures published by the MARD in 2008, the coastal countries are divided into five regions. The total area planned for a purpose of mangrove development was 323,712 ha, of which non-forested area was 113,972 ha and forested area was 209,741 ha (152,131 ha of forest plantations and 57,610 ha of natural forests), distributed in the following areas:

- The coastal area of Quang Ninh province and Northern Delta consists of 5 provinces (Quang Ninh, Hai Phong, Thai Binh, Nam Dinh and Ninh Binh): 88,340 ha, of which the forest area was 37,651 ha, distributed mainly in Quang Ninh area accounting for 18 %.

- North Central Coast Region (NCC) includes 6 provinces (Thanh Hoa , Nghe An, Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue): 7,238 ha, of which 1,885 ha of forest area, distributing primarily in Thanh Hoa province (1%).

- South Central Coast Region (SCC): 6 provinces (Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen and Khanh Hoa ): 743 ha , of which forest area was negligible.

**- Coastal Southeast (CSE) consists of 5 provinces (Ninh Thuan, Binh Thuan and Ba Ria - Vung Tau, Dong Nai and Ho Chi Minh City ): 61,110 ha , of which forest area was 41,666 ha, distributed mainly in Ho Chi Minh city accounted for 19.8%.**

- Coastal Mekong Delta (CMD) comprises 8 provinces (Long An, Tien Giang, Ben Tre, Tra Vinh, Soc Trang, Bac Lieu, Kien Giang and Ca Mau): 166,282 ha, of which the area had 128,537 ha of forest, mainly distributed in the provinces of Ca Mau and Kien Giang provinces accounted for 61 %.

**Table 2: Area and distribution of mangroves in Vietnam**

No	Coastal regions	Total	Mangroves area (ha)			Non-mangroves area (ha)
			Sub-total	Natural forests	Plantation	
1	Quang Ninh and Northern Delta	88,340	37,651	19,745	17,905	50,689
2	NCC	7,238	1,885	564	1,321	5,353
3	SCC	743	2	2		741
4	CSE	61,110	41,666	14,898	26,768	19,444
5	CMD	166,282	128,537	22,400	106,137	37,745
	<b>Whole of country</b>	<b>323,712</b>	<b>209,741</b>	<b>57,610</b>	<b>152,131</b>	<b>113,972</b>

[MARD, 2008]

**b. Distribution by sea dike system**

**Table 3: Area of mangroves by sea dike system**

Coastal regions	Total of dyke length (km)	Dyke length where is prioritized for developing mangroves for protecting the dyke					
		Having forest in front of dyke				Can be planted	
		Dyke length (km)	By area			Dyke length (km)	Area (ha)
			Total (ha)	Protection (ha)	Additio nal planting (ha)		
Northern Delta	841	254	27,209	23,040	4,169	187	7,770
North Central	338	67	5,393	5,393		88	1,997
The Mekong Delta	1,259	792	37,009	36,420	589	143	3,826
<b>Total</b>	<b>2,438</b>	<b>1,113</b>	<b>69,611</b>	<b>64,853</b>	<b>4,758</b>	<b>418</b>	<b>13,593</b>

According to survey results that was implemented by the Institute of Forest Inventory and Planning in 2006, there was 1,113 km in three regions of distribution of mangroves (Quang Ninh and Northern Delta, North Central and The Mekong Delta) in total 2,438 km of sea dykes that have dyke protection mangroves, which corresponds to a forested area of 69,611 ha of mangroves, of which:

- Quang Ninh and Northern Delta dyke length with mangroves was 254/841 km;
- North Central Region sea dyke length with mangroves was 67/338 km;
- The Mekong Delta sea dyke length was 792/1.259 km of mangroves; (South Central Region dyke length with protection forests on dyke length total is 73/501 km (15 %) corresponding to a forested area of 898 ha, however the front dyke forest in this area was shallow forest).

Currently, there are 1,325 km of sea dykes (which have 1,197 km in 3 regions of Quang Ninh and the Northern Delta; North Central and the Mekong Delta, equivalent to 55% of the total length of the sea dike system without system of protection forest. Of the length without forest protection, there is 418 km dyke front yard, equivalent to about 13,000 ha of mangroves that can be grown. Some remaining areas can not grow, because there is no yard in the front of dykes or erosion, mud, dilute silt. Hence, along with the planting of mangroves, the solutions like construction of embankments and Spur -dike, pile driving, additional soil and sludge,... should be done.

### **c. Distribution by functions**

Total of mangroves area is 323,712 ha, that is planned as follows:

- Protection forest: 153,294 ha, of which forested area is 115,950 ha;
- Special use forest: 41,666 ha, of which forested area is 28,311 ha;
- Production forest: 128,752 ha, of which forested area is 65,480 ha.

Details of coastal mangrove distribution in Vietnam by three types of forest are synthesized below:

**Table 4: Planning mangroves by three types of forest***Unit: ha*

No	Places	Total	Divided by three types of forest		
			Protection forest	Special use forest	Production forest
	<b>The whole country</b>	<b>323,712</b>	<b>153,294</b>	<b>41,666</b>	<b>128,752</b>
	<b>Forested area</b>	<b>209,741</b>	<b>115,950</b>	<b>28,311</b>	<b>65,480</b>
	<b>Non-forested land</b>	<b>113,972</b>	<b>37,344</b>	<b>13,355</b>	<b>63,272</b>
<b>1.</b>	<b>Quang Ninh and Northern Delta</b>	<b>88,340</b>	<b>43,776</b>	<b>8,589</b>	<b>35,975</b>
1.1	Forested area	37,651	30,928	4,489	2,234
1.2	Non-forested land	50,689	12,848	4,100	33,741
<b>2.</b>	<b>North Central</b>	<b>7,238</b>	<b>4,420</b>	<b>-</b>	<b>2,817</b>
2.1	Forested area	1,885	1,341	-	544
2.2	Non-forested land	5,353	3,080		2,273
<b>3.</b>	<b>South Central</b>	<b>743</b>	<b>-</b>	<b>-</b>	<b>743</b>
3.1	Forested area	2	-	-	2
3.2	Non-forested land	741			741
<b>4.</b>	<b>Southeast</b>	<b>61,110</b>	<b>41,511</b>	<b>900</b>	<b>18,699</b>
4.1	Forested area	41,666	38,468	16	3,182
4.2	Non-forested land	19,444	3,043	884	15,517
<b>5.</b>	<b>The Mekong Delta</b>	<b>166,282</b>	<b>63,587</b>	<b>32,177</b>	<b>70,518</b>
5.1	Forested area	128,537	45,213	23,806	59,518
5.2	Non-forested land	37,745	18,374	8,371	11,000

*[FIPI, 2008]*

#### **d. Classification of protection mangroves for stopping waves and encroaching the sea**

Until now, there have been no systematic and specific inventory, survey and assessment about area and quality of mangroves, as well as research on standards and criteria for protection mangrove belt system for preventing disasters, protecting sea dykes and etc. This is the problem requiring scientists to supplement in the near future.

Protection mangroves for stopping tides and encroaching sea are classified as follows:

**Table 5: Classification of mangroves**

No	Forest types	Forested area (ha)			Non-forested area (ha)		
		Very critical area (ha)	Critical area (ha)	Total	Very critical area (ha)	Critical area (ha)	Total
1	Natural forests (ha)	27,078	10,799	37,877	0	0	0
2	Plantation (ha)	27,493	50,895	78,388	0	0	0
	<b>Total</b>	<b>54,256</b>	<b>61,694</b>	<b>115,950</b>	<b>18,858</b>	<b>18,486</b>	<b>37,344</b>

[FIPI, 2008]

\* Forested area: 115,950 ha:

- Very critical area (VCA): 54,256 ha, of which:

+ Natural forests: 27,078 ha, including 9,625 ha of low quality forests that need to be additionally planted;

+ Plantation: 27,493 ha, including 23,245 ha of low quality forests that need to be additionally planted;

- Critical area (CA): 61,694 ha, of which:

+ Natural forests: 10,799 ha;

+ Plantation: 50,895 ha.

\* Tidal zones without forests: 37,344 ha:

- Very critical area (VCA): 18,858 ha, of which:

+Have sufficient conditions for planting: 13,593 ha.

+Have no conditions for planting (erosion, dilute silt,...), where need to have construction solutions before and during planting process: 5,265 ha.

- CA: 18,486 ha, of which:

+ Area for industrial plantations: 12,771 ha;

+ Area can be planted combining with aquaculture: 5,714 ha.

VCA are the coastal areas where are front dykes. The area is calculated from dykes to the coast at average height of tides of 200m or estuarine areas with dams, or without dams, and on going erosive areas, .... CA is the coastal areas without dikes and dams, being distance of 200 - 500m from the coast at average height of tides.

#### 1.1.2. Area and distribution of mangroves in the survey provinces

Survey results of mangrove area and distribution in six provinces are shown in follow table:

**Table 6: Mangrove area in the survey provinces**

No	Provinces	Area of tidal zones	Forested area	Non-forested area	Area for aquaculture	Area for producing salt
1	Quảng Ninh	45,358	21,702.76	9,558	14,017.80	0.00
2	Hải Phòng	24,578	4,742.10	10,357.1	5,615.00	
3	Thái Bình	26,353.00	7,084.00	14,482.00	4,747.00	40.00
4	Nam Định	10,410.43	3,546.50	754.93	6,109.00	
5	Thanh Hóa	3,987.66	1,192.80	760.40	1,870.32	164.14
6	Hà Tĩnh	1,961.70	796.50	949.00	202.20	14.00
<b>Total</b>		<b>112,648.79</b>	<b>39,064.66</b>	<b>36,861.43</b>	<b>32,561.32</b>	<b>218.14</b>

[Source: Survey results in 1/2012]

Mangrove distribution by functions is presented in below table:

**Table 7: Mangrove area by functions in the surveyed provinces**

No	Provinces	Total area (ha)	Natural forests			Forest plantation		
			Protection	Special use	Production	Protection	Special use	Production
1	Quảng Ninh	21,702.80	17,596.80	92.30	2,818.60	1,189.90		5.20
2	Hải Phòng	4,742.10	176.70	255.60		4,309.80		
3	Thái Bình	7,084.00				5,064.00	2,020.00	
4	Nam Định	3,546.50				2,145.50	1,110.70	290.30
5	Thanh Hóa	1,192.80				1,902.88	138.50	124.50
6	Hà Tĩnh	796.50	32.00			726.50		
<b>Total</b>		<b>39,064.70</b>	<b>17,805.50</b>	<b>347.90</b>	<b>2,818.60</b>	<b>15,338.58</b>	<b>3,269.20</b>	<b>420.00</b>

[Source: Survey results in 1/2012]

### 1.1.3. Area and distribution of mangrove forest in Mekong region

Distribution of mangrove forest in Mekong delta following its functions is shown in table 8.

**Table 8: Current status of coastal mangrove forest in Mekong delta province 2010**

No	Province	Special use forest (ha)		Protection forest (ha)		Production forest (ha)		Total (ha)		
		Natural forest	Plantation	Natural forest	Plantation	Natural forest	Plantation	Natural forest	Plantation	Total
1	Long An				65			-	65	65
2	Tiền Giang				1.358			-	1.358	1.358
3	Bến Tre	145	1.885	343	1.469	13	347	502	3.700	4.202
4	Trà Vinh			821	3.479			821	3.479	4.300
5	Sóc Trăng			1.759	4.885			1.759	4.885	6.644
6	Bạc Liêu			1.599	1.014			1.599	1.014	2.613
7	Cà Mau	3.879	5.391	3.976	21.066	155	18.458	8.009	44.914	52.923
8	Kiên Giang			805	3.042			805	3.042	3.847
	<b>Total</b>	<b>4.024</b>	<b>7.275</b>	<b>9.304</b>	<b>36.377</b>	<b>168</b>	<b>18.804</b>	<b>13.496</b>	<b>62.456</b>	<b>75.952</b>
	(%)	5	10	12	48	0	25	18	82	100

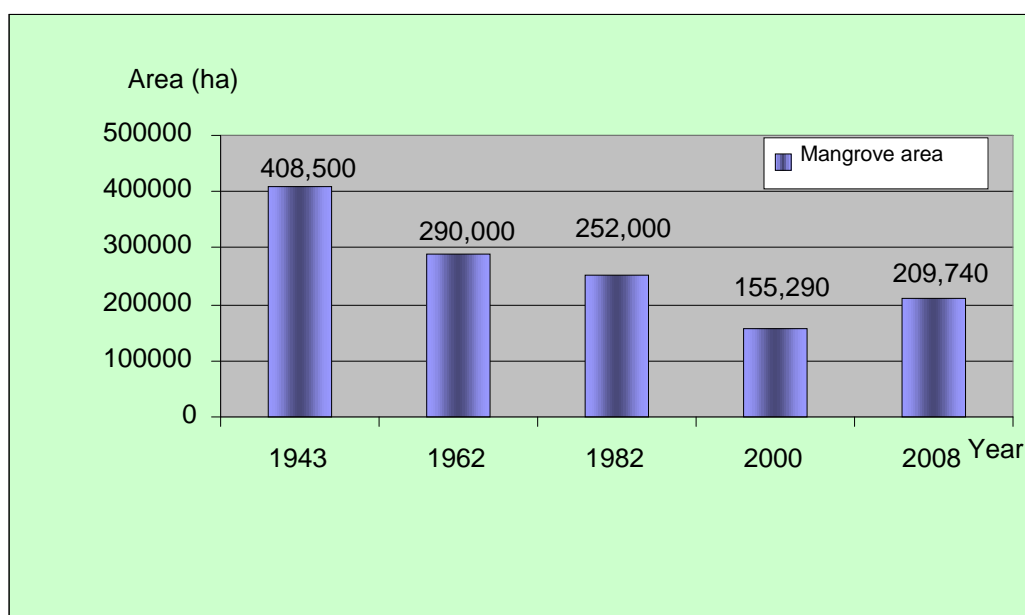
[Sources: Survey results 1/2012]

Table 8 shows that the total coastal mangrove forest in the southern region is 75,952 ha, of which 13,496.2 ha (17.8%) natural forest and 62,455.8 ha plantation (82.2%). Special use forest occurs 15%, protection mangrove forest (60%) and production forest (25%).

### **1.2. Changes of mangrove forest**

According to the statistics of FIPI, Institute of Forestry Science (MARD) and Ministry of Natural Resources and Environment (MNRE), mangroves area of Vietnam over the periods of 1943, 1962, 1982, 2000 and 2007, within the past 63 years, the rate of loss of mangroves in Vietnam was very high, mangrove area was from 408,500ha (1943) down to 209,741ha (2007) (a loss of 198,759ha (48.5 %), loss of 3,200ha in average per year). In recent decades, the area of mangroves has increased mainly due to investment of 661 and non-governmental organizations' support for planting, tending and protecting mangroves. Movements of mangrove area are shown in the bellowed graph





Source: Paul Maurand, 1943; Rollet 1962; FIPI 1982, 2006, Institute of Forestry Science 2000.

**Figure 1:** Changes of mangrove area from 1943 to 2008

Mangrove area changes in the survey provinces are shown in the table below:

**Table 9:** Changes of mangrove area in the northern provinces

No	Provinces	2000	2005		2010	
			Area (ha)	Change (ha)	Area (ha)	Change (ha)
1	Quảng Ninh	17,444.70	18,031.10	586.40	21,702.76	3,671.66
2	Hải Phòng	4,098.90	4,241.30	142.40	4,742.10	500.80
3	Thái Bình	6,721.00	6,973.00	252.00	7,084.00	111.00
4	Nam Định	6,012.00	4,010.00 <sup>1</sup>	-2,002.00	3,546.50	-463.50
5	Thanh Hóa	-	-	-	1,192.80	1,192.80
6	Hà Tĩnh	798.60	-	-	796.50	796.50
<b>Total</b>		<b>35,075.20</b>	<b>33,255.40</b>	<b>-1,819.80</b>	<b>39,064.66</b>	<b>5,809.26</b>

[Source: Survey results in 1/2012]

The survey results in the table above shows that in the period of 2000 - 2005, a total area of mangrove loss was about 2,000 ha. Mangrove forest area increased about 5.800ha in most provinces in the period of 2005 – 2010, in which area of Quang Ninh had the highest increase of 3,671.66 ha.

