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OVERVIEW OF WETLANDS STATUS IN VIET NAM FOLLOWING 15 YEARS OF RAMSAR CONVENTION IMPLEMENTATION





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Acronyms and Abbreviations

BAP	Biodiversity Action Plan
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanisms
CERED	Centre for Environment Research Education and Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRES	Centre for Natural Resources and Environmental Studies
DARD	Department of Agriculture and Rural Development
DOFI	Department of Fisheries
DONRE	Department of Natural Resources and Environment
GEF	Global Environment Facility
GIS	Geographic Information System
IUCN	The World Conservation Union
MARD	Ministry of Agriculture and Rural Development
MERC	Mangrove Ecosystem Research Centre
MOFI	Ministry of Fisheries
MONRE	Ministry of Natural Resources and Environment
MOSTE	Ministry of Science, Technology and Environment
MRC	Mekong River Commission
MWBP	Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme
NEA	National Environment Agency
NGO	Non-Governmental Organisation
PPC	Provincial People's Committee
RRA	Rapid Rural Appraisal
SIDA	Swedish International Development Cooperation Agency
Sub-FIPI	Southern Sub-Institute of Forest Inventory and Planning
TEV	Total Economic Value
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
VEPA	Viet Nam Environment Protection Agency
WOTRO	Netherlands Foundation for the Advancement of Tropical Research
WWF	World Wildlife Fund

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1. Introduction

There is a great diversity of wetlands in Viet Nam that possess a range of resources, biodiversity, functions and important social, economic and cultural values. With an area of more than 10 million hectares, wetlands can be found in almost all ecological regions of the country. These wetlands play a vital role in the lives of the local people and the socio-economic development of the country.

In recognition of the importance of wetlands, Viet Nam joined the Ramsar Convention on Wetlands in 1989 as the 50th State Member. Over the last 15 years, Viet Nam has initiated a great number of efforts relating to research, inventory, and development of tools and techniques for the conservation, utilisation and management of wetlands following the Ramsar Convention's objectives. However, these efforts have not fully met the requirements of wise use, sustainable conservation and development of wetlands. In regard to wetland management, one main constraint has been that available data and information on the location and status of wetlands, as well as legal frameworks and management policies relating to wetlands have been dispersed and incomplete. This has made it difficult to gather an overall assessment of wetland status in Viet Nam, which could lay a foundation for the identification of priorities and proper wetlands management strategies. In addition, up to now, Viet Nam has lacked a comprehensive and updated assessment of wetland status in the country. In regard to this it was necessary to conduct a review and assessment of achievements, shortcomings and trends of activities relating to wetlands in order to share lessons and identify

recommendations about wise use, conservation and management of wetlands in Viet Nam.

In response to the above mentioned situation and to contribute to the biodiversity conservation, management and sustainable development of wetlands in Viet Nam, the Viet Nam Environment Protection Agency (VEPA) of the Ministry of Natural Resources and Environment (MONRE) together with IUCN Viet Nam have prepared the "Overview of Wetlands Status in Viet Nam Following 15 Years of Ramsar Convention Implementation".

This report has been developed through a collation and analysis of reliable, up-to-date data, using an interdisciplinary approach and also recognising that wetland ecosystems should be conserved and developed in a sustainable manner. The report consists of three parts and six annexes (summary of the Ramsar Convention; Viet Nam wetland classification by MARD; maps of wetlands in Viet Nam; wetland sites of biodiversity and environmental value in Viet Nam; economic valuation of selected wetlands in Viet Nam; and list of selected legal documents related to wetlands).

It is anticipated that this report could serve as a valuable reference for managers, policy makers, researchers, post graduate students and others whose work relates to wetlands. The report could also serve as a milestone marking processes and trends in conservation and management of wetlands in Viet Nam over the last 15 years, and presenting recommendations for the country's wetland management in the future.

2. Overview of wetlands in Viet Nam

2.1. Wetlands in Viet Nam

There are a number of definitions of wetlands worldwide which vary from country to country, and depend on the purpose of wetlands use and management. In Viet Nam, the definition stated in Article 1 of the Ramsar Convention on Wetlands (Appendix A) has been officially applied for activities relating to wetlands: *"Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"*.

Under this definition, factors like geomorphology, hydrology, pedology, flora and fauna, and land use status are important criteria in the identification of wetlands.

