

Commemorative lecture at Kyoto University, Nov. 2th 2008  
and Tokyo University of Agriculture, Nov. 7th 2008

## Mangroves and Coastal Dwellers in Vietnam - a Long and Hard Journey Back to Harmony



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## Mangroves in the World



Mangroves of Malaysia  
(Photo: IPT – Malaysia)



A very dense roots system holds a 63-metre tall *Rhizophora mangle* tree on mud at Limone, Ecuador (photo: S. Baba)



Stunted mangroves on the coast in the deserts of Arab Saudi (photo: J. Primavera)



A big *Sonneratia* tree in New Guinea (photo: S. Baba)



*Heritiera littoralis* on Iriomote island, Japan (photo: J. Primavera)

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## Background of the Mangroves of Vietnam



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## Mangroves in Vietnam

- Coastline: 3,260km

- Mangrove area:

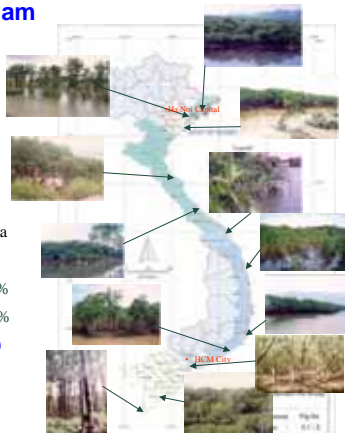
+ Before the wars: 408,500 ha

+ In 1999 : 156,608 ha

Natural forests: 38.10%

Replanted forests: 61.95%

(FIPI, 2001)



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## Geographical distribution

The different climatic and topographical conditions along the coast of Vietnam have deeply affected the distribution and composition of mangroves.

### ❖ The four mangrove zones

- The northeast zone
- The northern delta zone
- The central zone
- The coast of southern Vietnam



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### The northeast coastal zone (Quang Ninh Province)

#### Natural conditions:

- ❖ Bai Tu Long and Ha Long Bays
- ❖ Diurnal tide, high amplitude
- ❖ Salinity: 26 - 27‰
- ❖ Cold northern monsoon

#### Plant communities

- ❖ Pioneer population: *Avicennia marina*
- ❖ Mixed community: *A. marina*, *Rhizophora stylosa*, *Bruguiera gymnorhiza*, *Kandelia obovata*
- ❖ Dominant *B. gymnorhiza*
- ❖ Associate mangroves

Mixed true mangrove community



*Bruguiera gymnorhiza* community



Community on the land rarely flooded

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### The northern coastal delta zone (Red River Delta)

- ❖ Large mudflat rich in alluvium & fresh water
- ❖ Subject to strong winds and storms, cold in winter

#### Brackish water communities

- ❖ Pioneer population: *Sonneratia caseolaris*
- ❖ Mixed community of brackish water species
- ❖ Community on the land rarely flooded with normal tide



*Sonneratia caseolaris* community



*Kandelia obovata* community



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### The central coastal zone

- ❖ Short rivers
- ❖ Rocky coastline
- ❖ Strong waves
- ❖ Mangroves distribute along estuaries and river banks

- ❖ *Avicennia marina*-*R. apiculata* communities
- ❖ *Kandelia obovata* & *R. stylosa* communities. Associate mangrove communities.



Planted *Rhizophora stylosa* forest



7 year old *Kandelia candel* along the sea dyke of Ha Tinh Province



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### The coast of southern Vietnam

- ❖ Favourable natural conditions
- ❖ No cold winter
- ❖ Abundant alluvium of Mekong and Dong Nai Rivers
- ❖ Mangroves grow well and rich in composition

- ❖ Pioneer population: *A. alba*

#### Principal communities:

- ❖ *R. apiculata* + *B. parviflora* community
- ❖ *R. apiculata* + *A. alba* community
- ❖ *Lumnitzera racemosa* + *Ceriops decandra* community

- ❖ Brackish water communities

Mangroves along the river banks of Nho Hien Dist., Ca Mau Prov.



