mangroves in Vietnam

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Contents:

VIETNAM MANGROVES

- Coastline 3,260km
- Mangrove area:

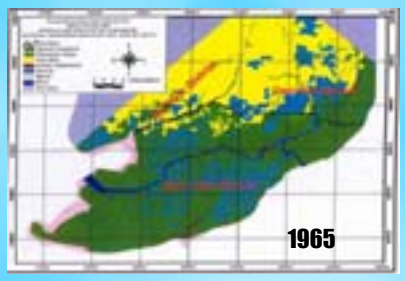
+ Before the wars: (1943) 408,500 ha
with preliminary and dense forests
(Maurand, 1943)

+ Year 2001 : 156,608 ha
with secondary and replanted forests

Natural forest :38.1%
Replanted forest :61.95%
(FIPI, 2001)

1. MANGROVES OF VIETNAM – THE PAST & THE PRESENT

Ca Mau Mangroves



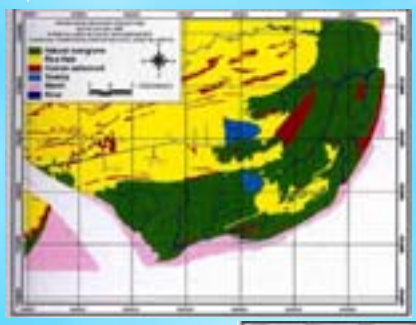
Source: Populus et al., 2004

Ca Mau mangroves before the war

Year	Mangrove area (ha)
1961	200,000
1999	58,258

Present mangroves of Ca Mau

Tra Vinh Mangroves (Mekong delta coast)



1965

21,221 ha of dense forests

2001

4,131 ha of replanted forest

Replanted *Rhizophora apiculata*

Source: Populus et al., 2004

Ben Tre Mangroves (Mekong delta coast)

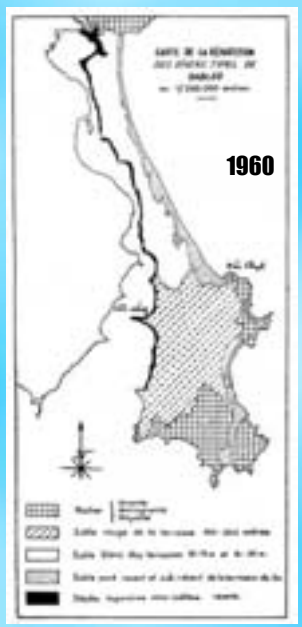
1965
36,276 ha

Protective mangroves at Thanh Phu

2000
7,153 ha

Source: Ngo An, 2003

Cam Ranh Mangroves (Central part)



Source: Le Cong Kiet, 1961

Photo: Le Cong Kiet

All the mangroves at the west of Cam Ranh Peninsula in 1960 (above photo) have been converted to shrimp ponds

Photo: Phan Nguyen Hong

Mangroves in the North part: Map of mangrove distribution of Yen Hung Dist., Quang Ninh Prov.

1965

10,107 ha

1993

2,969 ha

Source:Vu Trung Tang, Nguyen Thi Kim Cuc, 1999

Conversion of mangroves to shrimp ponds

2. THE ROLES OF MANGROVES IN COASTAL AREAS

Forestry resources

Mangroves provide many direct uses for communities: firewood, charcoal, food, medicine, tannin and construction materials.

The 7 year old mangrove forest in 184 Silvo- Fishery Enterprise in Ca Mau Province offered a large amount of timber and wood collected from thinning

Sap production from *Nypa fruticans* infructescence

Bee rearing in mangroves has bought high economic benefit

Rhizophora and *Ceriops* barks with a high content of tannin are used in tanning and net dying

Houses made from *Rhizophora* timber and *Nypa fruticans* leaves

Mangroves and biodiversity

Mangroves are living places for monkeys
(Can Gio forestry park, Ho Chi Minh City)

Mangrove ecosystems are important habitats for a great diversity of amphibians, reptiles, mammals, birds, many of which are threatened

Mangroves offer living shelters and food for waterfowl and migrant species

Biodiversity of mangrove ecosystem in Vietnam (No. of species identified so far)

Zone	Mangroves		Plankton		Benthos		Insect	Fish	Bird	Amph-ibian	Reptile	Mam-mal
	True	Associate	Phytoplankton	Zooplankton	Mollusca	Crustacea						
Northeast coast (zone1)*	52		355		400			194	57	-	-	-
	16	36	185	170	113	65						
Northern delta (zone2)**	42				138 (1)		113	124	136	13	24	6
	12	30			55	74						
Central coast (zone3)*	64		204		150			150	15	5	3	10
	23	41	171	33	16	20						
Southern delta (zone4)*	101		198		82			127	171	6	34	28
	33	68	119	79	52	30						