2.1.1. Physical characteristics of wetlands in Viet Nam

Geomorphology: Hills and mountains cover two thirds of the total natural area of Viet Nam, with a general downward slope from west to east. The northern and southern plains are river basins which form two of the typical wetlands in the country known as the Red River Delta and the Mekong River Delta.

Climate: Viet Nam is located in a tropical monsoon area. It has a rather high average annual temperature (above 20°C), a high average annual humidity (above 80%), and a high rate of rainfall (1,500 mm/year). Differences in the climate regime between regions, especially in terms of temperature and humidity, have influenced their respective hydrological regimes (e.g. duration of inundation, depth of inundated water, water temperature), leading to differences in wetland types.

Hydrology: Viet Nam has a dense network of rivers and streams through which water is drained to the sea. There are a total of 2,500 rivers in the country, 2,360 of which have a length of more than

10 km (Phan Nguyen Hong, 1996). The Mekong River system has the largest discharge volume into the country, accounting for 61.4% of the total volume of national runoff. Rivers flowing to the sea have created a number of estuarial systems - one of the most important wetland types in Viet Nam. There are currently more than 3,500 small reservoirs and 650 medium and large-size reservoirs in Viet Nam. Typical large reservoirs include Thac Ba, Hoa Binh, Dau Tieng and Tri An with surface areas of 23,400 ha, 21,800 ha, 35,000 ha and 27,000 ha respectively (Nguyen Viet Pho, Vu Van Tuan, Tran Thanh Xuan, 2003).

Box 1: Major river systems in Viet Nam

1. Mekong River
2. Red River
3. Thai Binh River
4. Ky Cung-Bang River
5. Ma River
6. Ca River
7. Thu Bon River
8. Ba River
9. Dong Nai River

Pedology: There are 15 soil types in Viet Nam, seven of which are related to soil characteristics of wetlands. They include saline, acid sulphate, alluvial sediments, clay, peat, grey, and sandy soil. The differences in geomorphology, climate and pedology define the vegetation characteristics of wetland ecosystems, with two typical types: vegetation of saltwater wetlands and vegetation of freshwater wetlands.

2.1.2. Inventory of wetlands

The first effort at creating an inventory of wetlands was conducted in 1989 by Le Dien Duc et al. (see Box 2).

Box 2: Typical wetland areas in Viet Nam

<p>Reservoirs (21):</p> <ol style="list-style-type: none"> 1. Ba Be 2. Thac Ba 3. Ho Chu 4. Ho Nui Coc 5. Ho Song Da 6. Ho Tay 7. Ho Dong Mo-Ngai Son 8. Ho Suoi Hai 9. Ho Cam Son 10. Ho Song Muc 11. Ho Yen My 12. Ho Ke Go 13. Ho Cam Ly 14. Ho Bien Ho 15. Ho Nui Mot 16. Ho Liet Don 17. Ho Phu Ninh 18. Ho Cu Mong 	<ol style="list-style-type: none"> 19. Ho Lak 20. Ho Da Nhim 21. Ho Bien Lac <p>Marshes and swamps (5):</p> <ol style="list-style-type: none"> 1. Chinh Cong 2. Dam Vac 3. Quy Nhon 4. Dam O Loan 5. Dam Nai <p>River deltas (2):</p> <ol style="list-style-type: none"> 1. Red River 2. Mekong River <p>Estuaries (2):</p> <ol style="list-style-type: none"> 1. Red River 2. Tien River <p>Swamps (3):</p> <ol style="list-style-type: none"> 1. Sen 2. Sau (He-Hlam) 3. Nam Cat Tien 	<p>Lagoons (1):</p> <p>Tam Giang Lagoon.</p> <p>Bird colonies (3):</p> <ol style="list-style-type: none"> 1. Bac Lieu 2. Dam Doi 3. Cai Nuoc <p>Mangrove forests (2):</p> <ol style="list-style-type: none"> 1. Vo Doi <i>Melaleuca</i> Forest Reserve 2. Nam Can Mangrove Forest <p>Seasonal wetlands(1):</p> <p>Plain of Reeds</p> <p>Islands (2):</p> <ol style="list-style-type: none"> 1. Cat Ba 2. Con Dao
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Source: Le Dien Duc et al., 1989

In 2001, the National Environment Agency (now the Viet Nam Environment Protection Agency) recommended 68 wetland sites as having environmental and biodiversity values (see Appendix D). This list contains more comprehensive data than any prior documents, and could serve as the foundation for the identification of wetlands of national and international importance.