Nipa palm at a river mouth



Replanted mangroves in Can Gio, Ho Chi Minh City



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## Traditional Harmonious Co-existence of Mangroves & Coastal Dwellers



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### Use of Products from Mangroves



A charcoal kiln in Ca Mau



Weaving mats from sedge



Bee rearing in mangroves has high economic benefits



Tannin from *Rhizophora* and *Ceriops* barks are used in cloth and net dying (Photo: M.Kogo)



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

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## Aquatic Resources



Litter fall - an important source of organic detritus



Many fishermen earn their living using nets and lights on canals in mangrove



Mudskipper catching



Poor women digging shellfish on tidal mudflat

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## The Broken Harmony



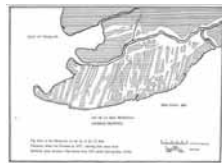
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## Chemical Warfare



Mangrove forest at Ca Mau Cape before the chemical war

Photo: Minh Hai Museum



Map of the mangroves on the tip of Ca Mau Peninsula, Minh Hai Prov. in 1972, showing areas bare from herbicide spraying (Source: NAS, 1974)



Rung Sat area sprayed with warring herbicides in 1969 (photo: E.W. Pfeiffer)

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## Mangroves Destroyed by Chemical Spraying in Ca Mau

A trace of mangrove land sprayed by herbicides and the remain (right)



Mature mangrove forest in Ca Mau Cape totally destroyed by herbicides (Photo: Phan Nguyen Hong)



The dead trees fell on the sprayed area



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## Mangroves Destroyed by Chemical Spraying in Can Gio



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



Mangroves in Rung Sat, Can Gio, Ho Chi Minh before being sprayed with warring herbicides (photo: E.W. Pfeiffer)



Map of mangroves in the post-war (left) (Source: Hirose, ASTER remote sensing)

A part of Rung Sat was being sprayed with herbicides (photo: E.W. Pfeiffer)



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## Over-exploitation

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



Over exploitation of mangroves in Ca Mau

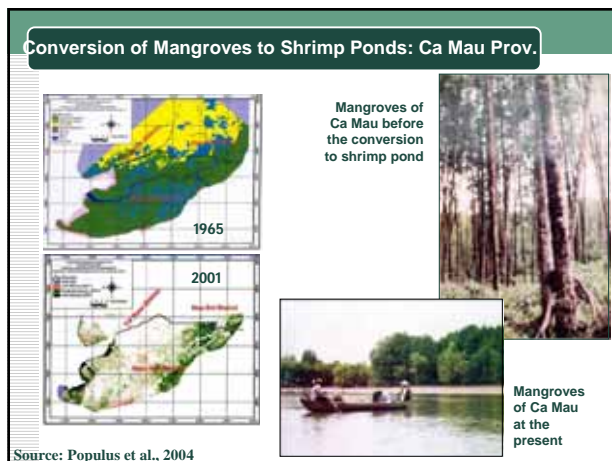


Men laugh - mangrove trees cry!!

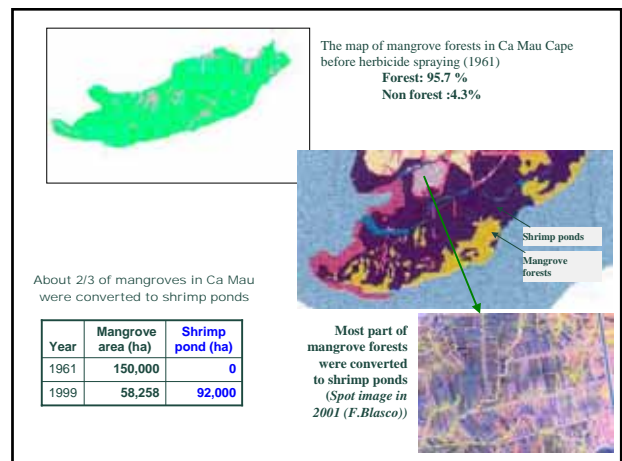


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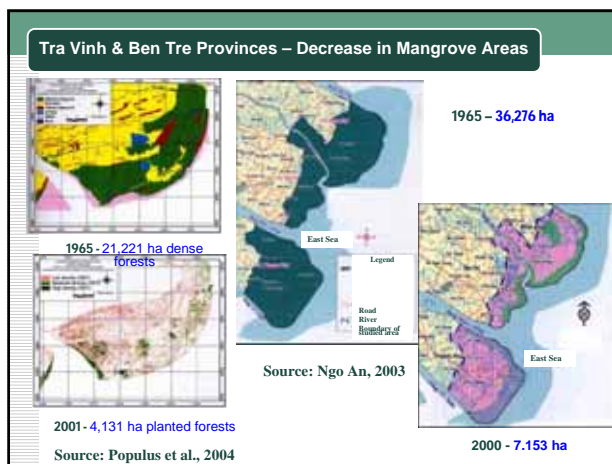