### **1.3. Species and status of plantations**

#### **1.3.1. Main species**

##### **a, North region**

The planting of mangroves in Quang Ninh and the Northern coastal provinces has mostly done with capital of 327 and 661 projects, and of international organizations like the Red Cross, Japan and Denmark...

Common species:

- In places near tidal estuaries: *Sonneretia caseolaris*, *Sonneretia caseolaris* + *Kandelia candel* or *Sonneretia caseolaris* + *Dioscorea*

- Where the beach away from estuaries (salinity waters): *Kandelia candel*, *Rhizophora apiculata* or *Avicennia marina* (where the land has high salinity and high sand content)

##### **b. Mekong delta**

The survey recorded 12 dominant species in natural forest and they are being used for both experiment plantation and forest regeneration.

- 1- *Sonneratia caseolaris* (L.) Engl. Grows naturally and planted into large population near estuaries in Soc Trang, Tra vinh, Ben Tre and Tien Giang.
- 2- *Avicennia alba* Bl. Grows naturally in coastal area on muddy clay soil far from river estuaries in Ca Mau and Kien Giang.
- 3- *Avicennia marina* (Forsk.) Grows naturally on mixed sand and clay in coastal areas of Bac Lieu and Kien Giang. Is planted for experiment in Kien Giang.
- 4- *Rhizophora apiculata* BL. Is a popular species on rich clay and mixed sand clay behind *Avicennia* forest in all Southern coastal provinces.
- 5- *Rhizophora mucronata* Lume. Is planted scatteringly in shrimp ponds in Ca Mau and Bac Lieu.
- 6- *Bruguiera parviflora* (Roxb.)Wight & Arn. Grows naturally and planted for experiment in Ca Mau, Bac Lieu, Soc Trang and Kien Giang.
- 7- *Bruguiera cylindrica* (L) Bl. Grows naturally and planted for experiment in Ca Mau, Bac Lieu, Soc Trang and Kien Giang.
- 8- *Ceriop decandra* (Griff.) Ding Hou. Planted for experiment in Ca Mau, Bac Lieu, Soc Trang, Kien Giang.
- 9- *Lumnitzera racemosa* Wild. Grows naturally and planted for experiment in Bac Lieu.
- 10- *Xylocarpus granatum* Koenig. Grows naturally in Bac Lieu, Soc Trang, Kien Giang.
- 11- *Nypa frutican* van Wurmb. Planted in large areas in Tien Giang, Ben Tre, Tra Vinh, Soc Trang, Ca Mau, Kien Giang.

- 12- *Threspacia populnea* (L.) Soland. ex Cor. Planted in experiment in Bac Lieu, Soc Trang, Kien Giang.

### 1.3.2. Mangroves planting area in the survey provinces

#### a, North region:

Area for planting mangroves until 2011 in the survey provinces is shown in the following table:

**Table 10:** Mangroves planting area in the survey provinces

No	Provinces	Total	Pure species				Mixed species
			<i>Avicennia</i>	<i>Rhizophora stylosa</i>	<i>Rhizophora (Kandelia)</i>	<i>Sonneretia</i>	
1	Quảng Ninh	2,168.49	-	376.35	963.30	350.00	478.84
2	Hải Phòng	4,309.80			261.00	1,395.00	2,653.80
3	Thái Bình	7,084.00			1,492.00	710.00	4,882.00
4	Nam Định	3,546.50			3,546.50		
5	Thanh Hóa	1,192.80		20.48	477.52	181.00	513.80
6	Hà Tĩnh	764.50		207.10	113.70	48.40	395.30
<b>Total</b>		<b>19,066.09</b>	<b>-</b>	<b>603.93</b>	<b>6,854.02</b>	<b>2,684.40</b>	<b>8,923.74</b>

[Source: Survey results 1/2012]

The survey result shows that up to 2011, the six Northern provinces have planted a total of about 19,000 ha of mangroves. Of which:

Mixed forest was 8923.74 ha, pure stand was about 10,000 ha.

Thai Binh province planted the most of about 7,000 ha, followed by Hai Phong, Nam Dinh and Quang Ninh province.

Ha Tinh province planted at least reached only 764.50 ha.

The survey result shows that up to 2011, the six Northern provinces have planted a total of about 19,000 ha of mangroves. Of which:

Mixed forest was 8923.74 ha, pure stand was about 10,000 ha.

Thai Binh province planted the most of about 7,000 ha, followed by Hai Phong, Nam Dinh and Quang Ninh province.

Ha Tinh province planted area was smallest (764.50 ha).

#### **b. Mekong delta**

Platation results from 1998-2010 indicated that 26.389 ha forest have been planted as protection forest mostly used mangrove species. Detail was showed in the following table

**Table 11:** Results of protection forest planting in provinces period 1998-2010

Item	Total	Year												
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Toal</b>	<b>18.068</b>	<b>275</b>	<b>2.352</b>	<b>2.648</b>	<b>1.964</b>	<b>2.100</b>	<b>2.045</b>	<b>1.249</b>	<b>902</b>	<b>469</b>	<b>903</b>	<b>1.244</b>	<b>1.565</b>	<b>352</b>
Tiền Giang	2.309		150	300	182	300	271	266	200	150	150	70	150	120
Bến Tre	882	135	123	147	81	50	38	9	50	40	16	53	80	60
Trà Vinh	2.934	140	163	189	450	383	170	265	340	249	130	140	180	135
Sóc Trăng	1.260	0	600	0	0	0	0	0	0	0	0	160	500	0
Bạc Liêu	2.603	0	742	563	169	429	450	0	0	0	0	200	50	0
Cà Mau	3.919		271	795	485	279	110	144	116	30	526	598	565	
Kiên Giang	4.161	0	303	654	597	659	1.006	565	196	0	81	23	40	37

[Sub-FIPI, 2010].

Field assessment conducting by Sub- FiPi showed that average planting success was 78.77%. Provinces with the highest success were Soc Trang (91.7%), Tra Vinh (87.8%), Ben Tre (over 80,2%), The lowest success found in Bac Lieu (43.6%), Kien Giang (57.3%), Ca Mau (79.5%)<sup>2</sup>.

## 1.4. Aquaculture

### 1.4.1. Current status of coastal aquaculture

For years, the field of aquaculture in the Northern coastal provinces has witnessed a significant growth in terms of area (the area of aquaculture in 2005 was about 35,215 ha) and yield (in 2005 reached 22,150 tons). Details are shown in Table 10.

Sugpo prawn was the largest proportion in brackish water and other species such as prawn, nipper shrimp white shrimp and some other native species of shrimp. Apart from shrimp, there were also many other subjects developed with high yield as mollusks and seaweed.

- **Brackish water prawn**

Brackish water prawns were identified as major species in the coastal provinces of Vietnam. Apart from regions where tidal brackish water sources is regularly provided, brackish water shrimp was fed in the regions where have been changed from rush land, salt production, bare land, coastal sand- bank, low-yield rice fields, fallow land and garden. Farming methods were diverse: intensive shrimp farming, shrimp - rice rotation farming, shrimp - forest, with the form of intensive, semi-intensive farming, advanced extensive improvements and extensive farming and etc.

- **Mollusks:**

<sup>2</sup> Nguồn: Tổng hợp từ các báo cáo đánh giá kết quả thực hiện dự án 661 của 11 tỉnh ĐBSCL do Phân viện Điều tra Quy hoạch rừng Nam Bộ thực hiện, T.6/2010.

To effectively exploit the natural conditions of estuaries, coastal tidal flats, some localities have adopted planning and developments of some mollusks which have exporting value and protect the natural breeding grounds.

Clam (oysters) was an animal with the greatest output of goods that was strong development of aquaculture in the provinces of Nam Dinh, Thai Binh and etc.

- **Crabs:**

Blue crabs were raised in some coastal provinces with specialized methods or shifting farming, intercropping crab with other objects. Crab breed was mostly natural. In three years, thanks to technical advances in the study of breeding, blue crabs were transferred to various localities. Crab varieties from breeding has been raised for goods in the provinces of Hai Phong , Nam Dinh, Thai Binh , Ninh Binh, Nghe An and Thua Thien –Hue. The crabs grew faster and had a high survival rate. At present, many localities are continuing to deploy projects of transferring the crab breeding technology to have enough breed to grow for commodities.

In 2005, Quang Ninh, Hai Phong, Ninh Binh and Nam Dinh province had crab yield of 1,700 tons, 1,500 tons, 1,100 tons and 1,000 tons, collectively.

**Table 12: Changes of area, productivity and yield of blackish water shrimp**

No	province	2003			2004			2005		
		Area (ha)	Productivity (ton/ha)	Yield (ton)	Area (ha)	Productivity (ton/ha)	Yield (ton)	Area (ha)	Productivity (ton/ha)	Yield (ton)
1	Quảng Ninh	10.440	0,32	3.290	11.300	0,41	4.600	11.500	0,43	5.000
2	Hải Phòng	6.929	0,37	2.538	5.457	0,44	2.400	5.300	0,57	3.000
3	Thái Bình	3.187	0,54	1.720	3.460	0,61	2.100	3.799	0,56	2.130
4	Nam Định	4.500	0,71	3.200	4.500	0,73	3.300	4.500	0,93	4.200
5	Ninh Bình	1.581	0,76	1.195	1.910	0,59	1.118	2.056	0,69	1.420
6	Thanh Hoá	4.120	0,56	2.323	4.120	0,49	2.000	4.120	0,63	2.600
7	Nghệ An	1.150	0,78	900	1.220	0,82	1.000	1.500	1,00	1.500
8	Hà Tĩnh	1.780	0,92	1.630	2.120	0,71	1.500	2.440	0,94	2.300
9	Long An	4.221	1,00	4.219	5.133	0,79	4.067	6.100	1,26	7.690
10	Tiền Giang	3.338	1,29	4.322	3.439	1,83	6.297	4.000	2	8.000
11	Bến Tre	27.818	0,46	12.731	32.368	0,64	20.561	32.478	0,81	26.300
12	Trà vinh	15.072	0,50	7.500	18.800	0,64	12.000	20.000	1	20.010
13	Sóc Trăng	49.548	0,45	22.356	48.856	0,56	27.407	45.000	0,76	34.000
14	Bạc Liêu	109.258	0,50	54.731	115.659	0,62	72.209	116.473	0,55	63.610
15	Cà Mau	226.299	0,28	62.241	231.110	0,32	72.936	236.255	0,35	83.860
16	Kiên Giang	51.044	0,20	10.183	67.725	0,22	15.228	74.771	0,27	20.060
<b>Tổng</b>		<b>520.285</b>	<b>0,60</b>	<b>195.079</b>	<b>557.177</b>	<b>0,65</b>	<b>248.723</b>	<b>570.292</b>	<b>0,80</b>	<b>285.680</b>

[Ministry of fishery, 2006]

#### 1.4.2. Some effective models of aquaculture in mangroves

##### **a. Vietnam coastal shrimp farming**

Area and production of shrimp in Vietnam for years has been increasing in terms of area, productivity, and yield and production value.

In 2005, in the coastal provinces of the Red River Delta where shrimp was raised by extensive farming method and advance extensive method accounted for 85.9 % of the region's shrimp farming. Area for intensive shrimp farming and semi-intensive farming was 3,825 ha (14.1%). Production of shrimp in 2005 was 15,750 tons, increased 13,247 tons compared to that in 1999 (up 5.3 times ), the average yield of shrimp in this area remains very low (in 2005 was 580 kg / ha).

##### **b. Some models of aquaculture in mangroves**

In Vietnam, the type of shrimp feeding under a canopy of mangroves forests was also a form of ecological farming, stocking breed sparsely and salvaging natural food, hence the forests develop normally. But shrimp yield was low because forest cover reduces light intensity in the waters, limiting development of natural food resources. This method is now very popular in the Southern region. The efficiency of

this method is relatively higher and safer than other feeding methods. It was the advantage of the biological relationship between forests and aquatic objects, between each other aquatic species in the aquatic food chain. This was the combination of multiple forms of aquatic species with mangroves. Feeding objects were tiger prawns, shrimps, goby, bass, fish, grouper, clams, oysters, ... Methods can be extensive farming, improved extensive and semi-intensive farming.

Currently, the method of development of aquaculture combined with forest is still major. Aquaculture without forests is developing. In present, for aquaculture in mangroves, shrimp farming methods is mainly implemented with no stocking (using natural breed), no food, and keep all year round. This method yield is instable and low economic efficiency, and decrease as tree age increases (lower natural food). The average yield is 150kg/ha/year.

More advanced feed method is to stock additional shrimp, crab, fish... Feeding subjects are regularly harvested and additionally stocked (1-2 months / time) and food is complementarily provided. Limitation of this method is that breed of species such as crabs, fish, seaweed,... and shrimp often prone to disease. The yield is from 200-250 kg/ha/year.

Model of aquaculture without forests is potential of productivity and economic efficiency. Improved extensive or semi-intensive and small-scale shrimp farming are as the current selection. Crab feeding is prospective, but limited breed sources.

- **Models of shrimp-crab farming in mangroves of Ca Mau province:**

The efficiency of integrated mangrove aquaculture farming in Ca Mau province showed that there is a difference between different models. The alternative extensive shrimp farming models without mangroves are not very effective, but the models of shrimp – crab farming in mangroves show differences with different rate of mangrove areas. The models with 30 – 60% of mangrove areas are the most efficient. While the effect of models with over 60% mangroves is lower than that of models with less than 30%.

- **Models of aquaculture farming in mangroves in fishery – forestry enterprize No. 184 of Ca Mau province:**

In general, models with less than 5 ha of farming area account for a high percentage. Apparently, the firm knows how to split the farming areas into small areas for to make it easier for managing and nurturing.

The *Rhizophora* – shrimp farming models bring a profit per labor at VND 3.31mil/ha and the percentage of profit and investment cost is 157%. Meanwhile those of the crab monoculture models are VND 1.65,1 mil/ha and 89%.

However, if we use this formula:

“Ratio of expense to margin profit”

= (Total profit of alternative farming model – total profit of current model) /

(Running cost of alternative farming model – Running cost of current model)

= (3505 – 5416.5) / (1854.4 – 2108.3)

= 7.5 ( If this ratio is 1.5, it is considered as “profitable” in theory)

Therefore, the farming of shrimp in *Rhizophora* is not very profitable, and should be reconsidered if being extended in the future, or should the specializing farming models be more profitable/ efficient?

- **Eco shrimp farming in mangrove forest (Ngoc Hien – Ca Mau).**

Total area of local land is 12.8 ha, among which the water surface area for shrimp farming is 4 ha, accounting for 30% of the total area. The canals system is at 30 m distance; and the rest of the area is for *Rhizophora* planting. The source of breeding shrimps are from natural shrimps and supplemented shrimps which are bred at 4 – 6 shrimps/m<sup>2</sup>. The shrimps used are natural white shrimp (*Penaeus merguensis*), greasy back shrimp (*Metapenaeus ensis*), white-leg shrimp (*Litopenaeus vannamei*) and supplemented tiger prawns (*Panaeus monodon*). The density of planted *Rhizophora* is two trees per square meter of ground area. After 90 days of cultivating, when the shrimps reach 30 individuals per kg, growers can take the first harvest, then increase up to two harvests each month in the next six months, with harvest time lasts from three to five days. The harvesting will finish by the seventh month with shrimps range from 13 to 15 individuals per kg. In the first two or three years of farming, the productivity is 0.5 ton/ha per year, but the productivity will decrease to 0.25 ton/ha in the following years. Obviously, extensive shrimp farming in mangroves only yield high profit in the first couple of years as the productivity declines almost a half. The profit is about VND 60 mil on average, which is about VND 4.8 mil/ha each year.