From 2002 to 2004, a Wetlands Component of the UNEP-GEF project on "Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand", coordinated by Prof. Dr. Mai Trong Nhuan, developed profiles for ten coastal wetland sites with the highest values in Viet Nam according to the Ramsar Convention's criteria (see Box 3).

2.1.3. Development of a classification system and mapping of wetlands

Viet Nam does not yet have an official classification system that can be applied for the various wetlands management related sectors. A map of the current status of wetlands in Viet Nam that could serve for wetland planning at the

Box 3: Ten coastal wetland sites of highest value* in Viet Nam

1. Tien Yen Estuary
2. Bach Dang Estuary
3. Van Uc Estuary
4. Ba Lat Estuary
5. Kim Son Tidal Flat
6. Tam Giang-Cau Hai Lagoons
7. Tra O Marsh
8. Dong Nai Estuary
9. Tien Estuary
10. Southwest Ca Mau Tidal Flat

* According to the Ramsar Convention's criteria

national level is not yet available. Thus, developing and legalising a classification system and mapping Viet Nam's wetlands should be a prioritised activity in the conservation and sustainable development of wetlands in Viet Nam.

Based on the Ramsar Convention wetland definition, as well as soil, water and biological characteristics, several classification systems have

been recommended by organisations and scientists including Le Dien Duc (1989), Phan Nguyen Hong (1996), Nguyen Chu Hoi (1999), Nguyen Huy Thang (1999), Nguyen Chi Thanh et al. (1999, 2002), Hoang Van Thang et al. (2002) and Vu Trung Tang (1994-2004).

From 1990 to 1996, the Southern Sub-Institute of Forest Inventory and Planning (Sub-FIPI) proposed a classification system for wetlands of the Mekong Delta to facilitate wetland management in this region. In 1993, Nguyen Chi Thanh et al. applied a classification system for Viet Nam's wetlands with four levels: Level 1 - System (based on water body's characteristics); Level 2 - Subsystem (based on geomorphological characteristics); Level 3 - Class (based on hydrological characteristics) and Level 4 - Subclass (based on the status of vegetation and land use). Based on this classification system, the Ministry of Agriculture and Rural Development (MARD) issued a Sector Standard Classification System of Viet Nam Wetlands in 2004. This system is compatible with the wetlands map at a scale of 1:1,000,000 and serves as a tool for the state management functions of MARD (Appendix B).

Scientists who implemented a Wetlands Component of the project "Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand" recommended a classification system following the one developed by the Ramsar Convention, with some additions and modifications in order to make it more relevant to Viet Nam (Mai Trong Nhuan, Vu Trung Tang et al., 2004). This system includes four levels: System (3 types), Subsystem (8 types), Class (20 types), and Type (57 types).

2.1.4. Wetland ecosystems

Wetlands in Viet Nam are comprised of two groups: inland wetlands and coastal wetlands. Inland wetlands are present in all ecological regions and are very diverse in terms of type, morphology, resources, functions, values and potential for exploitation, usage and protection. Inland wetlands include permanently flooded river deltas, creeks, permanent or temporary rivers and streams, freshwater lakes, peatland, swamps, saltwater lakes, mountain wetlands, geothermal wetlands, aquaculture ponds, lakes with areas

greater than eight ha, and marshes. Coastal wetlands are distributed widely along the coastline of Viet Nam, and include estuaries, tidal flats, lagoons, and marine water bodies with a depth not exceeding six metres at low tide. Mangrove forests and mudflats are concentrated mainly in deltas, estuaries and tidal areas. Lagoons are present mainly along the coastline of central Viet Nam, from Hue to Ninh Thuan. Coral reefs and seagrass beds are distributed in the coastal area of south-central Viet Nam.