(Source: * GEF/UNEP project, 2005; **P.N.Hong ed., 2004)
Note: (1): including Polychaeta

Mangroves and aquatic resources

Mangroves support a great number of marine life and food web interactions and act as refuges and nursery ground for many sp. of aquatic resources (EJF, 2003)
Organic detritus from mangroves attract many benthic and fish species coming to mangroves for food, creating a diversified biotope

Mangrove forests are places for many fishermen with nets and lights to earn their living

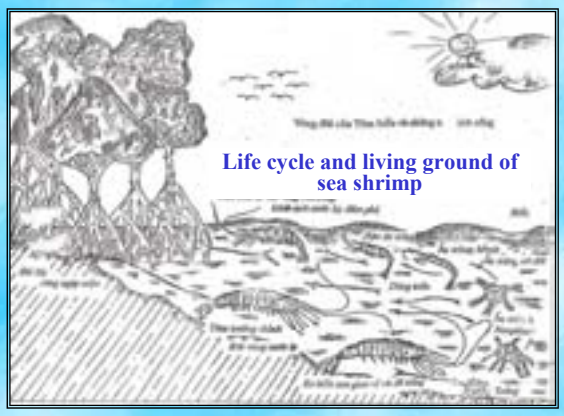
Periophthalmus schlosseri catching

Uca species living in mud

Clams

Mud crabs

Mangroves - habitats for shrimp and crab in the unadult period - provide seed source for farming ponds



Commune	Income (USD)
Nam Dien – Nghia Hung Dist.	2,031.4
Nghia Hung – Nghia Hung Dist.	535.6
Giao Lam – Giao Thuy Dist.	595.8

Average income from mud crab seeds of 30 households in November 2000 at Nam Dinh Prov.

Seed crab collecting for farming ponds

Mud crab seeds harvested in mangroves for aquaculture

Mangroves are the "giant kidney" filtering solid wastes

Mangroves where wastes are trapped and decomposed into nutrients

Micro-organisms decomposing wastes

Solid wastes from production and daily activities being decomposed as food for organisms in tidal mangrove area

Inland waste trapped by the mangrove forests in Nam Dinh after the storm in 2003

Mangroves are a solid "green wall" protecting coastal areas

Mangroves prevent shoreline erosion by acting as buffer and binding soft sediments reducing the impacts of storms

Mangroves play an important role in stabilizing coastal accretions

Mangroves - a safe shelter protecting boats and ships from storms

A dense system of on-the -ground roots of *S.caseolaris* effectively protecting coastline from erosion

3. IMPACTS OF HUMAN ACTIVITIES ON MANGROVE ECOSYSTEM

The US aeroplanes were spraying herbicides on mangrove areas for the tenth time

Four fixed wing UC-123 aircraft on a spray mission
Photo: Harold C. Kinne, Jr.

All mangrove trees died after herbicides spraying in Ca Mau (Photo: 1976)

Overexploitation and conversion of mangrove land into other use purposes

Mangroves at Con Den Island, Thai Binh Province were cut down by local people for firewood, resulting in heavy erosion of the coast

Mangroves around Ha Long City and Cam Pha Town covered by coal

Mangrove land converted to agricultural land produce very low yields

Mangrove land converted to salt fields provide salt of low yield and low quality

Photo: Phan Nguyen Hong

Impacts of shrimp culture in mangroves areas

The current greatest threat to mangrove eosystem in Vietnam is shrimp culture

Conversion of mangrove forest to shrimp pond

Table 1. Area of mangrove land, mangroves and brackish water shrimp ponds in Vietnam to the year 2000

No.	Region	Mangrove land		Mangrove covered area		Area not covered by mangroves		Brackish shrimp pond area	
		ha	%	ha	%	ha	%	ha	%
Total		606,792	100.0	155,290	100.0	225,427	100.0	226,075	100.0
I	Northern Vietnam	153,319	25.3	46,111	29.7	76.012	33.8	31,194	13.8
II	Southern Vietnam	453,473	74.7	109,179	70.3	149,415	66.2	194,881	86.2

Source: Reports of the Depts. of Agricultural and Rural Development (2000) and Ministry of Fishery (2000)

CONVERSION OF MANGROVES FOR UNSUSTAINABLE ECONOMIC PURPOSES IN COASTAL AREAS

MANGROVES

- North-East Region
- Red River delta and the Northen area of the Central Region
- Along the coast of the Southern area of the Central Region
- The Western area of the South Ca Mau