- **Aquaculture farming in mangroves in Can Gio district of Ho Chi Minh City.**

The income structure on mangrove forests in Can Gio district varies and each farming household can earn from VND 15.2 to 16.8 mil each year. The percentage in turn is from forest protection (21 – 25%), aquatic products (20.5 – 32%) and other sources (11 – 12%). Receivers of granted forest land not only collect products from the



forests but also earn considerable profit from aquaculture farming with VND 3.5 to 4 mil for each household each year.

- **Advanced extensive model of shrimp (*Metapenaeus*) in mangroves in Yen Hung district –Quang Ninh province:**

The total feeding area was 5 ha of (there was a canal of 1.2 to 1.5 m in depth in the middle of area). Nipper shrimp (*Metapenaeus*) size was 2.5 grams/shrimp, stocking 151 kg (approximately 60,400 shrimp). Stocking density was 1.21 shrimp/m<sup>2</sup>. 55 days after stocking, shrimp was harvested by using bags and assisted by light. The entire of shrimp was totally harvested in five days. Yield was approximately 0.061 tons / ha).

- **Crab farming in mangroves**

Farming crabs in cages was introduced to Can Gio district since 1990. The cages are made from bamboo at 1.2m x2mx5m size or 3 m<sup>3</sup> each. They are then tied together with floats, then put under water in mangrove areas, with four fifth of the cage submerged under the water surface. The creature is fed either for meaty crabs or crabs with fat through this kind of farming.

- **Rock hind fish farming in mangroves**

Rock hind fish (*Epinephelus adscensionis*) farming in mangroves was introduced to Can Gio district since 1995. The farming approach was cultivating in ponds with mangroves at small scale. The pond area is usually 200 m<sup>2</sup>, the farming density is 0.18 fish per m<sup>2</sup> or 30 to 40 fish in each pond. The original weight of the fish was from 200 to 300 grams each. Alternative extensive farming method is applied. After five to six months of cultivating, the fish will reach a weight from 0.6 to 0.7 kg each and can be harvested.

- **Bloodshell farming in mangroves:**

Feeding oysters in mangroves carried out mainly in the Southern and a part of the Northern coastal area (such as Quang Ninh). The bottom of pond was mud and had fewer slopes. Nets were used to surround and breed with the number of 300-800 fish /kg was stocked. Culture time was from 6-8 months, the volume of harvest was 10-25 fish / kg.

- **Mud creeper farming in mangrove forest:**

Mud creeper farming in mangroves was introduced to Can Gio district since 1995. This farming method is simple, and does not require high investment cost or

complicated techniques. Use a net to fence around a area of muddy soil of a few thousand square meter, with breeding density around 200 kg of snail per 100 m<sup>2</sup>, the snail size is around 100 to 150 snails per kg, with cost from VND 1,500 to 3,000 per kg. After four to six months of cultivating without any extra feeding, the snails could reach up to 30 to 50 snails per kg, selling at VND 6,000 to 12,000 per kg.

### **c. Aquatic advantages in some localities having mangroves**

Survey results of advantages of natural harvest and aquaculture in several localities having mangroves found that:

- Natural harvest (*Lucina philippinarum*, earth worm, *shrimp*, *fish*, *octopus*): approximate 200 tons, creating a turnover of 3,274,000,000 VND.
- Aquaculture (shrimp, fish) with extensive method: 230 ha, creating an income for aquaculture households of 400,000,000 VND/year, gaining about 1,750,000 VND/ha/year in average.

- In Thai Đò commune, Thai Thuy district, Thai Binh province, 200ha mangroves created the yield of aquatic products as follows:

- Natural harvest (fish, crabs, oysters,...): about 6,300,000,000 VND/year
- Aquaculture (Nipper shrimp (*Metapenaeus*), bass) with semi-intensive method: area of 300 ha created an income of 9,000,000,000 VND/year, gained 30,000,000 VND/ha/year in average.

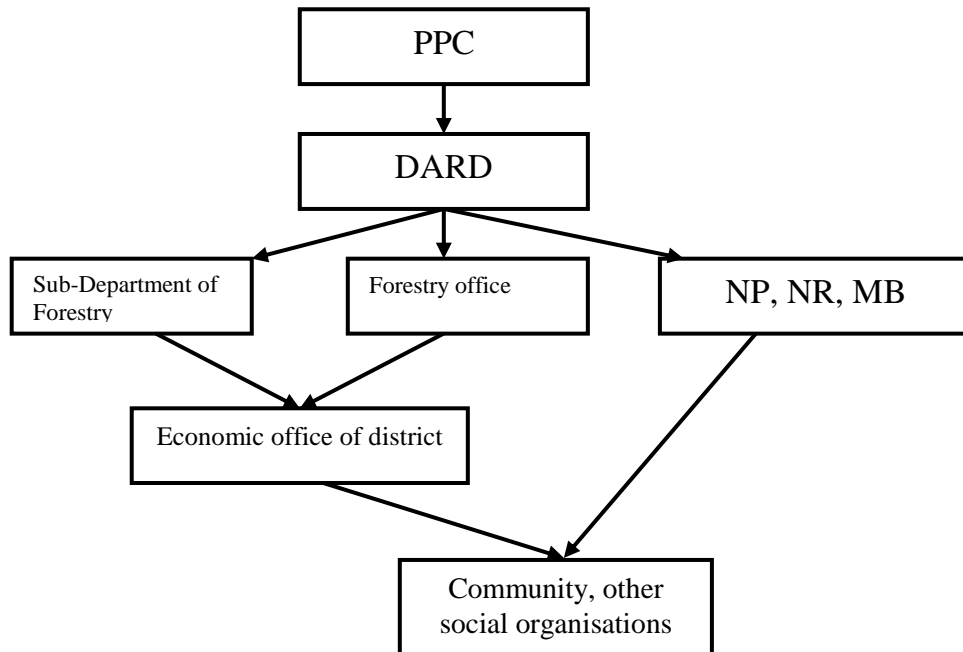
- In Thuy Thường commune, Thái Thuy district, Thái Bình province 1,000 ha mangroves created the yield of aquatic products as follows:

- Natural harvest (shrimp, crab, fish, snail...): about 7,680,000,000 VND/year.
- Semi-intensive aquaculture (Nipper shrimp (*Metapenaeus*), bass, crab): area of 700 ha created an income of 14,000,000,000 VND/year, gained 20,000,000 VND/ha/year in average.
- Intensive aquaculture (oyster): area of 50 ha created an income of 14,000,000,000 VND/year, gained 280,000,000 VND/ha/year in average.
- The survey results of aquatic benefits obtained based on mangroves (wild-caught and aquaculture) in some localities has shown that mangroves were well protected and maintained, that has given local people very substantial income from fishing and aquaculture.

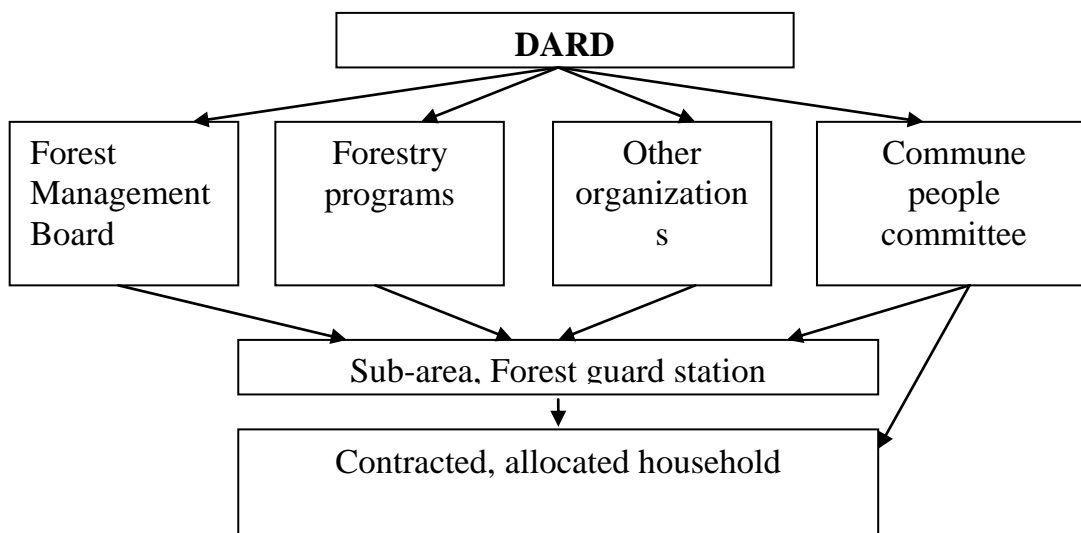
## 1.5. Mechanism and Policies

### 1.5.1. Structure for forest management

Mangrove management structure of the survey provinces:



**Figure 2a: Mangrove management structure in Quang Ninh province and the Northern Delta**



**Figure 1b: Mangrove management structure in Mekong delta**

In the north, PPC usually assigns the management model of mangroves of the provinces to DARD; under DARD is Sub-Department of Forestry or Forestry Office, NPs, NR and mangrove MB; followed by the Economics Office of districts; finally communities-communes/villages (graph 2a). The survey result shows that the management model was reasonable and the mangrove management in the Northern

provinces was implemented by the communes, and the communes assigned to village communities.

Mangroves in communes were managed by the CPC; most of mangroves were not allocated for households to manage, because they were remote from the residential areas. A common form was formation of mangroves protection team or board including government representatives, police, military, veterans and leaders of the village which has mangroves in the form of part-time basis. The wage may be deducted from the forest protection fund of the Red Cross or 661 project.

Some localities such as Dong Rui commune - Tien Yen district, Bang La – Do Son city, and Dai Hop commune- Kien Thuy district has built pilot models of community-based management of mangroves. This management model promotes initially efficiency in the management of local mangroves.

Còn ở ĐBSCL quản lý RNM có nhiều đầu mối như các xí nghiệp Lâm nghiệp, BQL RNM làm cho việc tổ chức chỉ đạo, giám sát có nhiều khó khăn hơn. (Hình 2b).

*1.5.2 .Policies relating to mangroves have been applied (on forest allocation, forest contract, benefits and associated agricultural production, investment ...)*

**a. Legal documents were issued:**

*Laws:*

- Land Law promulgated in 2003
- Law on Forest Protection and Development in 2004
- Law on Environmental Protection in 1994

*The Decree of the Government:*

- Decree No. 181/2004/ND-CP dated 29/10/2004 on the implementation of the Land Law.

- Decree No. 109/2003/ND-CP dated 23/9/2003 on the conservation and sustainable development of wetlands.

- Decree No. 23/2006/ND-CP dated 03/3/2006 on implementation of law on forest protection and management.

- Decree No. 135/2005/ND-CP dated 11/8/2005 on contracting agricultural land, production forest land and water surface for aquaculture in Agricultural and Forestry enterprises.

*The decision of the Prime Minister:*

- Decision No. 186/2006/QĐ-TTg dated 08/14/2006 of the Prime Minister on promulgating regulations on management of forests.

- Decision No. 178/2001/QĐ-TTg dated 12/11/2001 of the Prime Minister on government benefits and obligations of households and individuals who are assigned, leased, contracted forests and forest land.

- Decision No. 661/QD-TTg dated 29/7/1998 of the Prime Minister on objectives, tasks, policies and implementation project on planting 5 million hectares of forest.

*The Circular of the MARD and inter-ministry:*

- Circular No. 99/2007/TT-BNN dated 06/11/2006 of MARD on guiding the implementation of some articles of the Forest Management Regulation issued together with Decision No.188/2006/QD-TTg.
- Circular No. 57/2007/TT-BNN on 06/13/2007 on amending and supplementing some points of Circular No. 99/2006/TT-BNN.
- Joint Circular No. 80/2003/TTLB-BNN-BTC on 03/9/2003 of MARD and Ministry of Finance on guiding the implementation of QD178/2001/QD-TTg.
- Land Law stipulated all land owned by the whole population and the State is representative of the owner and has the right to dispose of planning, quotas, limits, deadlines, assignment, lease, withdrawal, allowing changes of purpose of land use, and evaluation.
- Law on Forest Protection and Development prescribes the forms of forest management including forest allocation and lease, land allocation for afforestation, lease land for afforestation, acknowledgement of forest use rights and ownership right of production plantation forests, forest transferred from other forest owners. Principles of forest allocation, lease, and withdrawal: Make proper jurisdiction concurrently with land allocation, land lease, land withdrawal, purpose change, and limits must conform to the provisions of land law.
- The Decrees of the Government, decisions of the Prime Minister and circulars had no specifically legal documents for mangroves, but there was generally legal framework and also some specific mention on the protection and development of mangrove forests, benefit policies in forestry - fishery production, and ecotourism in mangrove forests.

**b. Implementation of the policies and documents at localities**

- On the basis of policies, regulations promulgated by the State and localities apply on specific conditions to suit.
- The provinces in this region are ongoing investment in protection, management and afforestation of Project 661 mainly.
- There were two localities building the project of planning, restoration and development of mangroves of Quang Ninh and Hai Phong provinces. Hai Phong city had regulation on additional support of forest management (Hai

Phong City PC issued Decision No. 196/QD-UBND in January 25, 2006 about additional policies to support implementation of 611 Project in Hai Phong city, supporting 50.000d/ha/year for forest protection in the year 3, 4 and 5 of the project. Coastal protection forests in critical areas of Cat Ba NP is supported 50.000d/ha/year, assistance period is 5 years). The support has prompted people to participate in forest protection, especially in coastal protection forests. There were pilot plantation programs in key critical areas to protect sea dikes with high investment rate, following procedure and unit price of capital construction (considered as dyke construction items with the cost estimated was 132,529,999 VND /ha).

- In Nam Dinh province, wetlands and mangroves of Giao Thuy District was planning to establish Xuan Thuy NP with an area of 7,100 ha, as the International RAMSAR (International Convention on Wetlands in the world). Here, currently a development project is being built and an eco-tourism project is expected to build.

## **II. Evaluation of mangrove planting of some programs and projects in the survey provinces.**

### ***2.1. Programs and projects of mangrove planting in the northern provinces***

#### ***2.1.1. Quang Ninh province***

From 1996 to 2008, Quang Ninh province had a lot of projects and programs of coastal mangrove planting. The total planted area was about 4,586 ha with a total cost of VND 12,285,894,000 (2,679,000 VND/ha in average). But now about 1,926 ha of forest remained, including:

- **Program of mangrove planting of the Red Cross of Japan**

According to the report of the Quang Ninh Red Cross, from 1996 to 2005, total area of planting coastal mangroves in Quang Ninh was 1,933 ha (215 ha /year in average). 1-3 months after planting, rate of established plantation was fairly high (average 80%), but after 2-3 years, the rate of established plantation in the sites was very low. Some parts of forests in many localities died completely. According to statistics of the Red Cross in 2005, the area of mangroves of the project existed only about 675.65 ha (35 % of the total planted area) (Quang Ninh Red Cross, 2005).

According to the Quang Ninh DARD, up to 6/2008 this forest area was only about 785.15 ha (40.6 % of total planted area). The remaining area concentrated mainly in places where trees were planted in blanks in natural forests or other places with established forest or replanted several times. However, the success of the program was undeniable, because of its encouragement for a large number of people, members

and organizations participating in and organizing activities and extensive propaganda to help raise people's awareness of mangrove role and awareness of mangrove protection.

- **PAM 5325.**

The project was implemented in 3 years (1996-1998) and 463 ha of mangroves planted in eight coastal districts of Quang Ninh. Survival rate was over 90 %. In particular, the project has made a forest belt of *Sonneretia caseolaris* for the dike protection in some communes in Pha Rung area - Yen Hung District. *Sonneretia caseolaris* are currently growing and developing very well, promoting effective in preventing waves, creating a green belt and protecting the sea dykes, as well as increasing a significant income of aquatic resources for local people.

However, due to a lack of mangrove land use planning, some plantation area in Hung Yen, Hoang Bo, Ha Long, Cam Pha and Van Don districts had been devastated and changed the purpose to extensive shrimp farming, ...