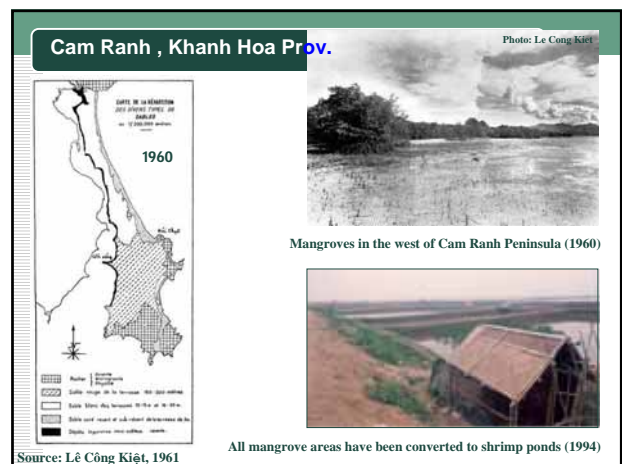
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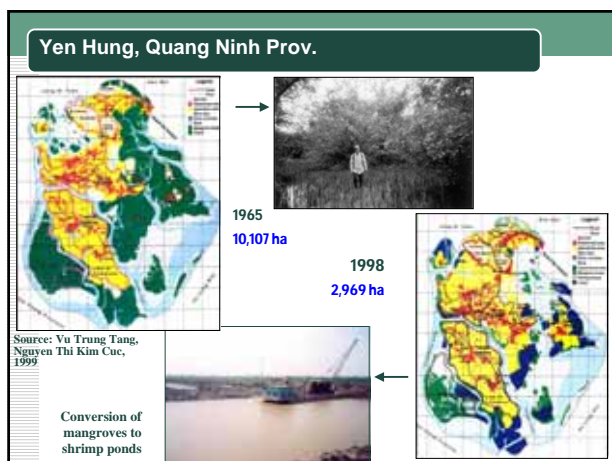
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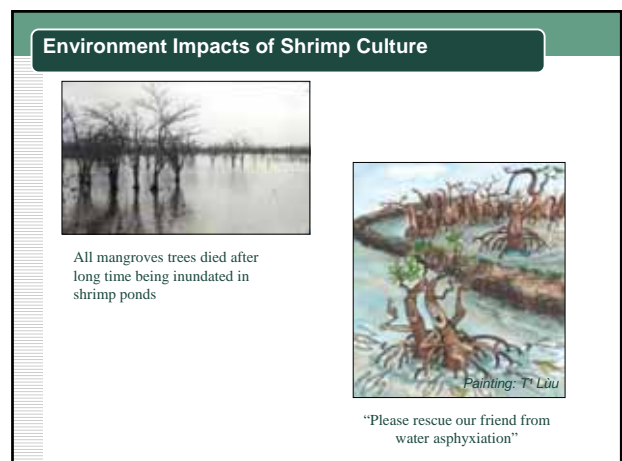
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## Environmental Pollution

Inside the pond, muddy soil turning black, benthos were killed



Water pollution due to shrimp culture



Outside the pond, alluvial soil is still good (Ngoc Hien – Ca Mau)

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## Conversion of Mangroves to Other Uses



Agricultural fields converted from mangroves have now become fallow



Salt pans converted from mangroves produce poor quality salt



Mangroves along Da Bach river – Uong Bi have been destroyed to build a coal port



Nam Can Town built on a former mangrove area

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## Other Impacts of the Loss of Mangroves



Severe erosion along river banks



This house had to be moved 3 times due to riverbank erosion

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## The Long & Hard Journey to Re-establish the Mangrove – People Harmony

### MANGROVE REFORESTATION – THE FIRST STEP

- ❖ Post-war period (1975-1980)
- ❖ From 1981 to 1990
- ❖ From the 1990s to date

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## Reforestation on the Areas Sprayed by Herbicides