- Rice planting
- Planting of sedge for export
- Partial rice planting

SRIMP FARMING IN BRACKISH WATER

Impacts of mangrove loss

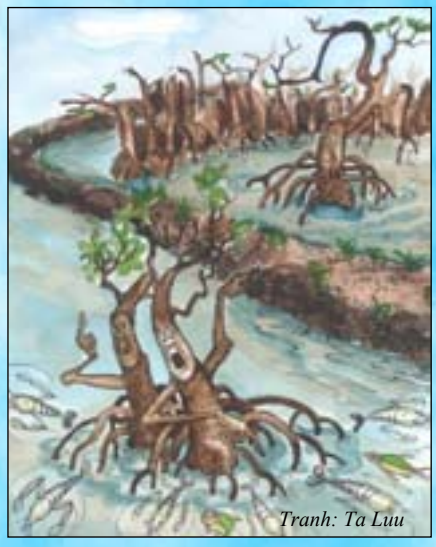
- Disappearance of sea products
- Biodiversity degradation
- Pollution
- Salt intrusion
- Erosion of river banks
- Disappearance of livelihoods of the poor

- Bank erosion
- Land slide
- Dyke damage
- Dyke broken leading to: Loss of humand lives; diseases; loss of land for rice planting; loss of farmed sea products; costs for reduction of soil salinity

Degradation of wetland ecosystem

Mangrove destruction for shrimp farming leaves coastal areas exposed to erosion and flooding, alters natural drainage patterns, increases salt intrusion and removes critical habitats for many aquatic species with serious implications for biodiversity conservation

All mangroves trees died after long time inundated in shrimp pond



Please rescue our friend from water asphyxiation in shrimp pond

Other impacts

- Cause the loss of the "mangrove shield" protecting seadykes, and coastal estuarine areas, severe erosion along river bank and coastal line

- Annual high cost for dyke maintenance

- Reduce alluvia deposited on tidal flat and increase adverse impacts of sea level rise

- Cause the loss of the trap of solid and liquid wastes from inland areas

Sea dyke was broken due to the loss of mangrove

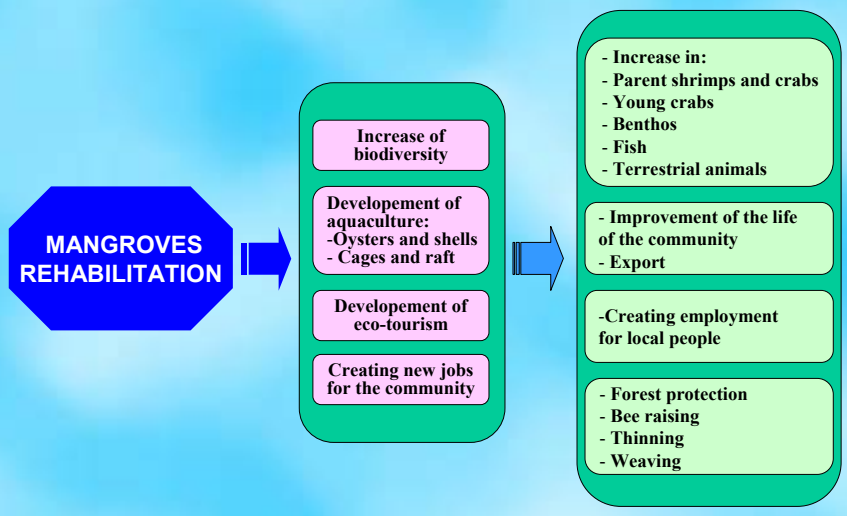
After the cutting of many mangrove stretches, erosion was very severe along the river bank

The reasons related to management

1. No specific policy and national strategy of the state on mangrove protection issued
2. Lack of coordination between marine resource protection organizations and forestry protection institutions from the local levels.
3. Shrimp farming for export in coastal areas encouraged by local governments
4. Some contracts and commitments about mangrove protection between NGOs and local authorities have been violated due to the change of leaders.

4. MANGROVE REHABILITATION AND ITS IMPACTS ON THE COMMUNITY

Mangrove rehabilitation and its impacts on the community



Area of newly planted mangrove forests (ha) in 8 northern provinces under the sponsorship of NGOs

Prov.	Sponsor	91-93	94 -96	97	98	99	2000	2001	2002	Total
Quang Ninh	JRC			200	299	520	150	30	60	*1259*
	ACTMANG					70	90			*160*
	SCF UK		18							*18*
Hai Phong	JRC			200	350	325	140	30	67	*1112*
	ACTMANG		86	18	330	232	139	144	91	*1040*
Thai Binh	DRC		2400	400		300	200	250	120	*3670*
	ACTMANG		190						150	*340*
Nam Dinh	DRC			790	746	243	183	230	50	*2242*
Ninh Binh	JRC			200	200	200		50		*650*
Thanh Hoa	JRC			200	400	305	110	40	43	*1098*
	ACTMANG					120	27			*147*
	SCF UK		275							*275*
Nghe An	JRC			200	350	330	60		15	*955*
	SCF UK	63	121							*184*
Ha Tinh	JRC					196	150			*346*
	SCF UK	240								*240*
	OXFAM UK&I	312	65							*377*
Total		615	3155	2208	2675	2841	1249	774	596	14113

Mangrove reforestation in the North

Mixed planted mangrove vegetation along the sea dyke of Thai Binh Prov. in the North of Vietnam

Three year old *Kandelia obovata* mixed with two year old *Sonneratia caseolaris* at Trang Cat, Hai Phong

Planted *Rhizophora stylosa* at Thanh Hoa Prov.