According to statistics of Quang Ninh DARD, up to 6/2008 forest area of PAM project was about 210.81 ha (46 % of total planted area). Apart from the reasons mentioned above, a very important reason for reducing the forest area was that forest areas after planting handover to the authorities of communes, but without benefits and clear monitoring mechanism, leading to a loss and significant decrease in the quality and quantity of planted mangroves.

- **ACTMANG of Japan**

The project has planted 150 ha of *Kandelia candel* in Dong Rui commune - Tien Yen district for 2 years (2000-2002), but after a year planting, the trees' growth and development was poor. The cause was defined being as unsuitable planting sites. The trees in some of the planted areas in fallow squares of shrimp died massively and had low rate of established plantations, due to water pollution. Currently, plantation area of the project remains very small (about 66 ha), scattered or concentrated into small patches of natural mangrove trees such as *Aegiceras corniculatum*, *Bruguiera*, Mangrove ,...

- **KTV Project of Holland.**

The project planted 750 ha of *Kandelia candel*, *Bruguiera* and Mangrove in Dong Rui and Hai Lang communes-Tien Yen district. Plantations established primarily on the blanks in natural forests. According to the local MBs, the forest area was still about 400 ha (53 % of total planted area), the survival rate was 85%.

- **Suma – Denmark Component.**

The project planted 2,450 ha in 2003 and 2004. Currently, this area is about 170 ha, accounting for 37%. The reason is that the forest was planted in areas with rapid

salinity changes and the plants did not adapt. The average height of the forest is currently around 140-180 cm; the survival rate was 85%.

- **661 project.**

According to the 2008 plan, Quang Ninh province planted 840 ha of mangroves including *Kandelia candel*, *Avicennia*, mangrove, ... But the survival rate and rate of established plantation was not high. The area is now only about 294 ha (not exceed 35 %). It is caused by low investment and slow implementation of the plan, leading to unsuitable seasonality, destruction by boats and people fishing products.



**Figure 3: Mangroves of *Avicennia marina* and *Rhizophora apiculata* + *Bruguiera parviflora* in Quang Ninh**

- **Model of planting in fallow shrimp squares**

Afforestation in abandoned shrimp square by the Forest Science Institute was implemented in 2003 in Ha village- Rui Dong commune- Tien Yen district. 12 months container stock/seedlings was planted, including four species are: *Kandelia candel*, *Sonneretia caseolaris*, *Rhizophora apiculata* and *Avicennia marina*; using mixed planting practice in rows, 17500-19600 *Kandelia candel* plants/ha with 640 *Sonneretia caseolaris* trees /ha or 2,500 *Rhizophora apiculata* with 2,500 *Avicennia marina*. The plants were planted in different times to suit different tidal regimes and salinity of sea water. One month before planting, proceeded to break up the drains and dykes for tidal water to flow easily into the areas.



Results: Survival rate of mangrove and *Kandelia candel* was fairly high (>80%) and about 15% higher than that of control experiments (planted by propagules); Its target of diameter and height growth was 21.5-40% higher than that of the control experiment.

### 2.1.2. Hai Phong City

Previously, natural mangroves appeared the entire of system of Hai Phong sea dykes, but due to the economic development that has been destroyed and converted to other uses. In recent years, people's awareness of the importance of protection and mangrove ecological environment protection has been increasing, Hai Phong has received the assistances of international organizations, of the State to plant and restore mangrove ecosystems.

From 1997 to 2008, Hai Phong City has many projects and programs of planting coastal mangroves. The total planted area was about 5379 ha. The result is presented in the following table:

**Table 13: Statistics of mangrove plantation area in Hai Phong city**

No	Programs/Projects	Area (ha)	Location
1	The Red Cross of Japan	2,227	Đồ Sơn, Kiến Thụy, Hải An, An Lão, Cát Hải, Tiên Lãng,...
2	PAM 5325	550	Đồ Sơn, Kiến Thụy, Thủy Nguyên, An Lão,...
3	ACTMANG	1,202	Đồ Sơn, Kiến Thụy, Thủy Nguyên, An Lão,...
4	661	1,400	Đồ Sơn, Kiến Thụy, Thủy Nguyên, An Lão,...
<b>Total</b>		<b>5,379</b>	

[Report on current status and solutions for developing mangroves in Hai Phong city, 2008]

Major species and types of forest in Hai Phong city as follows:

- Pure *Kandelia candel*: 1,000 ha.
- Pure *Sonneretia*: 1,000 ha.
- Mixed *Kandelia candel* + *Sonneretia*; *Kandelia candel* + *Sonneretia* + *Avicennia*: 3.379 ha.

The species was mainly grown in estuaries, tidal flats of the coastal districts and towns.

In the 2000s and earlier, most programs and projects of planting mangroves in Hai Phong focused on pure plantations of *Kandelia candel* and *Sonneretia*. In recent years, due to notice the benefits of mixed plantations, Hai Phong has planted over 3,000 hectares of mixed mangroves with mainly *Kandelia candel* and *Sonneretia*, and

few area with *Aegiceras corniculatum* and mangrove. Currently, the growth and development of forest area of Hai Phong is quite good, but rate of established plantations is low (about 38 %).



**Figure 4: *Kandelia candel* forest and mixed *Kandelia candel* and *Sonneretia* forest in Hai Phong**

Besides, Hai Phong had some experiential models bringing high efficiency, especially for preventing waves and protecting sea dykes.

- **Model of afforesting two canopies for preventing waves and protecting sea dykes**

In 2002 – 2003, at Tan Thanh commune -Kinh Duong urban district - Hai Phong, Forest Science Institute built a model of two species: *Sonneretia caseolaris* (level 1) with a density from 800 to 1,200 trees/ha and *Bruguiera* (level 2 ) with a density of 8,250 trees/ha.

Two canopies mangrove mangroves have created, that had a good growth and effective prevention of waves and protection of sea dykes such as the height of waves was reduced from 120 cm in front of the forest down to only 20-30 cm behind the forest. Also, alluvial sedimentation rate under the mangroves was 10 times higher than that of the control experiment.

- **Model of planting *Sonneretia caseolaris* in black sand site**

Hai Phong Center for High-Tech Agriculture - Forestry planted *Sonneretia caseolaris* in black sand at Tan Thanh commune- Kinh Duong urban district-Hai Phong province in 2004.

### 2.1.3. Thai Binh province.

Thai Binh is one of the provinces in the North which had successful mangrove plantations through the establishment of dyke protection forest belts and implementation of mangrove planting projects and programs.

**Table 14: Synthesized data of mangrove planting area in Thai Binh province**

No	Programs/Projects	Area (ha)	Location
1	Danish Red Cross	2,345	Tien Hai and Thai Thuy district
2	661	5,687	Tien Hai and Thai Thuy district
3	Others	941	
<b>Total</b>		<b>8,973</b>	

*[Results of re-planning three forest types of Thai Binh province, 2006; Report on current status and solutions for mangrove development of Thai Binh, 2008]*



**Figure 5: Pure *Kandelia candel* forest and mixed *Kandelia candel* + *Sonneretia* in Thai Binh province**

From 1997 to 2008, Thai Binh province planted 8,973 ha of mangroves. Of which 2,276 ha of pure *Kandelia candel*, 2,697 ha of pure *Sonneretia* forest and about 4,000 ha of mixed forest. However, according to Thai Binh DARD's evaluation in 2008, the rate of established plantations was still low (about 42.23 %). The reasons

were the early check before acceptance (1-3 months after planting), sea waves, storms and shipworm's clinging. 3 years after planting, *Kandelia candel* still died massively. Also, the bad technical application, no process, and unrealistic management and protection were reasons.

#### 2.1.4. Nam Dinh province

According to a report on status and solutions for mangrove development 2008 of Nam Dinh, the mangroves were planted here in 1997 funded by the Danish Red Cross. There were also national projects such as PAM and 661. As of 2007, Nam Dinh has planted 5,336 ha of forest with main species of *Kandelia candel*, *Sonneretia*, *Aegiceras corniculatum*, mangrove ...which were planted mostly in estuaries and coastal tidal areas.

**Table 15: Synthesized data of mangrove planting area of Nam Dinh**

No	Programs/Projects	Area (ha)	Location
1	Danish Red Cross	2,231	Giao Thủy, Hải Hậu, Nghĩa Hưng,...
2	PAM 5325	550	Giao Thủy, Hải Hậu, Nghĩa Hưng,...
3	661	1,450	Giao Thủy, Hải Hậu, Nghĩa Hưng,...
4	Others	1,105	Giao Thủy, Nghĩa Hưng
<b>Total</b>		<b>5,336</b>	

[Source: Report on current status and solutions for mangrove development of Nam Dinh province, 2008]

Mangroves that were planted in coastal area in Nam Dinh influenced by unstable alluvial grounds due to natural movements of flows of the Red River. Also, some other factors such as storms, tides, and shipworm's clinging and high salinity water caused to massively dead trees, leading to a decrease in forest area and insufficient density for establishing forests after many years. Besides, planning was not flexible/realistic, considering in market factors only, did not consider in building and protection elements of mangroves.



**Figure 6: Pure *Aegiceras corniculatum* forest and mixed *Kandelia candel* + *Sonneretia* forest in Nam Dinh**

#### *2.1.5. Ninh Binh province*

Ninh Binh had the smallest mangrove area in the study area. In recent years, Ninh Binh planted about 1,233 ha of mangroves (the entire area was located in Kim Son district). The forests planted here in 1997 funded by Denmark Red Cross, and recently 661 have been implemented in the area. Because planting project of Denmark applied the same species structure and techniques of afforestation for the whole mangrove area of Ninh Binh province in the previous years, hence mangroves were mainly pure *Kandelia candel* or *Sonneretia* forest. Mixed forests were planted from 1999 up to now through 661 project. At the same time, the localities conducted additional planting of *Sonneretia* on existing pure *Kandelia candel* forest for the purpose of forming multi-layered and mixed forests. That has obtained positive results.





**Figure 7: Pure *Kandelia candel* forest and mixed *Kandelia candel* + *Sonneretia* in Ninh Binh**

#### 2.1.6. Thanh Hoa province

6 coastal districts of Thanh Hoa have mangroves and tidal zones that mangroves can be planted. This area is mainly in the communes bordering the sea, estuaries and creeks. Because early identification of the role of coastal protection mangroves, from 1990, Thanh Hoa has invested in planting 1,512.5 ha of mangrove species as follows:

From 1990 - 1993: UNICEF UK (773 Project) has invested in planting 115ha of *Aegiceras corniculatum* and *Bruguiera* in the quagmire of the three coastal districts of Quang Xuong , Hoang Hoa and Son Nga .

From 1992 - 1997: PAM 4304 afforestation project has invested in planting 255ha *Aegiceras corniculatum* and *Bruguiera* at five coastal districts of Tinh Gia , Hoang Hoa , Quang Xuong , Hau Loc and Sam Son town.

From 1997 - 2005: The Vietnam- Japanese Red Cross has invested 1142.5 ha *Aegiceras corniculatum* and *Bruguiera*, *Kandelia candel*... at 3 districts of Nga Son, Hau Loc and Hoang Hoa.

However, the mangrove areas were mainly allocated to CPC for management. Because of dead trees, beatings up were conducted many times but the mangrove quality was not high. Due to the pressure of aquaculture growth and the ravages of

regular hurricanes in recent years, according to Results of re-planning three types of forests, Thanh Hoa, currently, has only 708.1 ha of mangroves.



**Figure 8: Pure *Kandelia candel* forest and mixed *Kandelia candel* + *Sonneretia* in Thanh Hoa**

### 2.1.7. Ha Tinh province

In Ha Tinh, mangroves were grown mainly by Non-governmental organizations in districts of Nghi Xuan, Ha Loc and Thach Ha, and Ha Tinh city. Total planted area was 1,356 ha (see table below) but so far area of established plantations were 728 ha, due to unsuitable sites (more sand), undeveloped trees and then dead trees.

**Table 16: Synthesized data of mangrove area in Ha Tinh**

No	Programs/Projects	Planting year	Area (ha)
1	Danish Red Cross	1998- 2005	739
2	United Nations Children's Fund -UK	1991- 1993	240
3	Oxfam UK&I	1991- 1996	377
<b>Total</b>			<b>1,356</b>

[Phan Nguyên Hồng & Lê Xuân Tuấn, 2007]

### 2.2. Mangrove planting in 3 GIZ projects in Mekong Delta

### 2.2.1. Mangrove restoration in highly eroded sites with wave break and silt trap fences in Kien Giang province

Erosion is a serious issue in many coastal areas. In Kien Giang Province around 34% of the coast is eroding, in some areas as much as 24 m is lost each year. Past mangrove plantings have often been unsuccessful. In severe erosion areas, all the planted mangroves are lost within one year. One of the main reasons for this catastrophic loss is the lack of protection of young plants from wave action and seasonal sediment movement following planting. Strong wave movement strips the seedlings of their leaves, pushes the plants over and uproots them. Seasonal sediment movement also uproots and buries seedlings.

The GIZ Conservation and Development of the Kien Giang Biosphere Reserve Project has designed and tested three different designs of coastal protection fences. The purpose of the fences is to reduce wave energy and to prevent sediment deposited in the early wet season from being swept away through wave action when strong monsoon wind events occur in the latter half of the wet season. The fences allow planted or naturally recruited mangrove seedlings to establish a more secure root system



**Figure 9(a). Wave break fence**



**(b) Silt trap fence**

Measurements and monitoring from the fence model showed that wave action energy is reduced up to 65% after going through the wave break fence. The wave break fence helps to trap and stabilize soft mud, enhancing the survival and growth of young plants and increase the biodiversity in the area.

The wave break and sediment trap fence have increased the surviving rates of mangrove forests in front of the impacts of waves, rubbish and deposited silt. The surviving rate of *Avicennia* forest is very high (70 -80%), which is double time higher than that of *Rhizophora* and *Nypa* palm.



In wave break fence areas where the newly deposited mud are weak and deep water, only *Avicennia* survives. This result proved that the species selection for each site needs to be based on the ecological succession study. *Avicennia* can be planted as a pioneer species in exposed areas along the coastal fringe.



**Figure 10 (a) Planting site on 2 December 2010      (b) Planting site on 28 October 2011**

The regeneration of mangrove forests in fenced areas is high, and can reach up to 20 seedlings/m<sup>2</sup> in some areas, particularly behind planted forests with natural regeneration.

This area has seen the regeneration of climax species like *Bruguiera* and *Ceriops*. Survey results in 2011 showed that there is higher biodiversity of benthic species and mangrove regeneration in fenced areas compared to the control areas.

### ***2.2.2. Mixed species planting on high elevation site with infrequent tides in Bac Lieu province***

Field survey was conducted for mangrove forest planting on high elevation sites with infrequency of tides. Several soil improvement approaches have been implemented to allow more tidal impacts on planting areas (Bac Lieu provincial forest protection sub department, 2011).

This area is within the east coast's forest protection station in Xiem Can ward of Bac Lieu province. The geographic co-ordinate of the surveyed site is (105°47'1"406; 9°13'35"018), with high topography and is only flooded with sudden high tide monthly. The indicator vegetation species here is the giant pigweed. Due to the high location with flood in high tide only, *Rhizophora* has limited growth. The area is divided into rows of 50 cm high for planting *Ceriops*, *Xylocarpus* and *Lumnitzera* since July 2011.

Previous *Rhizophora* planting attempts have failed due to high elevation of the site. Soil here is rough mixed sand clay. Due to the infrequent flood, irrigating canals need to be built in order to provide water for planted species such as *Ceriops decandra*, *C. tagal*, *Lumnitzera racemosa*, *Sindora maritime*, and *Xylocarpus mekongensis*.



**Figure 11. Rows of planted forest at 50 cm high, planted from July 2011 with three species (*Lumnitzera*, *Sindora maritime*, and *Xylocarpus*), before and five months after planting**

Field survey showed that *Sindora maritime* has reached 90 cm high and 80 cm for *Lumnitzera* on average. However, 50% of *Sindora* died from rotten roots possibly. We need to continue monitoring the salinity of ground soil, and deposition in canals. Water canals are to keep clear for leading tidal water into planted forest. The planting rows are quite high, which increases labour cost for soil upturning. In addition, the potential acid sulphate layer is exposed to light when being up turned on top of the row can increase the acidity of soil and harm the trees.