Local people replanting *Rhizophora apiculata* on the area sprayed with herbicides in Ca Mau Cape (1975)



Women replanting mangroves (1978)



Women of Can Gio preparing *Rhizophora* propagules for reforestation (1978)

The area of mangroves rehabilitated from 1975 to 1980 on the land sprayed with warring herbicides

Province	Area (ha)
Ben Tre	10,470
Tra Vinh	3,990
Soc Trang	1,750
Minh Hai (Ca Mau+Bac Lieu)	25,900
Dong Nai	4,100
HCM City	6,240
<b>Total</b>	<b>52,450</b>

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## Mangrove Rehabilitation Under State Programs

### Rehabilitated Areas in Some Coastal Provinces in the 1990s

No	Province	Area funded by State programs (ha)	No	Province	Area funded by State programs (ha)
1	Hai Phong	234	8	Ben Tre	1200
2	Thai Binh	1399	9	Tra Vinh	4137
3	Nghe An	563	10	Soc Trang	1404
4	Ha Tinh	46	11	Bac Lieu	716
5	Ba Ria-Vung Tau	3615	12	Ca Mau	18500
6	Ho Chi Minh City	20636	<b>Total</b>		<b>52913</b>
7	Tien Giang	463			



Eight year old *Rhizophora apiculata* at Ca Mau Province



Four year old *Kandelia obovata* forest at Nam Dinh Province

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## Rehabilitation Projects Supported By Foreign NGOs

### Save the Children Fund UK

Species: *Kandelia obovata*, *Avicennia marina*,  
*Rhizophora stylosa*  
Planting duration: 1991-1994, Area: 321 ha

Five years after *K. candel* planting  
*Avicennia marina* strongly regenerated  
(middle)



### Danish Red Cross (DRC) Projects in Thai Binh and Nam Dinh Provinces

Species: *Kandelia candel*, *Sonneratia caseolaris*, *Rhizophora stylosa*  
Planting duration: 1994-2002, Area: 6,912 ha

Planted  
*Kandelia*  
*obovata*  
mixed with  
*Rhizophora*  
*stylosa* in  
Nam Dinh



Planted  
*Sonneratia*  
*caseolaris*  
forest in  
Thai Binh

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## Rehabilitation Projects Supported By Foreign NGOs

### ACTMANG - TOKIO MARINE Project

Species: *K. obovata*,  
*S. caseolaris*,  
*Rhizophora stylosa*,  
*Bruguiera*  
*gyrinostris*  
Planting duration:  
1994-2007,  
Provinces: 8  
Area: 1,500 ha



Planted *Rhizophora stylosa* at Tinh Gia



Planted *Sonneratia caseolaris* forest at  
Tien Lang Distr, Hai Phong City

### Japanese Red Cross (JRC) Project

Species: *Kandelia*  
*obovata*, *Sonneratia*  
*caseolaris*  
Provinces: 6  
Planting duration:  
1997-2005  
Area: 5,685ha



8 month old *Kandelia obovata* at Kien  
Thuy Dist., Hai Phong City



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## World Bank Mangrove Planting Project

Prov.: Ca Mau, Soc Trang, Ben Tre, Tra Vinh  
Planting duration : 2000 – 2005; Area : 3648ha



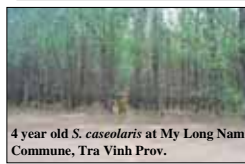
4 year old of *Sonneratia* at Trung Binh  
Commune, Soc Trang Prov.



1 year old *S. caseolaris* at Long Hoa  
Commune, Tra Vinh Prov.



1 year old *Rhizophora apiculata* at Vinh  
Chau Dist., Soc Trang Prov.



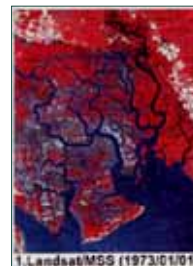
4 year old *S. caseolaris* at My Long Nam  
Commune, Tra Vinh Prov.