Four year old planted *Rhizophora stylosa* forest at Dong Mon Sea dyke-Hatinh Prov.

Some restored mangrove communities in the South

Pioneer population of *Avicennia alba* along the tidal mud flat

20 year old *Rhizophora apiculata* replanted in Can Gio, HCM City

Avicennia alba (dominant) and *Avicennia officinalis* along the river bank

Mixed *R.apiculata* and *A.officinalis* at Can Gio, HCM City

Planted mangroves – a nursery for aquatic species and a place for fishery support

Sciena sp., a very valuable fish caught at the river mouth in newly planted mangroves of Thai Binh Province. Its air bladder is used to make thread for some special operations. The price of each air bladder is 10,000 - 20, 000 USD

Clam harvest on the mud flat in front of mangrove area

Fishes in mangrove

Bostrichthys sinensis

Silvo-fishery model (mangrove protection and fish catching)

Photo: P.N. Hong

Fish cage model outside mangrove area

Photo: P.N. Hong

Replanted mangroves improve the life of coastal dwellers

Students catching young crabs

Women catching crabs and other sea products in mangrove areas

Poor people participating in the program of mangrove planting for disaster prevention

People catching sea products on the mudflats in front of the mangroves at Giao Thuy

Students camping, going on excursion, studying

Students of the Univ. of Natural Sciences (Ho Chi Minh City National Univ.) studying ecology on the field

Young students learning how to plant mangroves

Students camping in a mangrove area

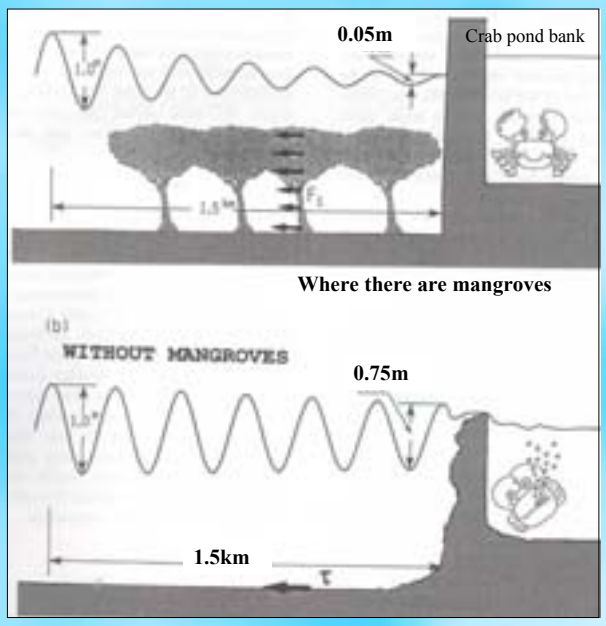
Mangrove's role in mitigating oceanic impacts on coastal areas and sea dykes

Planted *Rhizophora stylosa* at Thuy Hai Com., Thai Thuy Dist., Thai Binh Prov.

5km of seadyke protected by mangroves in Thai Do Commune and therefore, not eroded in presence of the storm Damrey (Photo: Phan Hong Anh taken on 10/10/2005)

The 650m of central seadyke in Thai Do Commune- Thai Thuy District - Thai Binh Province eroded due to Storm Damrey as a result of mangrove absence (Photo: Phan Hong Anh taken on 10/10/2005)

Mangrove and wave reduction



Impacts of the difference of wave reduction between an area with mangroves (a) and an area without mangroves (b) at Thuy Hai – Thai Binh

- Where there is a mangrove forest 1.5 km in width, 1-m waves from the planted site were reduced to 0.05m height when reaching the crab pond

- Where there is no mangrove forest, with the same distance, the wave height at the crab pond was 0.75 m and the pond bank was eroded.