Although there are numerous wetland ecosystems in Viet Nam, this report will focus on the five most important categories of wetlands for Viet Nam, including estuarine wetlands of the Red River Delta, the lagoon system in central Viet Nam, wetlands in the Mekong Delta, lakes and reservoirs, and some other unique and important wetland types.

a. Estuarine wetlands of the Red River Delta

According to a Map of Estuarine Wetlands in the Red River Delta at a scale of 1:100,000 (Southern Sub-Institute of Forest Inventory and Planning and Viet Nam Soil Science Association, 2004 - Appendix C), estuarine wetlands cover 229,762 ha, occupying 76% of the total natural area of the delta. Of this, 125,389 ha are saltwater wetlands consisting of 22,487 ha of coastal wetlands and 102,482 ha of estuarine waters. Coastal wetlands are mainly distributed at the estuaries of Nam Trieu, Cam, Lach Tray, Van Uc, Thai Binh, Ba Lat, Lach Giang and Day Rivers where land is used most commonly for agriculture, fisheries, and aquaculture production. Freshwater wetlands cover 103,373 ha of the Red River Delta, where agricultural production is the main land use activity.

Table 1: Wetlands in the Red River Delta

Wetlands of Van Uc Estuary	
Description	17,000 ha of Hai Phong alluvial flat, of which 11,000 ha are mangrove forests, 1,000 ha are not mangrove forests and 5,000 ha are brackish aquacultural ponds.
Mangrove profile	50 species from 28 families. Domination of <i>Sonneratia caseolaris</i> , together with <i>Kandelia candel</i> , <i>Aegiceras corniculata</i> , <i>Acanthus ebracteatus</i> , <i>Avicennia marina</i> and <i>Cyperus malaccensis</i> .
Species profiles	185 phytoplankton species, 306 zoobenthos species, 90 fish species, five reptile species and 37 bird species.
Dominant waterbird species	<i>Anas poecilorhyncha</i> , <i>Podiceps ruficollis</i> , <i>Fulica atra</i> , <i>Phalacrocorax carbo</i> , <i>Hydrophasianus chirurgus</i> and <i>Rallus</i> .
Local economy	Agriculture is the major livelihood of local communities.
Wetlands of Thai Binh and Tra Ly Estuaries	
Description	Typical estuarine delta where the intertidal flats are formed with high rates of sediment deposition. Total intertidal flat covers 11,409 ha, of which the potential area for mangrove forest plantation is 6,775 ha. The current area of mangrove forest is 3,388 ha.
Mangrove profile	52 species from 48 genera and 26 families. Dominant species include <i>Sonneratia caseolaris</i> , <i>Kandelia candel</i> , <i>Aegiceras corniculata</i> , <i>Excoecaria agallocha</i> and <i>Avicennia lanata</i> .
Species profiles	170 algal species, 108 phytoplankton species, 37 species of zoobenthos and 152 fish species with the most abundant species from three families of Perciformes, Clupeiformes and Pleuronectiformes.
Endemic bird species	<i>Platalea minor</i> , <i>Larus saundersi</i> , <i>Pelicanus</i> , <i>Pelicanus philippensis</i> and <i>Threskiornis melanocephalus</i> .
Local economy	The local communities earn their living by raising ducks, fishing, and through aquaculture and sand exploitation.
Wetlands of Ba Lat Estuary (Tien Hai-Giao Thuy)	
Description	Mangrove area of 6,008 ha and an alluvial flat of 25,934 ha (Picture 1). The tidal flat is formed annually by alluvial sedimentation at a rapid rate (26-67 m/year).
Mangrove profile	95 mangrove plant species. Dominant species include <i>Sonneratia caseolaris</i> , <i>Kandelia candel</i> , <i>Avicennia lanata</i> , <i>Derris trifoliata</i> and <i>Avicennia marina</i> .
Species profiles	180 algal species, 165 species of phytoplankton, 200 species of zoobenthos, 56 fish species from 29 families, six mammal species. 181 water bird species of which the most abundant is from the Passeriformes order.
Rare and endangered species	Three rare species: <i>Lutra lutra</i> , <i>Delphinus</i> and <i>Neophocaena phocaenoides</i> . Nine species are listed in the Red Book.