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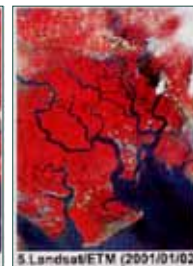
## Mangrove Restoration at Can Gio

Remote sensing map  
on the status  
of mangroves at Can Gio  
Biosphere Reserve

Forest land	33,385 ha	42.58%
▪ Replanted forest	21,427 ha	30.03%
▪ Natural forest	8,958 ha	12.55%
Total	71,361 ha	100%



1. Landsat/MSS (1973/01/01)



3. Landsat/ETM (2001/01/02)

Source: K. Hirose, ERSDAC

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## Nature's Response to People's Efforts



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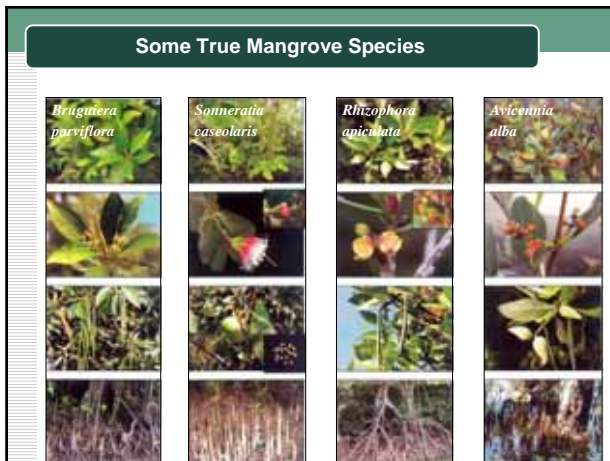
## Enhanced Biodiversity

### Flora and faunal species in the Can Gio Mangrove Ecosystem

Biological groups	Species	Families	Biological groups	Species	Families
<b>Plants</b>			<b>Vertebrates</b>		
True m. sp.	32	15	Fish	133	40
Associate m. sp.	42	29	Amphibia	9	4
Inland plants	120	45	Reptiles	31	15
<b>Invertebrates</b>			Aves	130	41
Polychaeta	32	18	Mammal	19	13
Crustacea	53	11			
Mollusca	32	15			

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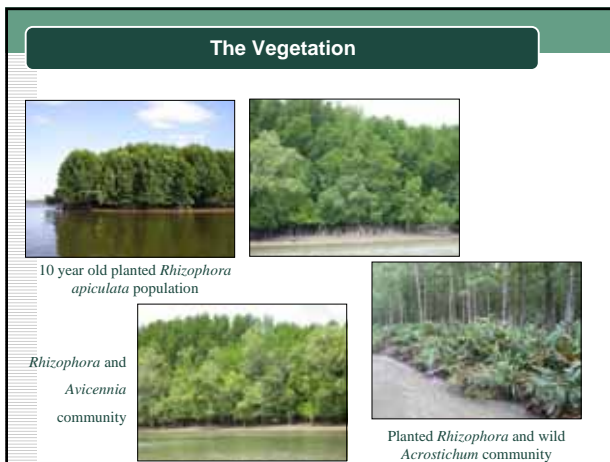