Source: Y.Mazda, M. Magi, M.Kogo, P.N.Hong, 1997

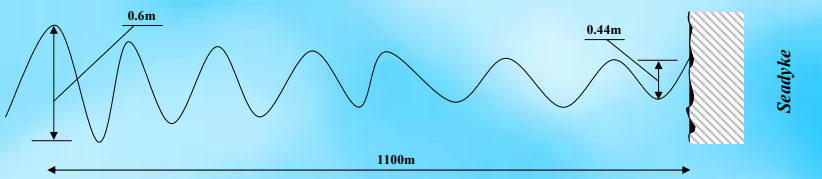
Mangroves in Vinh Quang Commune

- **Location: Pure planted *Sonneratia caseolaris* since 1995 at Vinh Quang Commune, Tien Lang, Hai Phong**
- **Characteristics: Average size of *Sonneratia:* 2R = 18.25cm, H = 13.6m**
- **Average number of trees / ha: 1,353 trees** **Width of the forest belt: 920m**

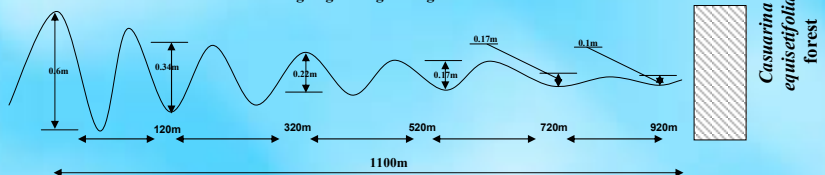
At the same distance (1.1 km):

Where there is no mangrove forest, the waves reduce from 0.6m to 0.44 in height when they reach the seadyke

Where there is a mangrove forest, 0.6 m waves from the planted site were reduced to 0.1m height when reaching the Casuarina forest



Wave reduction without going through mangroves on 17 November 2004



Wave reduction when going through 920m of planted *Sonneratia* forest on 17 November 2004

Source: Vu Doan Thai, Phan Nguyen Hong, 2005

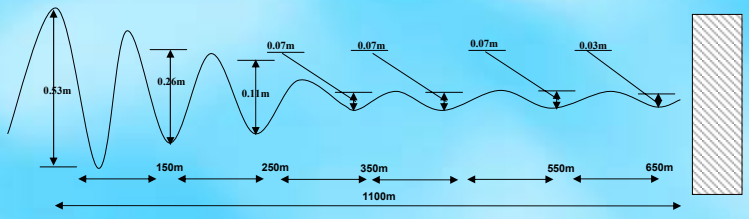
Planted *Sonneratia caseolaris* at Vinh Quang Com., Tien Lang Dist., Hai Phong City

Photo: Vu Doan Thai

Mangroves in Bang La Commune

- Location: *Kandelia obovata* planted in 1998 at Bang La Commune, Do Son, Hai Phong
- Sponsor: Japanese Red Cross Managed by: Hai Phong Red Cross
- Composition: *Kandelia* dominating at 97.7% planted together with *Sonneratia caseolaris* (1999): 2,3%
- Width of the mangrove belt: 650m
- Average number of trees / ha: 17.500 trees; *Sonneratia:* 400 trees

Where there is a mangrove forest, 0.53 m waves from the planted site were reduced to 0.03m height when reaching the foot of sea dyke



Wave reduction when going through 650m of planted *Kandelia* forest at Bang La (Do Son) on 17 August 2005

Source: Vu Doan Thai, Phan Nguyen Hong, 2005

Planted *Kandelia obovata* at Bang La Com., Do Son Dist., Hai Phong City

Photo: Vu Doan Thai

IMPACTS OF STORM NO. 2

Damage by strom No 2 in Quang Ninh

Tree falling in Ly Thuong Kiet Str, Hanoi

Storm and flood in coastal areas of Hai Phong

Mangroves successfully protect the seadyke during storm No 2

Storm No. 2 at Hai Phong sea dyke

The area behind Bang La Mangroves at 9h30, 31/7/2005, the storm waves can't hit the seadyke

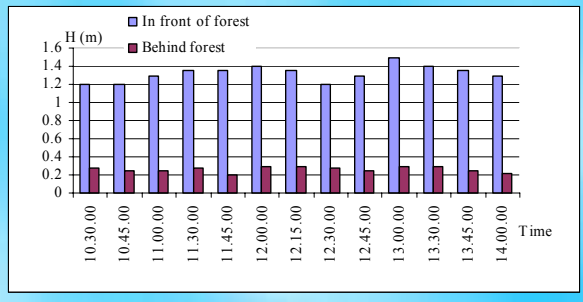
Sea dyke broken at Cat Hai where there were no mangroves

The area behind Bang La Mangroves at 12h45, 31/7/2005

Photo: Vu Doan Thai

Wave height (H) and wave height reduction factor (R) of *Kandelia obovata* at Bang La, Do Son, Hai Phong during storm No. 2 (31/7/2005)

Time	In front of forest	650m behind forest	
	H (m)	H(m)	R(%)
10.30.00	1.20	0.28	77
10.45.00	1.20	0.25	79
11.00.00	1.30	0.24	82
11.30.00	1.35	0.27	80
11.45.00	1.35	0.2	85
12.00.00	1.40	0.3	79
12.15.00	1.35	0.3	78
12.30.00	1.20	0.28	77
12.45.00	1.30	0.25	81
13.00.00	**1.50**	**0.30**	**80**
13.30.00	1.40	0.30	79
13.45.00	1.35	0.25	82
14:00:00	1.30	0,22	83
Average			**80**