Picture 1: Tidal flat wetlands at Ba Lat Estuary (Mai Trong Nhuan, 2003)



Picture 2: Mangrove forests along Nang channel of Ong Doc River mouth (Mai Trong Nhuan, 2003)

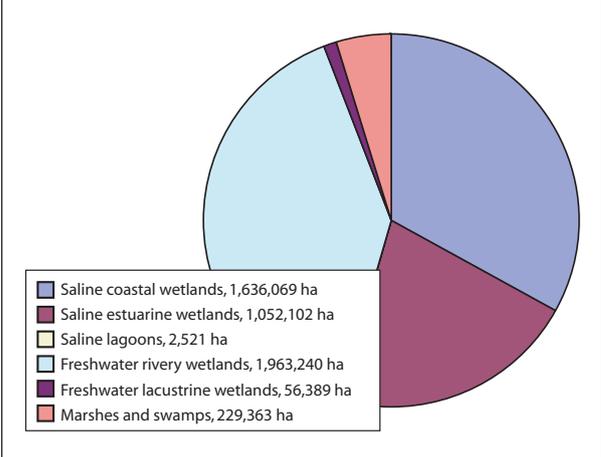
b. Wetlands in the Mekong Delta

The Mekong Delta within Viet Nam territory is the furthest downstream portion of the Mekong River Basin. The Mekong Delta has a total area of approximately 3.9 million hectares, occupying about 12% of the total natural area of the country, including thirteen provinces and cities: Long An, Tien Giang, Dong Thap, An Giang, Kien Giang, Hau Giang, Ca Mau (Picture 2), Bac Lieu, Soc Trang, Tra Vinh, Vinh long, Ben Tre and Can Tho City.

Wetlands of the Mekong Delta are among the richest ecosystems of the basin (tidal floodplains, coastal marshes, peatland marsh, estuaries, etc.) and are important breeding sites for many aquatic species migrating from upper reaches of the Mekong River. According to a Map of Wetlands in the Mekong Delta at a scale of 1:250,000 (Appendix C3), the wetland area covers 4,939,684 ha, which includes inland wetlands and coastal wetlands with a depth of less than six metres at low tide (Figure 1).

Saline coastal wetlands are distributed along the coastline of the East Sea, southwest of the Ca Mau Peninsula and the Gulf of Thailand. Of a total of 1,636,069 ha, 879,644 ha are permanently flooded wetlands distributed in the sea region at depths less than six metres at low tide, and 756,425 ha are seasonally flooded. The most common wetland types in this area include permanently flooded and non-vegetated saltwater wetlands, seasonal saltwater wetlands for agricultural cultivation, and seasonal saltwater wetlands for aquaculture. Mangrove forests along the coastline play a very

Figure 1: Areas of typical wetland types in the Mekong Delta (according to the Map of Wetlands at a 1:250,000 scale)



Source: Southern Sub-FIPI, 2003



Picture 3: Coastal mangrove forests in Ca Mau Province (Mai Trong Nhuan, 1998)

important role in the coastal wetland ecosystem (Picture 3). In the past, mangrove cover was extensive along the coast, but mangroves have

since been degraded and reduced substantially in terms of both quantity and quality.

Estuarine wetlands are distributed mainly in the mouth of the Mekong River in the provinces Long An, Tien Giang, Ben Tre, Tra Vinh and Soc Trang. They are either seasonal saltwater wetlands for agricultural cultivation or seasonal saltwater wetlands for aquaculture.

Saltwater lagoons are distributed in Dong Ho Lagoon (Ha Tien) and Thi Tuong Lagoon (Ca Mau) within the coastal area of the Gulf of Thailand.

Riverine wetlands cover a huge floodplain in the centre of the Mekong Delta. Permanent riverine wetlands are major tributaries of the Tien and Hau Rivers, and of other rivers and channels, covering 128,139 ha. Seasonal riverine wetlands have an area of 1,771,381 ha and are mainly rice fields, fruit gardens and other agricultural cultivation areas (Picture 4).

Lacustrine wetlands are distributed in lakes of *Melaleuca* forest in U Minh Ha (Ca Mau Province), lakes of *Melaleuca* forest in U Minh Thuong (Kien Giang Province) and in Tram Chim National Park (Dong Thap Province). In the past, *Melaleuca* forests covered almost all acid sulphate regions of the Mekong Delta. Nowadays, only 182,170 ha of *Melaleuca* forest remain, and are distributed mainly in the U Minh peatland area, in the acid sulphate soil area of the Plain of Reeds and in the Ha Tien grassland region (Southern Sub-FIPI, 2004). These are habitats for many freshwater aquatic species and also provide woods, fuels, fishes and honey. An outstanding feature is that a peaty soil layer in the U Minh *Melaleuca* forest plays a very important role in the ecosystem.