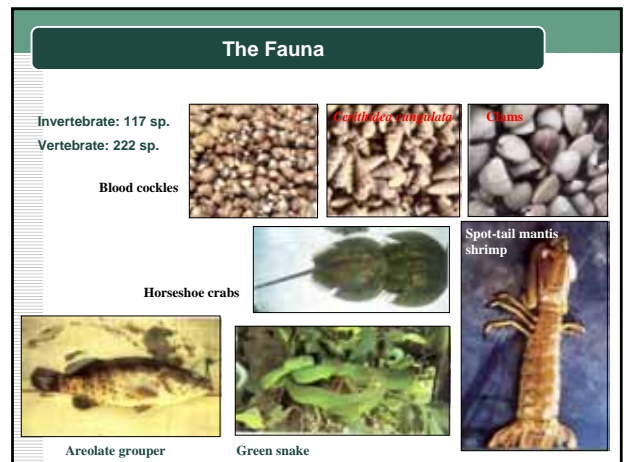
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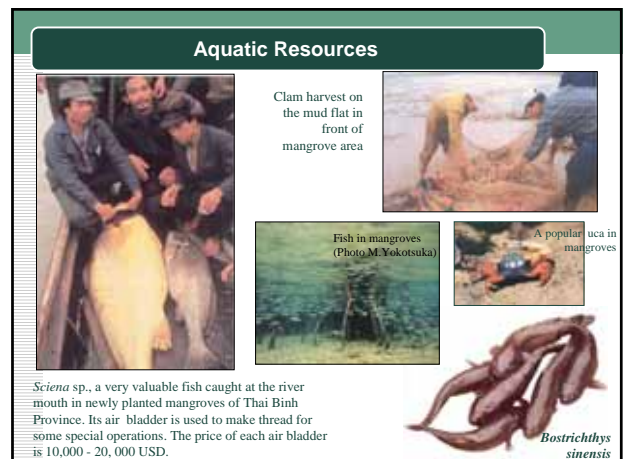
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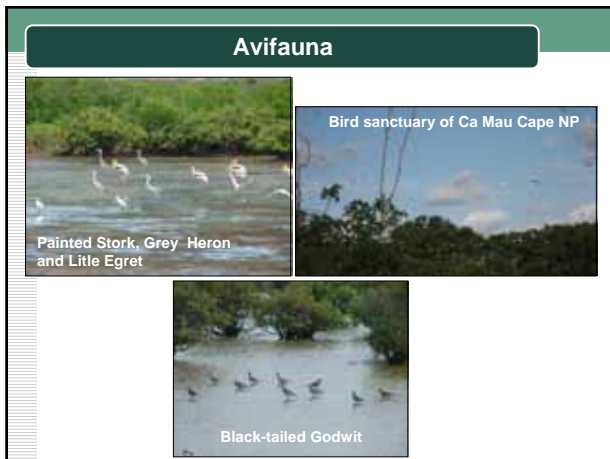
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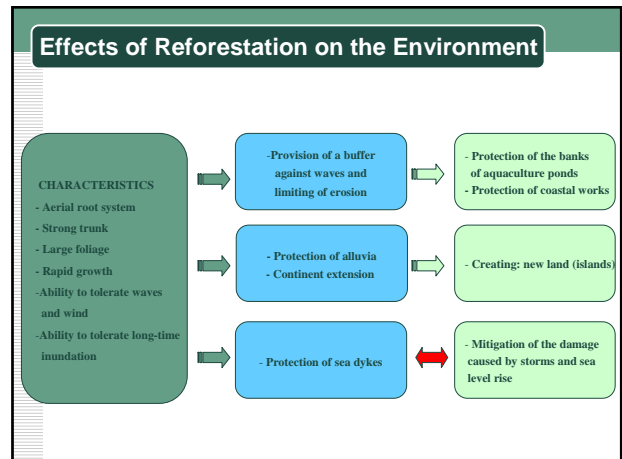
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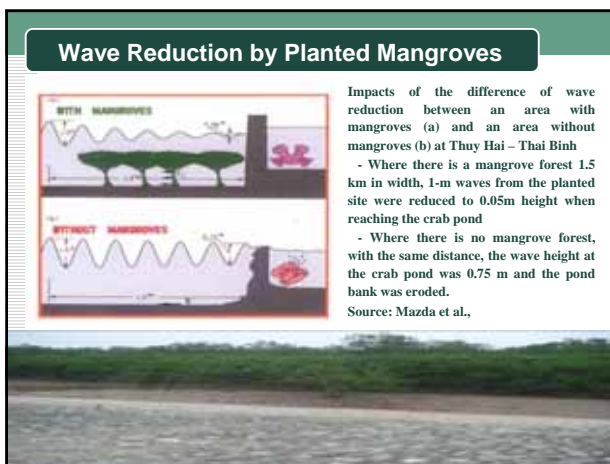
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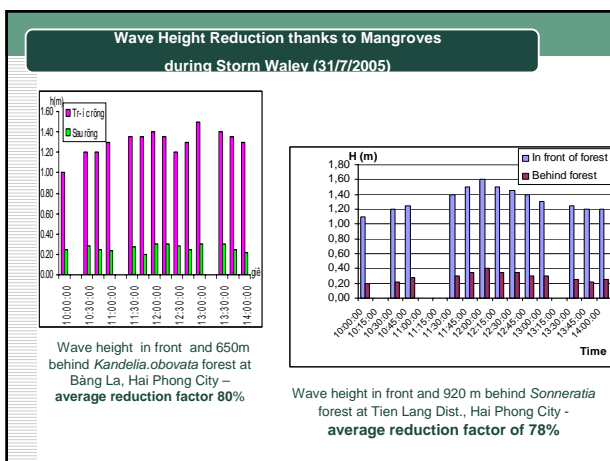
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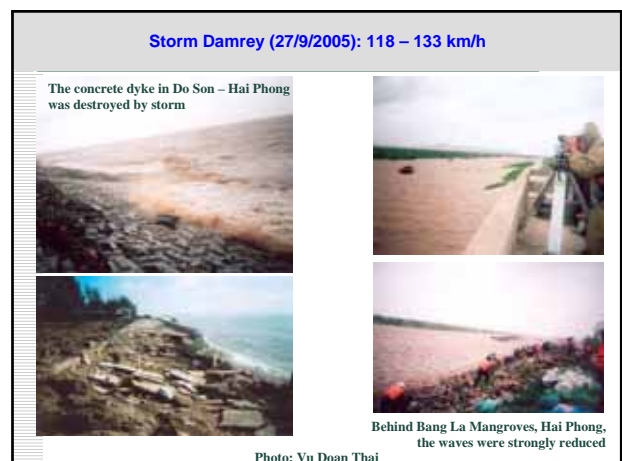
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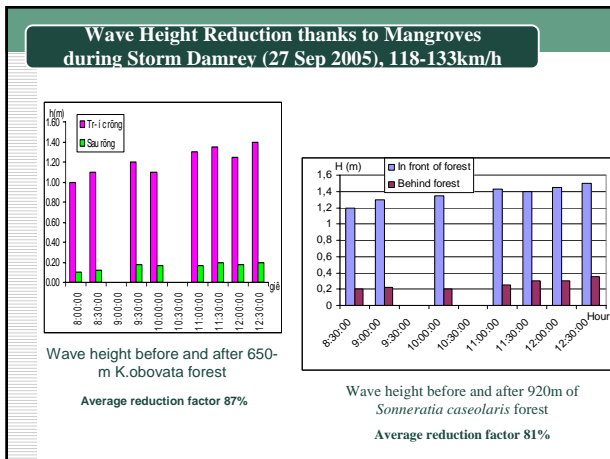