Irrigation canals can be used for growing *Rhizophora* and other mangrove species. This model needs more monitoring on both planted tree's growth and environmental factors for more accurate evaluation.

### 2.2.3. *Mixed species planting in Soc Trang province*

Single species plantation has resulted in single species forests with one canopy layer, resulting in limited protection to the dykes under the impacts of wave



**Figure 12. Mixed species planting in Soc Trang**

and strong winds. When the frequency and intensity of storms increase due to global warming, the protective role of mangrove forest has become more important for the sea dyke system along coastal areas.

Natural mangrove forests have diverse structure in both vertical and horizontal sides as well as in species composition. Thus they have higher capacity in limiting the negative impacts of climate change compared to single species forests.

In order to maintain the protective function of mangrove forests for coastal areas, we need to diversify the species, and plant different types of forest as well as their natural regeneration. In order to do this, the planting and regenerating techniques should be fully understood and acknowledged (Figure 12).

Mature forests with high density have more successful possibility in adaptation to climate change while still maintaining the natural populations and number of species. However, this approach is not applicable for large scale forest restoration programs as experience shows that in positions that are exposed to strong wave action, only young plants that are planted near mature trees can survive.

### 2.3. Investment for mangrove planting

#### 2.3.1. In the northern provinces

The sum rate of investment, projects' support for afforesting mangroves in 6 survey provinces is shown in the following table:

**Table 17: Rate of investment of projects for 1 ha of mangroves (VND/ha)**

No	Items	Programs/Projects					
		661	PAM	Red Cross	ACTMANG	KTV	Suma
I	<i>Kandelia candel</i> , <i>Avicennia mangrove</i> , <i>Aegiceras corniculatum</i> , <i>Bruguiera ...</i>	580,656	1,270,985	1,600,000	2,000,000	2,000,000	1,000,000
1	Direct expenditures	540,000	854,622	1,600,000	2,000,000	2,000,000	1,000,000
-	Collecting seeds	90,000	414,000	700,000	1,300,000	1,300,000	700,000
-	Transporting seeds	180,000					
-	Planting labour	200,000	440,622	400,000	700,000	700,000	300,000
-	Technical guidance	70,000					

No	Items	Programs/Projects					
		661	PAM	Red Cross	ACTMANG	KTV	Suma
-	Buying seeds			500,000			
2	Indirect expenditure	40,656	416,000				
<b>II</b>	<b><i>Sonneretia caseolaris</i></b>	<b>1,000,983</b>	<b>3,395,761</b>	<b>1,600,000</b>			
1	Direct expenditures	950,000	2,400,353	1,600,000			
-	Seedlings	600,000	1,287,500	700,000			
-	Planting Labor	260,000	1,112,853				
-	Technical guidance	70,000		400,000			
-	Beating up	20,000					
2	Indirect expenditure	50,983	995,408				

[Đoàn Đình Tam, 2010]

The rate of investment for 1 ha plantation of programs and projects in Hai Phong, Quang Ninh, Nam Dinh for planting by propagules such as *Kandelia candel*, *Rhizophora apiculata* and *Bruguiera gymnorrhiza* was markedly different, ranging from 1 and 3.2 million VND /ha. Projects and programs such as Suma only supports 70% of total funding (700,000 VND/ha), the remaining 30% is labor (planting) by the civil society contribution.

The wages for protecting forests of Red Cross project, Suma, ACTMANG and KTV was paid by contracts with \$ 1 /month/ha in 3 years. For 661 project, 1-3 months after planting, forest plantations were checked before acceptance and handed over to the CPCs for management and protection with the wage of 50,000 VND/ ha/year and the wage has now been adjusted to 100,000 VND/ha/year. Particularly, Hai Phong, apart from 100,000 VND / ha taken from the protection fund of the State, the city supports 50,000 VND /ha/year taken from the city budget.

Overall, from 2005 and earlier, investment rate of the mangrove plantation project implemented in the Northern coastal province was low, about 2 million/ha, of which the wage for planting in the first year was 700,000 VND/ha. This was the direct cause of low forest quality and that may not attract the social organizations and people actively engaged in the planting, management and protection of mangroves. Thus, it is necessary to adjust the appropriate norms for mangrove protection planting.

Then the state has adjusted the rate of mangrove planting investment was of 4,000,000VND/ha (2006-2008), 10 million VND/ha (2009, 2010) and from 2011 to

date is 15,000,000 VND/ha. However, this investment rate is only consistent with site conditions where are favorable and normal for planting, for those sites which are difficult, investment rate should be increased properly to ensure successful and effective planting.

Currently, forests were developed by dyke programs on difficult site conditions with high investment rates. As typical of plantations on difficult sites (black sand, big waves) to protect the dikes of the Center for Agro-forestry high- tech of Hai Phong, the investment rate in the first year was 170 million VND/ha. This was a new direction for research on planting, restoration and protection of mangroves to protect sea dykes in regions with difficult site conditions in the Northern coastal provinces.

### 2. 3.2. In Mekong Delta provinces

The investment cost or supporting fund for 1 ha of forest cultivation and protection from the 611 project fund is much lower than the real cost. In addition, the economic cycle of forestry plants is considered as “long-term”, which is over five years, while the participating households have limited economic ability. Thus this program hasn’t attracted very high participation of households and the quality of planted forest is fairly poor.

For example, in order to grow 1 ha of *Sonneratia* into real mature protective forest for preventing coastal erosion in Tra Vinh province, it costs up to VND 24,220,000 while the project only invests VND 10,000,000. The table below lists the unit cost for forest planting & designing of some mangrove species in Mekong Delta.

**Table 18: Cost norm for mangrove planting in Mekong river delta**

Provinc es	Year	Species, Forest types, sites, density (trees/ha), land preparation/seedlings/ planting techniques	Cost norm (đ/ha)
Bac Lieu	2005	Protection <i>Rhizophora</i> plantation on high elevation, high salinity. Canal preparation, 10.000 seedlings/ha. Large size propogules 23 cm; D > 1 cm, 40 -45 fruits / 1kg .	4.289.760
Bac Lieu	2005	Protection <i>Rhizophora</i> , high elevation, high salinity, degraded <i>Avicennia</i> . Canal digging, 10.000 seedlings/ ha. Propogules over 23 cm long; D > 1cm, 40 -45 fruits / 1kg .	2.594.160
Bac Lieu	2005	Protection <i>Rhizophora</i> and <i>Casuarina</i> on the bank, canal; 10,000 seedlings/ha ( <i>Rhizophora</i> ); 2,500 seedlings/ha ( <i>Casuarina</i> ); <i>Casuarina</i> was planted on the banks of old shrimp pond; <i>Rhizophora</i> was planted in the deposited canals.	4.391.118
Bac Lieu	2006	Protection <i>Rhizophora</i> and <i>Casuarina</i> on the bank and forestry-fishery land; <i>Rhizophora</i> was planted to replace degraded <i>Avicennia</i> with 10000 seedlings/ha of density	3.427.650
Bac Lieu	2006	Planting <i>Rhizophora</i> (10,000 seedlings/ha) to replace degraded <i>Avicennia</i> forest.	2.995.650

Provinc es	Year	Species, Forest types, sites, density (trees/ha), land preparation/seedlings/ planting techniques	Cost norm (đ/ha)
Bac Lieu	2006	Planting Rhizophora on bared land, using propogules (23 cm long, D> 1cm , 40 -45 fruits / 1kg) .	
Bac Lieu	2006	Protection Rhizophora plantation, high elevation, 10,000 seedlings/ha; canal preparation (20 x 30 cm); slightly stake propogules in to the mud (4 - 6 cm)..	5.080.050
Bac Lieu	2009	Protection Rhizophora plantation on bared land without digging canal; 10,000 seedlings/ha	2.835.000
Bac Lieu	2009	Protection Rhizophora plantation on high elevation areas; 10,000 seedlings/ha; irrigated canal applied.	5.335.000
Bac Lieu	2009	Trồng đước, rừng Phòng hộ, trên Đất cao, cao có đào kênh dẫn nước, mật độ 5000 cây/ha	4.724.000
Bac Lieu	2009	Protection Ceriops plantation on high elevation; 10,000 seedlings/ha	2.193.000
Bac Lieu		New planting and replaced planting by using Ceriops on high elevation place.	
Bac Lieu	2009	Provide Rhizophora materias for farmers to growth in shrimp pond; 10,000 seedlings/ha.	935.000
Kien Giang	2010	Cost norm for planting Avicennia with protection fence, 3 year tending and monitoring on depistional areas in Kien Giang; planting density is 10000 seedlings/ha.	50.010.000
Kien Giang	2010	Cost norm for planting on unstable depositional areas with protective fence, rubbish prevention fish net, year tending and monitoring; planting density is 10000 seedlings/ha.	90.030.000
Kien Giang	2009	Building 1 km of wave break fence including materias (Melaleuca pole 4, pole 5, pole 3, bamboo mat, fish net, iron wire, melaleuca branches) and labours cost. It does not include plantation cost.	357.680.000
Kien Giang	2009	Building 1 km silt trap- type 1 fence, including (Melaleuca pole 4, pole 3, bamboo mat, fish net, iron wire) and labour cost.	215.634.000
Kien Giang	2009	Building 1 km silt trap- type 2 fence, including (Melaleuca pole 4, pole 3, bamboo mat, fish net, iron wire) and labour cost.	347.880.000

### **2.3. Survey results of mangrove growth in six provinces**

#### **2.3.1. Survey results of mangrove growth in provinces**

##### **a, North region**

Results of survey and evaluation of mangrove growth in six the North coastal provinces are shown in the following table:

**Table 19: Mangrove growth at the survey provinces**

No	Places	Models	Site characteristics	Planting practices	Age	Initial density (trees/ha)	Remaining density (trees/ha)	Species	Growth		Growth
									Hvn	D <sub>0</sub> /D <sub>1,3</sub>	
1	Đông Rui, Tiên Yên, QN	Natural forest	Medium silt	-	-		19,000	<i>Bruguiera</i>	1.31	4.56*	
								<i>Rhizophora apiculata</i>	1.80	4.05*	
								<i>Avicennia</i>	1.00	3.50*	
2	Đông Rui, Tiên Yên, QN	forest plantations UNDP	Sandy	Propagules	5	10,000	4,500	<i>Rhizophora apiculata</i>	1.29	2.78*	Bad
								<i>Kandelia candel</i>	0.96	2.95*	
3	Đông Rui, Tiên Yên, QN	Forest plantations in fallow shrimp squares		12 months container stock	3	10,000	6,600	<i>Rhizophora apiculata</i>	1.30	1.91*	Fairly good
								<i>Bruguiera</i>	3.18	1.00*	
								Trang	1.13	3.14*	
								<i>Avicennia</i>	1.21	1.76*	
4	Yên Giang, Quảng Yên	Forest plantations	Medium silt	container stock	16	2,000	3,300	<i>Sonneretia caseolaris</i>	5.24	13.36*	Good
								<i>Avicennia</i>	2.50	7.01	
5	Tân Thành, Kinh Dương, HP	Forest plantations TTST	Light silt	container stock	9	1,200	18,000	<i>Sonneretia caseolaris</i>	9.71	16.33	Good
								<i>Bruguiera</i>	2.83	3.74	
6	Tân Thành, Kinh Dương, HP	Forest plantations Center for high-tech	Black sand	24 months container stock	8	2,600	2,500	<i>Sonneretia caseolaris</i>	3.28	7.51	Medium
7	Vinh Quang, Tiên Lãng, HP	Forest plantations 661	Heavy silt	12 months container stock	3	1,600	1,600	<i>Sonneretia caseolaris</i>	5.38	11.63	Good
8	Vinh Quang, Tiên Lãng, HP	Forest plantations	Heavy silt	Propagules	18	1,100	1,000	<i>Sonneretia caseolaris</i>	8.10	20.38	Good
9	Đông Long, Tiên Hải,	Forest	Medium silt	12 months	3	1,600	1,600	<i>Sonneretia</i>	2.86	5.91	Good

\* Diameter at stump: D<sub>0</sub>

No	Places	Models	Site characteristics	Planting practices	Age	Initial density (trees/ha)	Remaining density (trees/ha)	Species	Growth		Growth
									Hvn	D <sub>0</sub> /D <sub>1,3</sub>	
	TB	plantations TTST		container stock				<i>caseolaris</i>			
10	Nam Thịnh, Tiên Hải, TB	Forest plantations	Sandy	Propagules	18	13,200	13,200	<i>Kandelia candel</i>	2.10	2.27	Bad
11	Thụy Trường, Thái Thụy, TB	Forest plantations	Sandy	Propagules	20		5,500	<i>Sonneretia caseolaris</i>	6.79	14.44	Medium
12	Thái Đô, Thái Thụy, TB	Forest plantations	Sandy	Propagules	16	20,000	17,500	Trang		2.84	Bad
								<i>Sonneretia caseolaris</i>	4.50	10.51	
13	Giao Phong, Giao Thủy, ND	Forest plantations	Heavy silt	Propagules	18	11,100	8,400	<i>Rhizophora apiculata</i>	2.20	3.17	Bad
								<i>Kandelia candel</i>	2.01	2.55	
14	Hải Chính, Hải Hậu, ND	Natural regeneration	Sand					<i>Kandelia candel</i>	0.73	3.11*	Bad
15	Hải Chính, Hải Hậu, ND	Forest plantations	Sandy	12 months container stock	1	4,500	4,050	<i>Kandelia candel</i>	0.59		Bad
16	Hải Lộc, Hải Hậu, ND	Forest plantations	Medium silt	Propagules	11	20,000	17,200	<i>Kandelia candel</i>	2.50	7.49*	Medium
17	Đa Lộc, Hậu Lộc, TH	Forest plantations	Sandy	12 months container stock	2	1,600	1,600	<i>Sonneretia caseolaris</i>	2.18	2.35	Fairly good
18	Đa Lộc, Hậu Lộc, TH	Forest plantations CARE	Sandy	12 months container stock	2	16,000	5,100	<i>Kandelia candel</i>	1.51	8.39	Fairly good
								<i>Sonneretia caseolaris</i>	-	-	
19	Đa Lộc, Hậu Lộc, TH	Forest plantations	Medium silt	Propagules	21	20,000	10,300	<i>Kandelia candel</i>	5.00	5.24	Medium
20	Thạch Môn, Hà Tĩnh, HT	Forest plantations	Medium silt	Propagules	21	20,000	4,000	<i>Rhizophora apiculata</i>	3.64	5.54	Medium
								<i>Avicennia</i>	4.14	6.35	
21	Hộ Độ, Lộc Hà, HT	Forest plantations	Sandy	Propagules			5,000	<i>Rhizophora apiculata</i>	4.91	5.59	-

\* Diameter at stump: D<sub>0</sub>



No	Places	Models	Site characteristics	Planting practices	Age	Initial density (trees/ha)	Remaining density (trees/ha)	Species	Growth		Growth
									Hvn	D <sub>0</sub> /D <sub>1,3</sub>	
								<i>Avicennia</i>	5.23	8.79	
								<i>Kandelia candel</i>	2.83	5.12	
								<i>Bruguiera</i>	3.00	2.73	

### **b. Mekong delta provinces:**

Study results shows the growth rate of mangrove forest in Mekong delta:

**Table 20:** Growth indicators of mangrove forest in Kien Giang

Forest types	District	Commune	D <sub>1,3</sub> (cm)	H <sub>vn</sub> (m)	H <sub>dc</sub> (m)	Density trees/h a
Young Rhizophora (1-5 years old)	An Biên	Tây Yên	9	8	5	2.100
Rhizophora plantation – III age class (10-15 years)	An Biên	Nam Thái	8	8	5	3.100
Rhizophora plantation – IV age class (15-20 years)	An Minh	Đ. Hưng A	8	8	5	3.800
Mixed natural forest of <i>Aviennia</i> sp and <i>Excoecaria agallocha</i>	An Minh	Tân Thạnh	11	6	2	460
Mixed natural forest of Rhizophora and young <i>Avicennia</i>	An Biên	Nam Yên	14	11	5	600
Young natural <i>Avicennia</i> forest	An Minh	Tân Thạnh	10	6	2	780

[Sub FIPI, 2010]

Table 20 shows the average growth of mangrove forest in Kien Giang. In general, large area of mangrove forest in Kien Giang is young and premature; mature forest occurs at a small proportion.