Picture 4: Houses along Ca Mau River (Mai Trong Nhuan, 1998)

Under saturated conditions, the peat will prevent the process of acidification in potentially acidic sulphate soil. Under dry conditions however, such as when the wetlands are drained, the peat is rapidly oxidised, leading to acidification of the soil.

Swamps and marshes in the Mekong Delta are mainly intermittent marshes used for agricultural cultivation. They are distributed in the Plain of Reeds and Long Xuyen Quadrangle.

Major wetland ecosystems in the Mekong Delta are very important to the region, and include mangroves, *Melaleuca* forests, and estuaries. Some typical wetlands in the region are wetland national parks and nature reserves that have been established by the Prime Minister (Table 2).

c. Lagoon systems in central Viet Nam

Lagoon systems of Viet Nam are located mainly along the coastline of central Viet Nam, from Thua Thien Hue to Ninh Thuan (Box 4). The total area of these lagoons is about 447.7 km². The biggest lagoon is the Tam Giang-Cau Hai system which is more than 67 km in length with an area of approximate 216 km² (Appendix C2, Picture 5). The smallest is Nuoc Man Lagoon in Quang Ngai Province with an area of about 2.8 km². Currently, for a number of reasons, lagoons have not been properly managed and have been exploited irrationally leading to their degradation. Within the lagoon systems, there are four wetland groups, including non-vegetated wetlands, vegetated wetlands, wetlands with a water depth reaching six metres, and man-made wetlands. Depending on the origins of formation, physical conditions and interactions between natural processes and human activities, wetland types in the lagoon systems differ from one another.

Biological resources: Lagoon systems support very rich fauna resources in terms of composition and structure, including freshwater, brackish and saltwater species. Dominant species vary according to season. Potential biological resources from lagoons are mainly fish, crustaceans, molluscs, seaweeds and seagrasses. The most typical species include: *Mugil cephalus*, *Clupanodon punctatus*, *Metapenaeus ensis*, *Penaeus monodon*, *Arca*, and *Meretrix*. These wetland habitats also have some valuable algal species, such as *Glacilaria asiatica* and *Glacilaria*

Table 2: Wetland National Parks and Nature Reserves in the Mekong Delta

Mui Ca Mau National Park	
Ca Mau Province Area: 41,862 ha	Main functions and tasks are to conserve the mangrove forest ecosystem of the Ca Mau cape. This ecosystem is typical of coastal wetlands in southern Viet Nam and has a vast array of values in terms of biodiversity, socio-economics, culture and history of the area.
Tram Chim National Park	
Dong Thap Province Area: 7,588 ha	Main functions and tasks are to conserve a flooded <i>Melaleuca</i> forest ecosystem of the Mekong River, which is a typical wetland ecosystem of the Plain of Reeds and a habitat for many rare waterbirds, especially the Eastern Sarus Crane (<i>Grus antigone</i>).
U Minh Thuong National Park	
Kien Giang Province Area: 8,038 ha	Main functions and tasks are to conserve <i>Melaleuca</i> forest and peatland, together with the preservation of rare wildlife species and the U Minh historical monument.
Thanh Phu Wetland Nature Reserve	
Ben Tre Province Area: 4,510 ha	Main functions and tasks are to conserve mangrove forests of the Mekong Delta Estuary and the Ho Chi Minh sea trail of southern Viet Nam - a national historical monument.
Kien Luong Landscape Reserve	
Kien Giang Province Area: 14,605 ha	Main functions and tasks are to conserve a <i>Melaleuca</i> forest ecosystem and a seasonally flooded grassland as well as the conservation of rare waterbirds, especially the <i>Grus antigone</i> .
Lung Ngoc Hoang Wetland Nature Reserve	
Hau Giang Province Area: 6,000 ha	Main functions and tasks are to conserve <i>Melaleuca</i> forest and floodplain wetlands in the west of Hau River, as well as waterbird species and cultural values relating to historical periods of wet rice cultivation expansion in southern Viet Nam.
Bac Lieu Bird Colony Reserve	
Bac Lieu Province Area: 127 ha	Mandates are to conserve saline wetland areas and waterbird species.
Vo Doi Wetland Nature Reserve	
Ca Mau Province Area: 3,394 ha	Main functions and tasks are to conserve rare waterbird species and natural <i>Melaleuca</i> forests above peatland.

tenuistipitata, and some seagrass species with high biomass, which can be exploited and used as fertilisers and food source for cattle. In the Tam Giang-Cau Hai Lagoon system, there are 37 species of zoobenthos (*Polychaeta*), crustaceans and molluscs, of which molluscs are the most abundant, followed by crustaceans. The potential stock of dried *Glacilaria* can reach 5,000 tons/year, and the density of fresh *Valisneria spiralis* can range from 3.6 to 10.2 kg/m².