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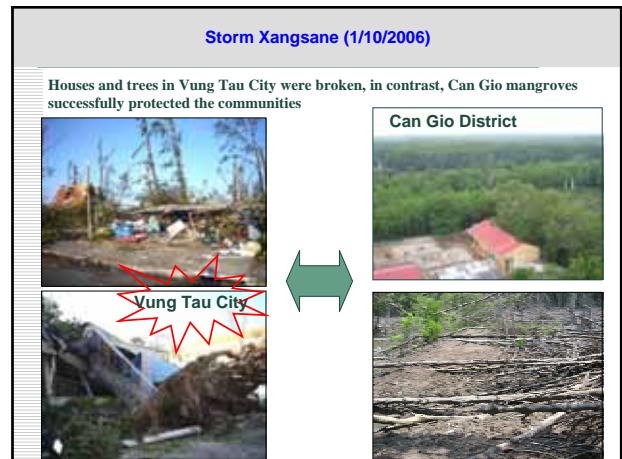


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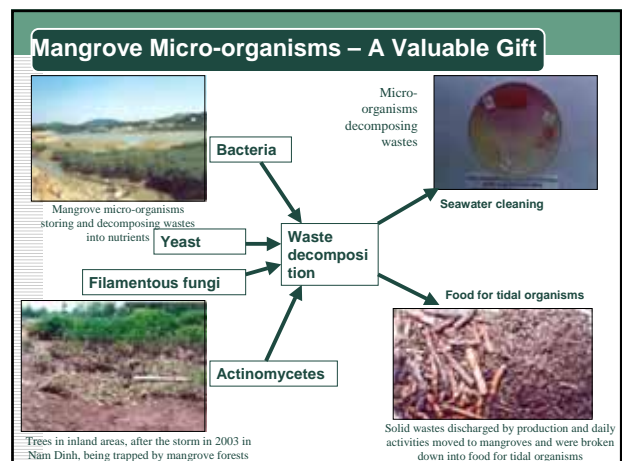
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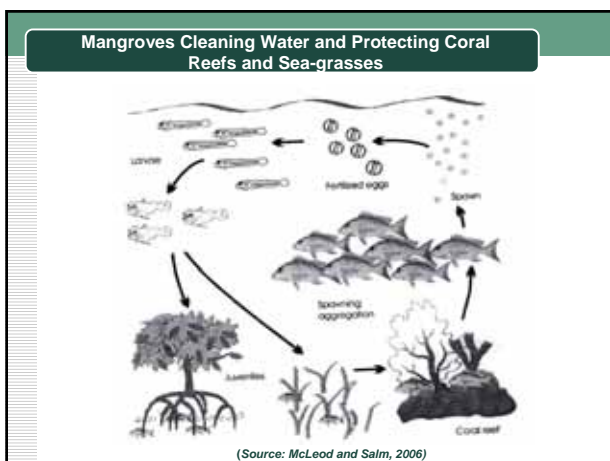
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### Catching Aquatic Resources – the Livelihood of Poor Coastal Dwellers