Current studies conducted by Sub-FIPI show that *Sonneratia* plantation from 1993 in Cầu Ngang, Châu Thành is 190 m<sup>3</sup> /ha; its growth rate is high (  $\Delta D = 1,9$  cm/year ;  $\Delta H = 1,3$  m/year). *Rhizophora* plantation in 1997 ( Đông Hải commune, Duyen Hai district) reach to 55-80 m<sup>3</sup> /ha in average;  $\Delta D = 0,6$  cm/year;  $\Delta H = 0,7$  m/year.

**Table 21:** Growth of some planted species under 661 program in Mekong delta

TT	Species	$\Delta D$ (cm)	$\Delta H$ (m)	$\Delta M$ (m <sup>3</sup> )/ha/year
1	Rhizophora apiculata	0,6	0,7	5,2-7,8
2	Sonneratia	1,90	1,30	11,2
3	Avicenia	0,80	0,70	5,2
4	Rhizophora micronata	0,70	0,7	2,5-5,7
5	Hibicus...Tra	0,50	0,30	0,6

*[collected data under 661 program, Sub-FIPI, 2010]*

### 2.3.2. Selected pictures in the field



**Figure 13: Naturally regenerated mangrove forest in Dong Rui, Tien Yen, Quang Ninh**





**Figure 14: 16 years old plantation of Sonneratia in Yên Giang, Quảng Yên, Quảng Ninh –good condition**



**Figure 15: 3 year old plantation of sonneratia in Vinh Quang, Kien Thuy, Hai Phong**

**Good condition**





9 years old forest, 2 layers- to protect dyke in Tân Thành, Kinh Dương, HP



18 years old Sonneratia plantation in Vinh Quang, Kiên Thụy, HP

**Figure 16: good condition plantation forest model in Hai Phong**





**Figure 17: 3 year old plantation on abandoned shrimp farm in Dong Rui, Tien Yen, Quang Ninh – fairly growth condition**



**Figure 18: 3 year old Sonneratia plantation in the difficult site at Dong Long, Tiền Hải, Thái Bình –fairly growth**



**Figure 19: 2 year old plantation of Sonneratia, Kandelia in Đa Lộc, Hậu Lộc, Thanh Hóa – fairly good condition**



**Figure 20: 8 years old Sonneratia plantation in the difficult site (black sand) at Tân Thành, Kinh Dương, Hải Phòng – Normal growth condition**





**Figure 21: 20 years old *Sonneratia* plantation at Thụy Trường, Thái Thụy, Thái Bình – normal condition**



**Figure 22: 11 year old *Kandelia* plantation at Hải Lộc, Hải Hậu, Nam Định sinh – Normal condition**





**Figure 23: 21 year old plantation of Rhizophora, Avicennia at Thạch Môn, TP. Hà Tĩnh, Hà Tĩnh – normal condition**



**Figure 24: 5 year old Rhizophora, kandelia plantation in Đồng Rui, Tiên Yên, Quảng Ninh sinh- bad growth**



**Figure 25: Bad growth 18 year Kandelia plantation in Thuy Truong, Thai Thuy, Thai Binh**



**Figure 26: 16 year old Kandelia, Sonneratia plantation in Thai Do, Thái Thụy, Thái Bình – Bad condition**





**Figure 27: Mangrove nursery of the high technology for agroforestry center – Hai Phong**



**Figure 28: Nursery mangrove seedlings – Thai Binh forest protection department**





**Figure 29: Erosion threatens coastal communities in Kien Giang**



**Figure 30:: Forest loss by erosion in Mekong delta**



**Figure 31: illegally destroy protection forest in Sóc Trăng (a) and Catching peanut worm causes soil disturbance in Thanh Phú , Bến Tre (b)**



**Figure 32: inappropriate management of high density of trees in shrimp farm**

### **III. Drivers to increase and decrease in area of coastal mangroves**

#### ***3.1. Drivers to the increase in mangrove area***

##### **Policies:**

Facing mangrove forests cleared for rice cultivation, the Prime Minister issued Decision No. 327/CT dated 09.15.1992 on policies on use of bare land, hills, coastal alluvial ground, water surface and investment in forest restoration. Next, on 21/12/1994, the Government issued Decision No. 73/QD on use of fallow land, alluvial ground along banks of rivers and coast, and water surface, including investment in mangrove and casuarinas planting for dike protection. In 1998, the government promulgated 'Five Million Hectares Reforestation Program', including mangroves. A number of policies on the management and protection of mangrove forests which have been enacted to bring high performance, such as land and forest allocation, policy benefits, credit investment... Thanks to those policies, mangrove forests in the provinces have increased significantly.

##### **Supportive projects:**

Some non-governmental organizations such as the Danish Red Cross, Japanese Red Cross Society, UNICEF UK, ACTMANG ... fund and support a part of mangrove planting. From 1991 to 2005, nearly 19,000 ha were planted along the Northern estuary to protect dykes.

##### **Planting techniques:**

Several the governments' programs and research have been applied in reality. Some process and procedures/norms of planting were issued, the transfer of technical training was held at the local level.

##### **Investment:**

Before 2005, cost norms investing in mangrove planting were low, however, from 2005 until now, the government has been continuously adjusting and improving investment cost norm for mangrove planting and restoration.

#### ***3.2. Drivers to the decrease in coastal mangrove area***

##### ***3.2.1. In the north:***

There were many directly and indirectly factors leading to a decrease in area of coastal mangrove forests in Vietnam in general and in six survey Northern provinces in particular. According to 2007 statistics, the mangrove area was 209.741ha, compared to 1943 (408.500ha), the mangrove area of cut was nearly in half. The main reasons for this situation were:

- Deforesting for spontaneous and extensive shrimp farming: due to the very large demand for shrimp exports, people and organizations which have made deforestation for extensive shrimp farms in many coastal areas and estuaries;
- Changing the purpose of the lawful land use to aquaculture, agriculture, and embankment, construction of industrial parks, ports, resettlement, mineral exploitation and salt production;
- Storm deforestation, landslides at river banks, flooding the sand;
- Logging, harvesting mangrove firewood and aquatic resources excessively;
- Pollution: uncontrolled solids and liquids waste from lives and industrial activities, a large number of chemical fertilizers and pesticides in agriculture surplus has poured into rivers generate adversely affect on mangroves;
- No solution for preventing the abuse of harmful marine organisms such as shipworm cling on newly planted trees as tree mortality;
- There are no policies to create incentives to attract people and local communities involved in the protection and development of mangroves;
- Mangrove ecosystem management is still loose, the lack of coordination or collaboration between sectors, especially at local levels;
- There was a few process and regulations/norms on mangroves that do not meet the practical requirements, particularly, planting techniques species on the different sites.

### 3.2.2. Mekong delta

Field evidence from study of sub-FIPI on the effectiveness of mangrove planting in Mekong delta provinces indicated that the average success rate was 78.8% (5). But some provinces, this figures was only 44%. From the study results, we found some main drivers impacting to the survivor of mangroves.

a, Coastal erosion: Within 768 km of the Mekong coastal line, 310.6 km of the coast were eroded. Coastal erosion occurred in Tien Giang (42.7 km), Ben Tre (29.22km), Tra Vinh (14.2 km), Soc Trang (18.7 km), Bac Lieu (6.3km), Ca Mau (111.6 km), Kien Giang (87.9 km). (Pham Trong Thinh, 2006(6). Negative impacts from climate change, coastal erosion and saline intrusion far to inland are being threaten to the life of million coastal residents.

Kien Giang has 205 km of coast line <sup>(7)</sup>, of which 35km (26%) is eroding. In many areas, erosion rate is up to 25m per annum. Currently, many infrastructures



locates near by the vulnerable coast line. There are a great number of canals that allow to release flood water to the sea without protection forest; Many residential areas are very near to the sea and in the criticall protection areas. Erorion is becoming more severe .



**Figure 33.** Coastal erosion threatens community along the coast of Kien Giang



a. Plantation with wave break fence

b. Mature plantation

**Figure 34.** Mangrove retreat from erosion

Figure 30 shows coastal erosion in the east sea. This causes the loss of land and forest. Strong waves make tree uprooted and bank erosion. Many new planting areas or large scale plantation were eroded and washed a way by sea currents.

b- Inappropriate site selection

In Mui Ca Mau national park, selected site for planting Rhizophora trees was weak mud (in 1999 and 2001). Most planted Rhizophora trees (60-90 %) in lot a, plot 5, sub area IIIB2 and lot b, plot 4, sub area BI died. In sub forestry enterprize No 184 – Ngoc Hien forestry enterprize, 100 % of planted Rhizophora seedlings in the lots 420, 465, 493, 438 that belong to plot 12, sub area 3 (planted in 2000) died because seedlings were planted in solid clay soil (rarely tide inundation).



**Figure 35.** Inappropriate site selection (a) unsuccessful planted Rhizophora in high, dry soil without water supply system and improved site (b) Planted Sonneratia trees died in the deep inundation area

Rhizophora planting in Vinh Tan commune, Vinh Chau district (figure 31). Soil is clay, it is fairly high elevation. It is also solid, dry soil and tide can not reach to, survivor rate of seedlings was very low. The density at the survey period was 400 to 500 seedlings/ha. Survived trees were in bad growth condition and being die back. After 3 years, remaining trees were only 0,5 m high.

In planting season of 2004, around 29 ha Rhizophora were planted in Vinh Tan – Vinh Chau but 7,9 ha was lost all seedlings. The last area had a low survivor rate ( 55%). Fishing (e.g., catching clams, fish, crabs...) was the main reason for the loss of



**Figure 36.** Oysters cause the death of Sonneratia trees



planted mangroves. It was happened in many planted areas (e.g., Soc Trang).

Practical experience from CWDP project showed that seedlings should high enough (at least 2 times higher than average inundation level in planting area and *Sonneratia* only used to plant in the inundation area under 1 m. In some planted areas of CWDP project, planted seedlings grew very bad on the weak mud, ground sinking from 20-30 cm, flooding from 1.7-2.0 m.

Figure 32 shows that 100% of newly planted *Sonneratia* was attacked by a dense oysters on the stem and that made trees fall down. In the river mouth, depositional process occurs from June to October and it is flood season in Mekong. The northeast wind is from November to February that often causes the shoreline erosion in many areas. Oysters often attack planted seedlings from February to June (dry season). Thus planting season is very important. All planting activities must be finished before June. This will help seedlings to survive from silt filling and resist to the northeast wind.

### **c- Under investment in Science and Technology**

When study guidelines and regulations about the planting design from provinces we found that there was no information, data on geography, soil characteristics in the soil assessment report. Hydrological information also did not exist in the design document. This shows the lack of assessment. Information on site management, water management, improvement of the planting site that fits into the species ecology did not completely take into account.

In addition, low cost norm that invested in plantation led to the cut off some technical procedures (e.g., Bac Lieu and other provinces), resulting to the low quality of the planted forest. Many organizations who implemented 661 program did not strictly follow the technical procedures, including wrong site matching, inappropriate species selection and this also led to the low success rate of the plantation or even loss all seedlings in some areas.

### **d – Unsustainable livelihood activities**

Limited awareness, underevaluation about the role, function and value of forest to the sustainable environment in many local places led to the lack of consideration and interest of all economic stakeholders. In some allocated land and forest the owners did not have an effective program to manage and protect forest. Low awareness of the

local communities resulted to deforestation, encroachment for aquaculture production, harvesting non timber forest products (peanut worm, clams in Soc Trang, Ben Tre).



**Figure 37. (a) illegally destroy protection forest in Soc Trang and (b) catching peanut worm causes the soil disturbance in Thanh Phu Ben Tre)**

#### **e – Lack of appropriate silicultures for forestry-fishery activity**

Currently, Aquacultural yield declines due to environmental pollution, thin forest canopy, alge development. Observation in the aquaculture ponds we found the low forest cover with 30% of the total allocated land (compared to 60% minimum under the regulation). In some areas, seedlings were planted with very high density (spacing between trees from 0.3-0.4 m (compared to 1m x1m in regulation) to compensate the lack of seedlings in the open area.

Shrimp pond design was inappropriate. Planted forest often has high density. The local households did not receive the instructions to design the drainage system. Local people didnot apply thinning, pruning techniques leading to accumulation of organic mattter in shrimp pond and that led to the slow growth of aquatic species. To have a sustainable system, it needs to apply a management scheme to adjust light for shrimp pond, improve water quality.

## **IV. Recommendations of mangrove restoration solutions**

### **The advantages and challenges in the protection of mangroves**

Natural and socio-economic conditions are important factors affecting resilience and sustainable development of mangroves in the coastal provinces of Northern Vietnam:

- **Main advantages**

- In some places, topography is convenient for the growth of mangrove species and much more developed than the Central region;
- The coastal salt is suitable for many mangrove species;
- Convenient transportation system to ensure the provision of technical materials in time for planting and forest protection;
- Protecting, restoring and developing mangrove forests are concerned by many international organizations; it will be convenient to call for substantial investment in both finance and techniques;
- The Northern coastal provinces have abundant labor force, educational level is quite high so people acquire easily new techniques in planting and forest use;
- Through a number of projects which have been implemented earlier, the lives of a part of coastal farmers have improved, so that they trust the Party's policies and are ready to participate in the project;
- A majority of coastal people understand the role of mangrove forests to ecological environment, especially the protection role from coastal storms for human lives. Therefore, they have the spirit and responsibility for the development and protection of coastal mangrove forests.

- **Challenges**

- Most of the coastal provinces of Northern Vietnam did not have MBs of mangroves yet, the mangroves were directly managed by coastal CPCs;
- Coastal mangrove land in some areas had thin sludge, poor nutrient due to low sediment from rivers. Average thermal vibration amplitude in months was large. The northeast monsoon brings cold and dry air interfering the ability of mangrove plant growth. Most of mangrove species in the area had small diameter and low height;
- Many coastal areas are the major tourist attractions; there are many coal mines and coal ports, hence the mangrove environment contaminated quite heavily;
- Currently, many localities do not have mechanisms and policies to encourage people to participate in the protection and development of mangroves;
- Due to the strong effects of market economy, purposes of forest land use were changed to highly profitable sectors such as aquaculture, marine transportation, construction and services, which is increasing day by day, resulting to difficulty for the mangrove protection and development ;

Currently, many aquatic ponds were arbitrarily dressed up even the landmark of 100 m for sea dyke protection, killing mangroves, violating dikes ordinance, adversely influencing on sea safety.

Conflict between development of aquaculture and development and protection of coastal protection mangroves are critical issues to be addressed in the coming years.

- The aquaculture is extensive, fishing natural fish. The phenomenon of forest encroachment to feed shrimp reduced capital of mangroves;

- The people of the coastal communes had free grazing habits of cattle and poultry (buffalos, cows, goats, pigs, and chickens) on beaches, causing difficulty for forest protection;

- The natural fishing activities of the coastal people: catching small crab, digging looking for seafood ... has caused adverse impacts on forests as floating seedlings.

For the rehabilitation and development of coastal mangroves with high efficiency, we propose the following specific measures:

#### ***4.1. Technical solutions***

##### ***4.1.1. Technical solutions***

In recent years, the planting and restoration of mangrove in the Northern coastal provinces has been much interested in and bringing both economic and the environment efficiency. But rate of established plantation was still relatively low. Planting new mangroves is really exciting so far in 1987 through domestic and international programs and projects. However, most the programs and projects did not yet have the agreement of investment level as well as a specific technical process. Therefore, the level of success and efficiency achieved was very different.