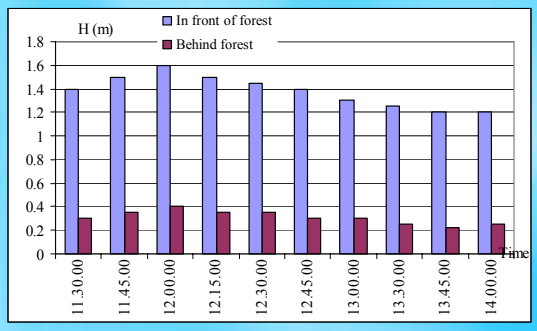
Wave height before and after 650m *Kandelia* forest (storm No. 2)

The highest wave at 13.00h before reaching the forest (150m) is 1.50m; wave height behind the forest is 0.3m; wave height reduction is 80%

Source: Vu Doan Thai, 2005

Wave height (H) and wave height reduction factor (R) of *Sonneratia caseolaris* at Vinh Quang, Tien Lang during storm No. 2 (31/7/2005)

Time	In front of forest	920m behind forest	
	H (m)	H(m)	R(%)
11.30.00	1.40	0.3	79
11.45.00	1.50	0.35	77
12.00.00	1.60	0.4	75
12.15.00	**1.50**	**0.35**	**77**
12.30.00	1.45	0.35	76
12.45.00	1.40	0.3	79
13.00.00	1.30	0.3	77
13.15.00			
13.30.00	1.25	0.25	80
13.45.00	1.20	0.22	82
14.00.00	1.20	0.25	79
Average			**78**



Wave height before and after 920m *Sonneratia* forest (storm No. 2)

The highest wave at 12.15h before reaching the forest (920m) is 1.50m; wave height behind the forest is 0.35m; wave height reduction is 77%

Source: Vu Doan Thai, Phan Nguyen Hong,, 2005

Mangroves successfully protect the seadyke during storm Vincente

Flood and waves at Ba De Temple, Do Son, Hai Phong during storm on 18 September 2005

Behind Bang La Mangroves, Hai Phong, at 11h45 on 27/9/2005

Photo: Vu Doan Thai

Mangroves successfully protect the seadyke during storm Damrey

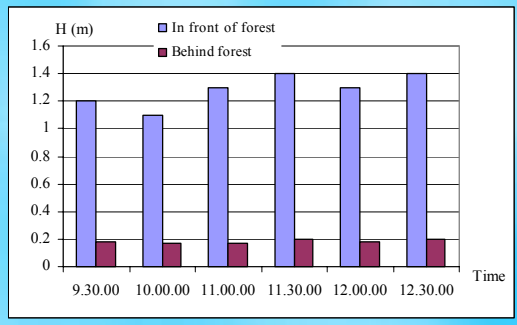
Storm Damrey reaching Hai Phong City

Behind Bang La Mangroves, Hai Phong, the waves strongly reduce

Photo: Vu Doan Thai

Wave height (H) and wave height reduction factor (R) of *Kandelia obovata* at Bang La, Do Son, Hai Phong during storm Damrey (27/9/2005)

Time	In front of forest	650m behind forest	
	H (m)	H(m)	R(%)
9.30.00	1.2	0.18	85
10.00.00	1.1	0.17	85
11.00.00	1.3	0.17	87
11.30.00	1.4	0.2	85
12.00.00	1.3	0.18	86
12.30.00	**1.4**	**0.2**	**86**
Average			**86**



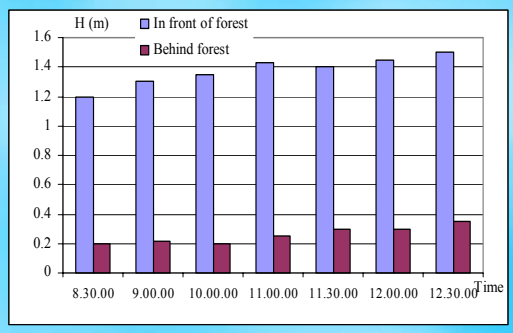
Wave height before and after 650m of *Kandelia* forest (storm Damrey)

The highest wave at 12.30h before reaching the forest (150m) is 1.4m; wave height behind the forest is 0.2m; wave height reduction is 86%

Source: Vu Doan Thai, 2005

Wave height (H) and wave height reduction factor (R) of *Sonneratia caseolaris* at Vinh Quang, Tien Lang during storm Damrey (27/9/2005)

Time	In front of forest	920m behind forest	
	H (m)	H(m)	R(%)
8.30.00	1.2	0.20	83
9.00.00	1.3	0.22	83
10.00.00	1.35	0.20	85
11.00.00	1.43	0.25	83
11.30.00	1.4	0.30	79
12.00.00	1.45	0.30	79
12.30.00	1.5	0.35	77
Average			81