The new house of one poor household living on catching aquatic resources

Digging for sea crabs



On the way to catch aquatic products



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### Side-line Jobs for Poor Households



Thinned timber is very good for house building



Handicraft: weaving of nipa palm leaves (photo: L.K.Thoa)



Stimulating nipa fruit bunch to extract sap for soft drink

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### Eco-tourism – a New Source of Income



Can Gio Resort

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Macaques

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Visiting resistance base



Watching crocodiles

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### Ca Mau Cape National Park



Ca Mau Cape National Park



New road in the planted mangrove



Tourist area



Bird sanctuary

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## Xuan Thuy Ramsar Site



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## Scientific Research



Students of Ho Chi Minh City studying mangrove flora



Vietnamese and Japanese scientists studying the growth of mangrove trees



Japanese scientists studying physical processes in mangrove areas

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## Scientific Research



Studying structure of mixed forests in Can Gio mangrove forest



Japanese and Vietnamese scientists studying mangrove soil in Can Gio (photo: P.N.Hong)



Scientists studying biomass of *Avicennia alba* forest

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## Students' Camping and Educational Excursions

Japanese students participating in mangrove plantation



Students watching monkeys



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## Public Education on Mangrove Protection - the Next Step



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## Raising Awareness of Students and Communities



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## Educational and Promotional Activities



Educational activities for the whole community

- Training courses for local communities and local management staff
- Mobile exhibition "For the Green of Mangroves"
- Study visits to MERS for secondary school students in coastal mangrove areas
- Mangrove knowledge quizzes



Training course for teachers of biology in coastal area



Training students on environmental knowledge at Mangrove Ecosystem Research Station (MERS)



Training course for local officials at MERS

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## National Symposium "Mangrove Restoration For Climate Change Adaptation And Sustainable Development" – Can Gio, 26-27/11/2007



Symposium presidium



Overview of the meeting hall



Participants learning about the life of forest guards



Visiting Can Gio Mangrove Museum

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## Maintenance of the Harmony: Can Gio Case Study



Group of farmers discussing forest protection allocation for protection purpose



Meeting of forest guard households



Meeting of forest protection staff on coordination with forest guard households

Meeting of the Steering Board on forest protection

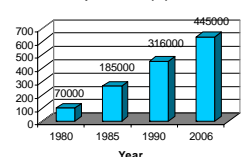


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## Policies for Mangrove Protection

- City leaders have created favorable material and spiritual conditions for local households in long-term mangrove caring and protection:
  - Select poor households with labor force
  - Provide payment for house building in forests, and internal furniture
  - Provide boats
  - Provide fresh water
  - Grant scholarship to their children
  - Increase gradually the payment for forest guards
- Stable life, secure feelings

Yearly increase in payment for forest protection (%)



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## Discussion on selection of forest guard households and establishment of a supporting group for forest protection



Group of farmers discussing forest protection allocation for protection purpose



Meeting of forest guard households



Meeting of forest protection staff on coordination with forest guard households

Meeting of the Steering Board on forest protection



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## Guard Households Living in Harmony with Mangroves

Cockle rearing areas



House of a forest guard household



Crab pond of a forest guard household



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### Additional Income for Forest Guard Households

Blue dragon cultivation



Goat raising



Pig raising



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### Can Gio Biosphere Reserve – Our Pride



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Welcome Japanese students and scientists  
to Vietnam and our mangroves!



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