The afforestation failure, especially in areas with difficult site conditions such as sandy and rocky soil, tidal flooding, ... was due to the use of seedlings as propagules or bare root seedlings with normal seedling specifications (height of about 20-40 cm ) for planting. Thus, plants can survive only a short time after planting. In the rainy season, strong tides make the mobile sand, sediment transport,... roots shaken and become loose, and tidal waves rolling uprooted, trees washed away as mortality.

The remaining trees survive in the rainy seasons; the roots have damaged and grown on poor- nutrient sites, so growth should slow and weak. In the dry seasons, water is saltier, many shipworms cling on bark, causing fallen trees and continuing to do a series of dead trees.

To the mangrove planting with high efficiency, the following issues need to be focused on:

##### **a. Forest tree breeding:**

- Nursery: Each locality should develop at least 1 nursery to plant mangrove seedlings, select and protect the mother plants and seed forest with good quality at

localities to provide good quality seed sources stably, and appropriate for specific conditions of the localities.

- Planting seedlings: seedlings have to be in containers with age of at least 6 months to ensure the high rate of survive and established plantations.

### **b. Site selection:**

- Selecting appropriate species: for each specific plantation area should be based on meteorological conditions, salinity, maturity ... to choose appropriate species.

- Building up local maps of sites division by difficulty levels in order to offer appropriate planting solutions. For example, with very difficult and extremely difficult sites, digging holes and bringing alluvial soil from other places could be done.

To build the maps of site division by difficulty levels, firstly some following concepts need to clarify:

#### ***Difficult sites***

+ Currently, there is no concept mentioning the problem of "difficult site" (especially with tidal zones). The perceptions and views on current land issues mainly referring to assessment and land use issues, or is mentioned as one of the criteria for degradation. However, the views and this concept also refer to study land for forest ecosystems on the mountains. Difficult sites often have the following characteristics:

- Difficult sites are where soil has texture with mainly of sand, more gravel, and poor nutrition.
- Directly influenced by the geographical landforms factors and other natural factors such as salinity, waves, currents and the destruction of marine organisms.
- Degraded by human impact through business production.
- Being tidal zones with or without natural mangroves and that can not apply the usual technical measures that need to use new techniques with high investment rate to forest planting and restoration, aiming to prevent waves, protects sea dykes and ecological environment.

***Proposed criteria for dividing up the North coastal sites:*** Forestry Science Institute has researched and proposed preliminary criteria for dividing the coastal sites in Northern Vietnam, including tidal flooding regime, soil types, soil composition and soil maturity.

### **c. Planting practices:**

- For protection mangroves for preventing waves, mixed planting with at least 2 or more species should be applied to create multiple layers, to ensure effective protection breakwater dyke.

- For production mangroves, pure planting can be applied. However, mixed planting should be prioritized to ensure biodiversity.

#### 4.1.2. Proposed models of mangrove planting

The present mangrove planting models in the Northern coastal provinces focus on such models as pure or mixed planting on the advantageous alluvial ground and do beating up on blanks in the forest or additional planting. In addition, there are some models planted in sites with different conditions but also small and the nature of research and testing. Several effective plantation models are:

##### **a. Model of mangrove planting on the alluvial strips**

- **Natural characteristics:**

This model is often grown on the alluvial lands without forests where are relatively flat, having slightly sloping inclined towards the East Sea, directly influenced by the regime of homogeneous tide, flood tide levels can fluctuate from 0.5 to 3.5 m depending on specific sites, mostly salt-marsh alluvial soil, soil texture of silty sand, high maturity (usually deflection  $\geq 30$  cm feet away); is the tidal zones where have exposure time of from 6-10 hours/day.

- **Crop composition:**

Usually species planted in these site conditions are: *Kandelia candel*, *Sonneretia caseolaris*, *Rhizophora apiculata*, *Bruguiera parviflora*, *Avicennia* and *Aegiceras corniculatum*.

- **Applied technical methods:**

In the survey provinces, main planting techniques are to inherit research results and experiences in years of mangrove planting by the coastal people.

**Table 22: Synthesized technical factors of mangrove planting on alluvial ground**

No	Contents	Technical methods
1	Vegetation clearing	Clearing grass and burying it under mud
2	Land preparation	No need to prepare land on advantageous sites
3	Planting practice	- Mixed by rows or patches - Pure or inter-planting
4	Density	Pure planting: - <i>Sonneretia caseolaris</i> : 1,100 – 2,500 plants/ha - <i>Kandelia candel</i> : 10,000 – 16,000 plants/ha - <i>Bruguiera gymnorrhiza</i> , <i>Rhizophora apiculata</i> : 5,000 trees/ha. - <i>Avicennia</i> , <i>Aegiceras corniculatum</i> : 5,000 – 8,000 trees/ha Mixed planting: - <i>Kandelia candel</i> + <i>Sonneretia</i> : 10,000 <i>Kandelia</i> + 500- 1,000 <i>Sonneretia</i> /ha - Others: 10,000 trees/ha
5	Seedling sources	Gathering at localities and in nature by season
6	Planting method	propagules or bare-rooted seedlings
7	Planting season	Depending on ripen seed seasons in each locality - <i>Planting Kandelia</i> in April - May - <i>Avicennia</i> , <i>Aegiceras corniculatum</i> in May – June - Mangrove, <i>Bruguiera</i> in July – September - <i>Sonneretia</i> in July – August
8	Planting techniques	- By propagules: sticking the propagules down mud with depth as 1/3 sprout height and inclined 30° backward wave direction. - Seedlings: digging holes, sticking seedlings down at root base position, refilling with mud and pressing firmly (Fixing tree with poles if possible)
9	Tending	In the first 3 years, picking weeds, algae, waste sticking on the trees, rebuilding fallen trees, peeling shipworms...
10	Protection	Banning people from seafood catching by nets and boats and free grazing of poultry and cattle ...

**b. Mangrove afforestation on blanks or supplementary planting.**

- **Natural characteristics:**

This model is often grown in the blank area of natural forests or plantations was established in the past, but had insufficient density to establish forests with the purpose of establishment of mixed, multi-age and multi-layer plantations. Provinces of Quang Ninh, Thai Binh and Nam Dinh applied this model from 1998. Similar to the alluvial areas, the areas have also influenced directly by the regime of homogeneous tide; tide flooding levels can be varied from 0.5 to 3.5 m depending on specific locations;

mostly salt-marsh alluvial soil, soil texture of silty sand, high maturity (usually subsidence  $\geq$  30cm feet away)

- **Crop composition:**

Species planted on this site conditions are *Kandelia candel*, *Sonneretia caseolaris*, *Rhizophora apiculata*, *Bruguiera parviflora*, *Aegiceras corniculatum* and *Avicennia marina*.

- **Applied technical methods:**

It is similar to afforesting on alluvial ground without mangroves.

**c. Afforesting on difficult sites.**

Firstly, site class needed to be divided to provide technical solutions to cope with difficult site conditions such as the renovation of soil texture, creating waves barriers, appropriate species selection, plant specifications...

For example, Haiphong Forestry Development Centre planted 50 ha of *Sonneretia caseolaris*, the density of 1,600 trees /ha (3 x 2 m) on the black sand along the I sea dyke at Kien Thuy district. In the process of afforestation, the following technical measures are applied:

- Seedlings: using seedlings in containers, 2 years, large size ( $H \geq 1.2$  m and root base diameter  $\geq 2$  cm).
- Land preparation: improving partial texture of the soil by digging large holes (80 x 80cm ) and transporting alluvial soil from other areas before planting.
- Planted seedlings will be fixed with bamboo poles to fight with the waves.
- Care and protect the trees strictly

**4.2. Investment solutions**

So far low rate of investment has been applied in mangrove planting, mainly facilitating the planters. Therefore, mangrove planting efficiency was not high, the survival and established plantation rate were low. To increase mangrove planting and restoration efficiency, an increase in investment rate for afforestation is one important solution.

Proposed investment rate for afforestation in the survey provinces are presented in the following table:



**a. Afforesting on advantageous sites**

**Table 23a: Investment rate for 1 ha of mangroves on advantageous sites in Quang Ninh province (planting by propagules, initial density of 15,000 plants/ha)**

*Unit: 1,000 VND/ha*

Items	Total	Planting, tending and protecting in the year 1	Tending and protecting in years		
			Year 2	Year 3	Year 4
<b>Total estimate</b>	<b>15,000</b>	<b>6,000</b>	<b>4,000</b>	<b>3,000</b>	<b>2,000</b>
Direct expenditure (labor, materials)	14,401	5,595	3,927	2,927	1,952
Others:	599	405	73	73	48
- Design and estimation	585	400	70	70	45
- Verification	14	5	3	3	3

*[Decision No. 999/QĐ issued on 05/04/2011 of Quang Ninh province]*

**Table 1: Investment rate for 1 ha of mangroves on advantageous sites in Quang Ninh province**

(Planting by container seedlings, initial density of 1,600 plants/ha with *Sonneretia caseolaris*, *Avicennia* and 3,300 plants/ha with *Kandelia candel*, *Rhizophora apiculata*, *Bruguiera*)

*Unit: 1,000 VND/ha*

Items	Total	Planting, tending and protecting in the year 1	Tending and protecting in years		
			Year 2	Year 3	Year 4
<b>Total estimate</b>	<b>15,000</b>	<b>8,000</b>	<b>3,000</b>	<b>2,500</b>	<b>1,500</b>
Direct expenditure (labor, materials)	14,401	7,595	2,927	2,427	1,452
Others:	599	405	73	73	48
- Design and estimation	585	400	70	70	45
- Verification	14	5	3	3	3

*[Decision No. 999/QĐ issued on 05/04/2011 of Quang Ninh province]*

**Bảng 23c: Investment rate for 1 ha of mangroves in Lai Hòa and Vĩnh Phước,  
Sóc Trăng 2011**

Species: *Avicennia marina* (50%), *Ceriops taga* ( 25%), *Bruguiera parviflor* ( 25%)

Density: 10.000 seedlings/ha ( 1m x 1m);

Planting materias: *Avicennia* seedlings on plastic containers; Propogule *Avicennia*

<b>No</b>	<b>Item</b>	<b>Uni cost</b>	<b>Quantity</b>	<b>Unit cost (VN Đồng)</b>	<b>Total (VN Đồng)</b>	<b>Note</b>
<b>A</b>	<b>Direct cost</b>				<b>10.480.000</b>	
<b>1</b>	<b>Plantation</b>				<b>9.400.000</b>	
	Site clearance	manday	0			
	Chemist spray	manday	2	80.000	160.000	
	transportation	times	3	600.000	1.800.000	From nursery to planting area
	Carry seedings to the truck	manday	10	80.000	800.000	Take in and off materials from nursery to the transportation facility
	Carry propogules to the truck	manday	2	80.000	160.000	
	Hole digging	manday	16	80.000	1.280.000	For <i>Avicennia</i>
	Planting trees	manday	59	80.000	4.720.000	
	Replacement planting	manday	6	80.000	480.000	
<b>2</b>	<b>Materias</b>				<b>1.080.000</b>	
	Seedlings	trees	13.750	0	0	(*)
	Brugeria	kg	36	10.000	360.000	
	Ceriops	kg	25	10.000	250.000	
	Cần xé	cái	6	20.000	120.000	
	Melaleuca pole (4m)	Pole	2	15.000	30.000	
	Signs (cờ)	Sign	2	20.000	40.000	
	Pesticide	ha	1	280.000	280.000	Except crab that kills the seedling
<b>B</b>	<b>Indirect cost</b>				<b>737.400</b>	
	<b>Total</b>				<b>11.217.400</b>	

(\*) : Seedlings are provided by GIZ

**Bảng 23d: Cost norm for planting 1 ha, Bac Lieu Forest protection sub-department 2010**  
**Species: Cериops, Lumnitzera, ... . Seedlings on plastic containers**  
**Density: 7.000 seedlings/ha**

No	Items	Unit	Quantity	Unit cost	Total (VND)	Note
<b>I</b>	<b>Preparation</b>				<b>455.000</b>	
1	Site survey, design	manday	7	65.000	455.000	Item 4.2.6 Decision 38/2005
<b>II</b>	<b>Materia</b>				<b>2.100.000</b>	
1	Transporting to the planting area	seedlings	7.000	300	2.100.000	
<b>III</b>	<b>Labour</b>				<b>6.711.651</b>	
1	Hole digging and filling	Manday	45	65.000	2.916.667	
2	Hole filling	Manday	20	65.000	1.307.471	
3	Carrying and planting	Manday	36	65.000	2.357.513	
4	Site checking	manday	2	65.000	130.000	
<b>IV</b>	<b>Management fee 10%(I+II+III)</b>				<b>926.665</b>	
	<b>Total</b>				<b>10.193.316</b>	

**b. Afforesting on medium – difficult sites**

**Table 24: Proposed investment rate for 1ha of *Sonneretia caseolaris* and *Kandelia candel* with container stock on medium – difficult sites in Thai Binh province**

No	Items	Unit	Quantity	Norm	Price unit	Total
<b>A</b>	<b>Direct expenditure</b>					<b>43.800.000</b>
<b>I</b>	<b>Materials</b>					<b>28.800.000</b>
1	Seedlings	Plant	1600		15.000	24.000.000
2	Bamboo poles	Plant	1600		3.000	4.800.000
<b>II</b>	<b>Labor</b>	Person-day		<b>150</b>	<b>100.000</b>	<b>15.000.000</b>
1	Seedling transport	Plant	1600	40	100.000	4.000.000
2	Digging holes	Hole	1600	30	100.000	3.000.000
3	Planting	Plant	1600	40	100.000	4.000.000
4	Sticking poles and clinching	Pole	1600	40	100.000	4.000.000

<b>B</b>	<b>Indirect expenditure</b>					<b>620.000</b>
1	Designing fee	Person-day	1	5	100.000	100.000
2	Verification	ha	1		20.000	20.000
3	Management and check before official acceptance	ha	1		100.000	100.000
<b>Total (A+B)</b>						<b>44.420.000</b>

[Proposal of Thai Binh Sub-Department of Forest Protection, 2011]

### c. Afforesting on difficult sites

**Table 25: Proposed investment rate for 1ha of *Sonneretia caseolaris* and *Kandelia candel* with container stock on difficult sites in Thanh Hoa province**

No	Items	Unit	Quantity	Norm	Labor	Price unit	Total
<b>A</b>	<b>Direct expenditure</b>						<b>78,515,405.9</b>
<b>I</b>	<b>Materials</b>						<b>56,310,000</b>
1	Seedlings	Plant	1600			32,000	51,200,000
2	String	Kg/ha	3			50,000	150,000
3	Bamboo poles	Plant	1600			3,100	4,960,000
<b>II</b>	<b>Labor</b>	Person-day					<b>17,047,005.9</b>
1	Transporting seedlings and planting	Plant	1600	29	55.17	93,496	5,158,400
2	Digging holes	Hole	1600	30	23.88	93,496	2,232,740.3
4	Sticking poles and clinching	Pole	1600	40	45.71	93,496	4,274,102.86
5	Tending and protecting in year 1	Ha	1		43.75	94,197	4,121,118.75
6	In August, Sept., Oct. (one time per month)	M <sup>2</sup> /ha	10,000	748.0	13.36	93,496	1,249,946.52
7	Protecting	Person-day	1	8.74	0.114	93,496	10,697,482.8
<b>B</b>	<b>Indirect expenditure</b>						<b>10,209,292.1</b>
<b>Total (A+B)</b>							<b>83,566,298</b>

(Source: Thanh Hoa DARD10/2011)

**d. Afforesting on very difficult sites**

**Table 26: Proposed investment rate for 1ha of *Sonneretia caseolaris* with container stock on very difficult sites in Hai Phong province**