Wave height before and after 920m of *Sonneratia caseolaris* forest (storm No. 6)

The highest wave at 12.30h before reaching the forest (920m) is 1.5m; wave height behind the forest is 0.35m; wave height reduction is 77%

Source: Vu Doan Thai, 2005

5. Effects of propagation and Education activities

Thanks to effective mangrove propagation and education among local communities:

- **16,000 ha of mangroves planted in Northern Vietnam have been well protected.**
- **Local people have protested against the contracts about shrimp farming between local authorities and companies**
- **Illegal shrimp ponds have been cleared to make room for mangrove replanting**

Field trip for secondary school teacher to replanted mangrove

Secondary school students participated in exhibition ***"For the green of mangroves"***

Contest on the knowledge of mangrove

SCOPE

- To organize study excursions at MERS for students of 16 secondary schools in the coastal mangrove area of Nam Dinh and Thai Binh Provinces (each school chose 50 students who had good results in learning)
- To organize the exhibition program "For the green of mangroves" (carried out since 2001) in DRC funded mangrove reforestation project localities of 13 communes in Thai Binh and Nam Dinh Provinces

Exhibition programme "For the Green of Mangroves" at Thai Do Commune

Audience at the Exhibition programme in Rang Dong Town

MANGROVE ECOSYSTEM RESEARCH STATION(MERS)

at Giao Lac Commune, Giao Thuy District, Nam Dinh Province

Objectives:

- Display of biodiversity specimens in mangrove ecosystem, posters and paintings
- Training local communities about the role of mangroves
- Field study of undergraduate, postgraduate and doctoral students researching mangrove ecosystems
- Study excursion of coastal students

Display room on biodiversity at MERS

Training course on “the role of mangroves” for the district and commune managers and leaders

INTRODUCTIONS OF INTERNAL REGULATIONS AND EXCURSION PROGRAMME

Introducing the internal regulations and programme for students

Students answering the multiple choice questions to check their awareness before the program

Short lecture with illustrations on the role of mangroves at the MERS yard

Prof. Vo Quy – a famous expert – talking about problems of environment

STUDENTS ANSWERING THE QUESTIONS OF LECTURERS

Giao Lac
Secondary School

Nghia Loi
Secondary School

STUDENTS LOOKING AT POSTERS, PAINTINGS AND SPECIMENS OF BIODIVERSITY IN MANGROVE AREA SHOWN AT MERS

Students observing fauna speciments in the display room

Students looking at posters hung on the wall

Students looking at comic paintings

STUDENTS VISITING THE MANGROVE GARDEN

- Composition of flora in the garden:
  + Mangrove species in the North
  + Mangrove species collected from the South
- Area for watching the activities of benthos

EVALUATING RESULTS OF STUDY EXCURSIONS

- STUDENTS ANSWERING THE MULTIPLE CHOICE QUESTIONS AFTER THE STUDY EXCURSION PROGRAM

Nam Phu Secondary School

Thai Do Secondary School

Nam Dien Secondary School

Exhibition programme "For the Green of Mangroves"

Introduction to the role of mangroves through images on big screen or video

- **Time and sites:**
  - July 2001 to September 2003
  - 13 communes of 4 districts of Thai Binh and Nam Dinh Provinces
- **Objectives:**
  - To provide a general knowledge of mangroves for local community
  - To provide data for participants in mangrove games

- **Contents:**
  - Introduction to the characteristics of mangroves
  - Role of mangroves toward nature and human
  - Destruction of mangroves for economic purposes and resulting negative impacts on environment and coastal community
  - Effects of mangrove reforestation

Posters and painting display

- **Objectives:** To provide knowledge about mangrove ecosystem
- **Picture contents:**

- Mangrove landscape
- Main mangrove species and aquatic resources
- Role of mangroves
- Traditional occupations in mangrove areas
- Human impacts on mangrove ecosystem
- Effects of mangrove rehabilitation
- Support of NGOs


Ha Noi


Nam Phu


Thai Do

Mangrove picture tear and paste

- **Topic:** Mangrove scenery, we-school childen-planting mangroves, mangroves in our homeland after 20 years, destruction of mangroves...
- **Procedures:** 3 teams of 3 participants each (students and young people) are chosen for the game; colored paper is torn by hand and pasted on Ao paper; the game lasts 40 minutes)

-While the game took place, the audience and compere watched the game, sang songs and heartily supported play teams
-The jury marked the paste-and-tear works and the Organizing Board gave prizes

- **Procedures:**

- Attract a great number of audience especially school students
- The game is of mangrove protection educational value
- Help develop artistic aptitude for school students and youth