No	Expenditure	Quantity (VND)	Note
<b>1</b>	<b><i>Direct expenditure</i></b>		
	Seedlings	48,000,000	30,000 VND/seedling
	Buying land	67,200,000	70,000VND/m <sup>3</sup>
	Wage for planting	30,000,000	150,000VND/person-day
	Wage for technical guidance	780,000	
<b>2</b>	<b><i>Indirect expenditure</i></b>	<b>17,000,000</b>	<b>10%</b>
	<b>Total</b>	<b>170,000,000</b>	

[Doan Dinh Tam, 2010]

**e. Integrated proposals of investment rate for mangrove afforestation on different sites in the North**

**Table 27: Proposed investment rate for mangrove afforestation on different sites**

No	Site	Items	Total (VND)	Proposed cost norm (mil. VND/ha)	
<b>1</b>	<b>Easy</b>	<b>Cost</b>	<b>Total cost</b>	<b>15.000.000</b>	<b>15-20</b>
			Direct cost (materials, labours)	14.401.000	
			others (indirect cost):	599.000	
			- Fee for design, preparation	585.000	
			-appraise assessment, contract liquidation	14.000	
		<b>Planting and tending techniques</b>	Following the MARD's guidelines, can plant by propagules or seedlings.		
<b>2</b>	<b>medium</b>	<b>Cost</b>	<b>Total cost</b>	<b>44.420.000</b>	<b>20-40</b>
			Direct cost (materials, labours)	43.800.000	
			others (indirect cost):	620.000	
			- Fee for design, preparation	100.000	
			-appraise assessment,	120.000	

No	Site	Items	Total (VND)	Proposed cost norm (mil. VND/ha)
		<i>contract liquidation</i>		
		<b>Planting and tending techniques</b>	Following the MARD's guidelines and select suitable planting species.	
			- Seedling's quality: 1- 2 year old seedlings in plastic containers.	
3	Difficult	<b>Cost</b>	<b>Total cost</b>	<b>83.566.298</b>
			Direct cost (materials, labours)	78.515.405,9
			Indirect cost	10.209.292,1
		<b>Planting and tending techniques</b>	Following MARD's guidelines. Higher technique requirement:	
			- choose suitable planting species	
-Seedling quality: 1- 2 year old seedlings in plastic container, big seedlings (H ≥ 1,2m and diameter at base ≥ 2cm).				
-soil preparation: Partly improve soil structure by digging holes (40 x 40 x 40cm) and fill up with alluvial soil.				
		-Planting techniques: Seedlings after planting are fixed and protected from wave action by bamboo poles.		
4	Very difficult	<b>Cost</b>	<b>Total cost</b>	<b>170.000.000</b>
			Direct cost (materials, labours)	153.000.000
			others (indirect cost):	17.000.000
		<b>Planting and tending techniques</b>	Following MARD's guidelines. Higher technique requirement:	
			- choose suitable planting species	
			-Seedling quality: 2 year old seedlings in plastic container, big seedlings (H ≥ 1,2m and diameter at base ≥ 2cm).	
			--soil preparation: Partly improve soil structure by digging holes (40 x 40 x 40cm) and fill up with alluvial soil before planting.	
			- Planting techniques: planted seedlings are protected from wave action by bamboo poles.	
			- build wave break fences.	
		-strictly tending and protecting seedlings.		

Notes: *cost norm for restoration needs to base on the specific condition to decide.*

#### **4.3. Policy and mechanism solutions**

To ensure the effectiveness of the rehabilitation and development of mangrove forests, the management policy of the state plays a key role. We propose some

solutions on mechanisms and policies to restore and develop mangrove forests as follows:

#### *4.3.1. Mangrove land use planning*

(1)- Necessary to develop the master plan for nationwide mangroves, and details for provinces to formulate programs and plans for mangrove ecosystem restoration and development.

(2) - Mangroves having coastal protection functions need to be classified into 2 types:

- Very critical protection forests are the forest areas where are outside the national sea dykes, used for the purpose of limiting natural disasters, stopping wind, reducing erosion of river and coastal areas; Developing a system of coastal protection forest belts to prevent waves, directly protect sea dykes.

- Critical protection forests are the forest areas where are inside the national sea dykes with a supporting role for very critical protection forests.

(3) - Review and planning stability for the major sectors, use coastal mangrove land for planting and protecting mangroves and aquaculture. Planning must be considered to be interdisciplinary plan and accepted by the state in terms of legality, field markers, and signboards...

(4) - Need to choose some typical mangroves for each ecological region to establish NR of species genetic resources and intertidal animals and nature reserves; can be combined in the selection of mangrove conservation areas with tourism destinations and education to attract foreign and domestic tourists.

(5) - To enhance the land and mangrove use management and planning

- Need a backup solution to minimize the adverse effects of activities in infrastructure construction, tourism development, sea dykes ... to the activities in sustainable forest protection, restoration and development; prohibit encroachment on forests and land that is planned for forestry for marine aquaculture; strictly handle the cases of using land with improper purposes to harm the forest. The area used improperly need to be reclaimed and applied strict punishments; the areas where shrimp are not effective, should be determined to take back for afforestation, creating long-term habitat for seafood.

- For alluvial coastal ground, localities should have plan of forest development and sea encroachment; be assigned to a specialized agency to manage from the beginning, should not be assigned communal authorities to manage, people will themselves carry out aquaculture, affecting the development of forests when alluvial ground is stable.

- Regulation on the rate of forest and shrimp: at the present, provinces are applying rate of forest and aquaculture is different, hence it is necessary to set a rate of forest and aquaculture area to ensure good mangrove environment, protecting and enhancing aquaculture productivity. This rate depends on natural context, the needs of people as well as forest development strategy.

(6) - Develop and implement detailed land use planning at commune level as a basis for recovery, management and protection of mangrove ecosystem.

#### *4.3.2. Allocation, hire and contract of forests and forest land*

(1) - To further allocation of mangrove forests and forest land that are not managed by specific owners to household groups and village communities. Currently, CPCs or rangers are responsible for state management of forest.

(2) - Review and implementation of production forest land allocation and water surface for aquaculture of agriculture, forestry enterprises under Decree No. 135/2005/ND-CP dated 11/8/2005 of the Government and Circular 102/2006/TT-BNN dated 13/11/2006 of MARD on guiding implementation of Decree 135/ND-CP.

3) – Carry out bidding in mangrove planting to create highly competitive and costs reduction; bidding the alluvial coastal areas for afforestation, prioritizing for local people who have investment conditions.

#### *4.3.3. Investment, credit*

(1) - The government should invest in special use and protection afforestation and protection; Increase investment rate in the direction of intensive farming on ecological areas and sites where has problems and risky but very important for environmental protection and disaster prevention.

(2) - Organizations and households assigned bare land for afforestation, get loans with preferential interest rates (about 5 % /year), the 10-year loan term, to pay principal and interest when have main products; to borrow 100% of capital needs on the basis of accurate and complete estimate according to current economic and technical norms; to get loans with preferential interest rates to develop aquaculture, poultry and bee incorporated in mangroves.

(3) – The State should issue policies on loans with trust for farmer groups contracted to protect forest (no red book) to feed shrimp, because generally people living in the mangrove areas are poverty, lack of capital for production, especially capital for shrimp (shrimp development for forest protection).

(4) - Raising capital -investment for regenerating mangroves from other sources.

(5) - Increasing investment in infrastructure construction from 10-15 % to 20-25% of total budget, especially in an area where get no large investment for



mangroves to facilitate better protection and management better development.

#### 4.3.4. *Science and technology, and forestry extension*

(1) – Need conduct research and evaluations to supplement, amend and promulgate silvicultural procedures and regulations for mangroves appropriate to each ecological zone; necessary to have processes for investigating sites, tending, and appropriately managing forests for ecological conditions for each type of mangrove species.

(2) – Crop composition

- For very critical protection forests, native plants and some species should be chosen. For critical protection forests, natural conditions, economic conditions and species should be taken into account to not affect shrimp farming.

- Choose suitable species for ecological zone of localities and afforesting by container seedlings and big enough to be able to live in wetlands.

- Using intensive cultivation techniques, establishing seed production, seed selection, planting techniques and procedures for major species such as mangrove, *Avicennia*, *Sonneretia*, *Rhizophora stylosa*, *Aegiceras corniculatum* and *Bruguiera* for both the South and North.

- Transforming pure to mixed forests; afforesting mixed species to create 2-3 layers to improve efficiency of wave prevention, land fixing, natural disaster prevention and the environmental protection.

- Improving mangrove varieties:

(3) - Guidelines and technical transfer of effective production models to be in mangrove areas.

#### 4.3.5. *Improving mangrove management organization*

(1) - To strengthen the State management system of mangrove in provinces, districts, communes and implement management functions of forests and forest land under Decision 245/1998/QD-TTg dated 21/12/1998 of the Prime Minister and strengthen inter-sectoral coordination in mangrove management, use, recovery and development.

(2) - To establish, strengthen and expand the system of forest owners in mangrove region.

- To strengthen and maintain or establish a new of local level MBs of coastal protection forests (if eligible) under DARDs which has the main task is to manage, protect, restore and develop coastal mangroves.

- To mobilize the participation of citizens through implementation of land and forest allocation to households, village communities used long-term stability for

forestry purposes.

(3) – MARD needs to promulgate a National Action Plan on mangrove management and other policies relating to the sustainable management of mangroves.

(4) – To develop and submit to the Prime Minister promulgating a regulation on management and sustainable use of mangrove ecosystems.

(5) - It is necessary to organize and manage coastal land and mangroves through projects in key provinces where has embankments and dykes, much erosion of soil and mangroves to prioritize the management, monitoring and investment in forest development.

#### *4.3.6. Sharing benefit policies*

1. For forest owners are households, individuals and village communities allocated critical protection forests

- The State shall provide funds for the protection, regeneration promotion and afforestation as for Forest MBs (Decision 100);

- To harvest firewood, thinning trees in the forest;

- To use 30% of the forest land allocated for aquaculture; the state loans with preferential interest rates (by 60-70% of commercial rates) for aquaculture; exempting taxes for aquaculture when harvesting.

2. For forest owners are household groups, village communities allocated production forests

- To receive loans of the state development credit with preferential interest rates (by 60-70% of commercial rates); to borrow 100% of the demand for loans; to repay of principal loan and interest when have main products (at least 10 years); loan procedures are simply, mortgaging certificates of land use rights only.

- To harvest firewood, thinning, exploiting forests;

- To use 50% of the allocated forest land for aquaculture; the state provide loans with commercial interest rate for aquaculture, when harvesting aquaculture, they get tax exemption.

3. For households and individuals contracted very critical protection forests

- The contracting party granting 100% of funds for protection, regeneration promotion and afforestation under Decision 100;

- To harvest firewood, thinning trees in the forests;

- Absolutely no aquaculture under the forest canopy;

- Depending on the local land fund, they can be assigned a forest area or barren land, alluvial ground and wetlands for horticulture, aquaculture, salt production and agricultural production; get loans with interest preferential rate (60-70% of commercial rate) for aquaculture, when harvesting, they receive all products and tax

exemption under the provisions of law.

4. For families and individuals contracted critical protection forests

- The contracting party granting 100% of funds for protection, regeneration promotion and afforestation under Decision 100;

- The aquaculture under the forest canopy at the rate of forest land / Shrimp: 7/3;

- The forest thinning under the guidance of forest MBs. Forest products from mangrove thinning are permitted for consumption in and outside the s;

- Depending on the local land fund, the contracted parties can be assigned a forest area or barren land, alluvial ground and wetlands for horticulture, aquaculture, salt production and agricultural production; get loans with preferential interest rates (by 60-70% of commercial rates) for aquaculture, when harvesting, they receive all products and tax exemption under the provisions of law.

5. For households and individuals contracted production forests

- The contracting party shall pay contractual remuneration as agreement in the contracts;

- To use 40-50% contracted forest land for aquaculture, the state loans with preferential interest rates (by 60-70% of commercial rates) and to borrow 100% loan demand for aquaculture, when harvesting, they get tax exemption for aquaculture;

- To harvest firewood, forest thinning and enjoy 100 % of thinning products, get tax exemption for these;

- To harvest the forests and gain a part of harvesting products, depending on the contracted time.

6. For households and individuals and contracted to protect special-use forests

- The contracting party shall pay contractual remuneration as stated in Decision 100;

- Depending on the local land fund, the contracting parties can be assigned a forest area or barren land, alluvial areas, wetlands for horticulture, aquaculture, salt production and agricultural production; get loans with preferential interest rates (by 60-70% of commercial rates) for aquaculture, when harvesting, all products are received and exempted from tax under the provisions of law;

- To directly implement tourism business on the contracted areas or the contracted households get from 30 % - 40 % of revenue from eco-tourism business on special use forest environment of organizations.

*4.3.7. Addressing socio-economic issues in mangrove regions*

(1) - Reviewing and re-planning the coastal resident areas, implementing free migration restrictions in mangrove regions

- Re-planning the coastal residential area, implementing free migration restrictions in mangrove regions because the great shrimp benefits in mangrove areas has attracted a large number of people from many locations to deforest for shrimp. On the other hand, many people gave up the traditional craft to make shrimp farming, leading to the dispersion increases. If this situation lasts, the mangroves will be continued to destruct and marine resources will be rapidly declined;

- To avoid phenomenon of people coming to build new economic development zones in coastal areas without specific plans for mangrove protection and development.

(2) - Investment in infrastructure for production and lives in mangrove regions.

## REFERENCES

1. MARD, 2009. National forest area in 2010. Agriculture Publishing House, Ha Noi. 2010.
2. Nguyễn Ngọc Bình, Đỗ Đình Sâm, Ngô Đình Quế, Phạm Đức Tuấn (2008). *Effective and sustainable use of Vietnam coastal salt-marsh land and mangroves*. Agriculture Publishing House, Ha Noi.
3. Hoàng Công Đăng, 1995. *Results of cultivating seedlings of some saltwater species Quang Ninh*, National Workshop: Restoration and management of Vietnam coastal mangrove ecosystems, Hai Phong , p. 20 – 26.
4. Phan Nguyên Hồng, 1999. *Vietnam mangroves*, Agriculture Publishing House, Ha Noi.
5. Phan Nguyên Hồng et al. (2005). *Roles of mangroves for protecting coastal regions*. Agriculture Publishing House, Ha Noi.
6. Phan Nguyên Hồng and Lê Xuân Tuấn, 2007. *Overall evaluation of coastal mangrove ecosystem decline*. Thematic report, Institute for Water Resources.
7. Vũ Tấn Phương, Trần Thị Thu Hà (2008). *Research on sea dyke protection value of mangroves at Xuan Thuy-Nam Dinh*. Science and Technology Journal of Agriculture and Rural Development, No. 17, 2007 (P. 68 - 72).
8. Ngô Đình Quế, 2003. *Restoration and development mangroves and Melaleuca forests in Vietnam* Agriculture Publishing House, Ha Noi. (2003).
9. Cao Lệ Quyên và cộng sự, 2007. *Status and policies in relevant to coastal aquaculture development*. Thematic report, Institute for Seafood Economics and Planning.
10. Đỗ Đình Sâm 2005, *Action Plan of mangrove protection and development in Vietnam to 2015*. Agriculture Publishing House 2005.
11. Đoàn Đình Tam, 2010. *Technical research on planting mangrove on difficult site conditions contributing to waves prevention in the Northern Vietnam coastal regions*. Preliminary summing up report, Vietnam Forest Science Institute.
12. Synthesized survey data in Quang Ninh, Hai Phong, Thai Binh, Nam Dinh, Thanh Hoa and Ha Tinh, 01/2012.
13. Yoshihiro Mazda, Michimasa Magi, Mothoko Kogo, Phan Nguyên Hồng (2005). *Roles of wave prevention of mangroves in the Northern Delta of Vietnam*.
14. Yoshihiro Mazda, Michimasa Magi, Yoshichika Ikeda, Todayuki Kurokawa và Tetsumi Asano, 2006. “Wave reduction in a Mangrove forest dominated by *Sonneratia sp*” *Wetland Ecology and Management* (2006) 14: 365-378. DOI 10.1007/s 11273-005-5388-0.