Mangrove quiz game

- **Objectives:** To provide and exchange knowledge about mangroves and understandings about surrounding environment
- **Contents:**

- Answering questions about mangroves
- Using a big screen to present questions and keys with illustrated images

- **Results:**

- The audience was large in number enthusiastically involved in the game
- Through the game, undertanding and awareness of the role of mangroves were improved.
- Mangrove destruction actions were condemned

Some experience

After 13 trips implementing the exhibition programme in 13 localities, some experience has been drawn as follows:

1. Coordination and cooperation between the organizing body, authorities and mass associations are very important
2. The advocacy of local people has to base on local societies and schools using posters and slogans, loud speaker and radio

3. There needs to be security personel at sites where the exhibition and games take place to avoid disorder and damage to the exhibits
4. The mobile programme should be organized on a moderate scale, preferably in one day (weekends or holidays are the best)

5. Integration of singing and artistic performance at intervals of mangrove games brings about high effectiveness of the program with a great number of attendance.

One or two volunteer artists are suggested to be invited for performance at the program

Performance of traditional music team

6. There needs to be presents for each game, sometimes it is sufficient to prepare a few notebooks and a facial towel carefully wrapped. This would attract more people to take part in the game because what the audience desire is not presents or gifts but a useful playing ground of high educational implication like the mobile exhibition program For the green of mangroves.

6. CHALLENGES TO THE PROTECTION AND WISE USES OF MANGROVES IN VIETNAM

1. No specific policy, national strategy and decision of the state on mangrove protection issued
2. Lack of coordination between marine resource protection organizations and forestry protection agencies from the central to local levels
3. Shrimp farming for export in coastal areas has been encouraged by governments
4. Some contracts and commitments between NGOs and local authorities have been violated due to the change of leaders
5. Due to high profit from shrimp export, many local households who want to practice illegal shrimp farming have destroyed mangroves
6. In coastal area, many local authorities have had the contracts with shrimp farming owners for long-term land use and therefore, no land is available for mangrove planting

All the mangrove land in Khanh Hoa Province has been converted to shrimp ponds


Pollution caused by industrial zone


Pests

Oil spill

Oil spill rescue
(Lao Dong Newspaper, 30/2/2005)

7. SOME RECOMMENDATIONS

Improving aquaculture in mangrove areas

Promote poly-culture and diversification of aquaculture in the brackish water canal, river and coastline

Silvo fishery model in mangrove area of Tra Vinh by OXFAM GB
Photo: EJF, 2003

Silvo-fishery model with two sluice gates for tidal water exchange
Source: Sub-FIPI II, ARCADIS Euroconsult, HASKONING

Model to use isolated mangrove & shrimp areas while keeping the 75% mangrove 25% shrimp ratio.
Photo:P N Hong

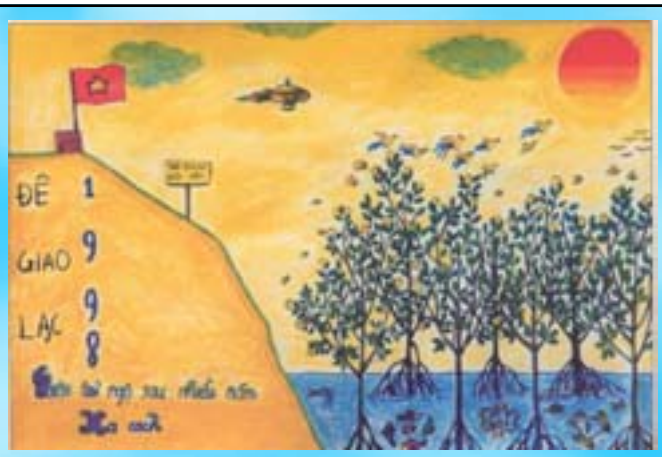
7. Recommendations:

1. The Ministry of Agriculture and Rural Development should cooperate with the Ministry of Natural Resources and Environment and the Ministry of Sea Products to prepare plans for rehabilitation of protective mangroves:

- **Planting wave-buffering mangrove belts along river banks (20-30m) and the coast (100-1000m)**
- **Recovering the land from coastal fallow and ineffective shrimp ponds to plant mangroves, and at the same time developing caged aquaculture on water surface**

2. The Ministry of Sciences and Technology should develop a national program to:

- Study the effects of natural disaster mitigation by protective mangrove belts



Painting by a student from Giao Lac Secondary School

- Study the direct and indirect benefits (such as protecting and developing natural resources and the environment) of the mangrove ecosystem in comparison with conversion to shrimp farming and other economic purposes

3. The Ministry of Agriculture and Rural Development should take into consideration the benefits of mangroves in its master plan for sea dyke strengthening and development, and include in such plan the planting and protection of wave-buffering mangrove belts.


THANK YOU VERY MUCH