 Picture 5: Tam Giang-Cau Hai Lagoon
(Mai Trong Nhuan, 1999)

Box 4: Lagoon systems in central Viet Nam

1. Tam Giang-Cau Hai
2. Lang Co
3. Truong Giang
4. An Khe
5. Nuoc Man
6. Tra O
7. Nuoc Ngot
8. Thi Nai
9. Cu Mong
10. O Loan
11. Thuy Trieu



Picture 6: Mangrove forests in Quang Dien Commune, Hai Ha, Quang Ninh (Tran Dang Quy, 2004)

Abiological resources: Abiological resources are not rich, but minerals present include zircon, ilmenite, and sand for construction. White sand is present in many lagoons and can be used as a raw material for making glass. For instance, the white sand area of Phu Xuan (Tam Giang-Cau Hai Lagoon) has a potential volume of approximately 8 million m³.

In terms of biodiversity and ecological functions, there are five coastal lagoons that could be considered important wetlands of Viet Nam. They include O Loan (Phu Yen Province), Thi Nai and De Gi (Binh Dinh Province), Cau Hai (Thua Thien Hue Province) and Dam Nai (Ninh Thuan Province).

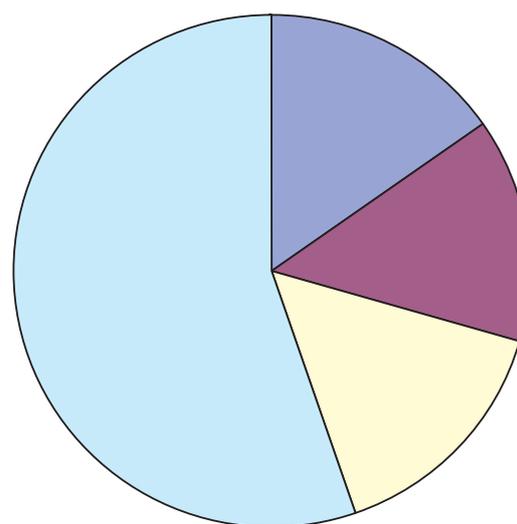
d. Some other wetland types in coastal Viet Nam

Mangrove forests: According to statistical data provided by the Viet Nam Forest Science Institute in 2001, Viet Nam has approximately 155,290 ha of mangrove forests, of which natural mangrove forests cover 32,402 ha (21%) and planted mangrove forests cover 122,892 ha (79%). Mangrove forests play a vital role in coastline protection, mitigation of wave and storm impacts and local climate stabilisation. Mangroves also provide tourism and recreation areas as well as medicine and animal food sources.

Mangrove forests have many important functions and values, including: provision of wood, fuel, fish and other resources; provision of breeding, feeding and nursing areas for many species which have economic values; stabilisation of newly formed tidal mudflats; protection of the coastline from impacts of waves, storms and tsunamis; and

provision of habitats for many local and migratory wildlife species (bird, mammal, amphibian, reptile). According to Phan Nguyen Hong (2004), the Red River Estuary has 111 mangrove species which can be used as food and medicinal sources, 13 species provide food source for cattle, and 33 species can play a role in dike protection and mitigation of impacts from waves, wind and soil erosion (Picture 6).

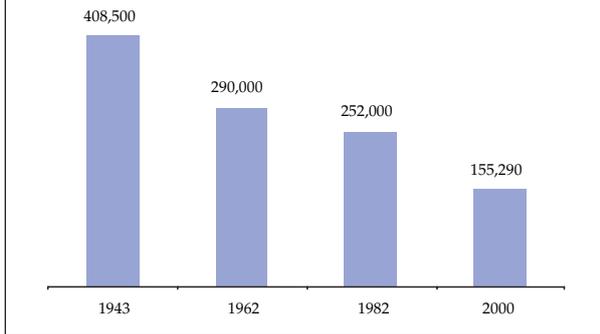
Figure 2: Mangrove forest distribution in Viet Nam



■ Northeast region, 22,969 ha
 ■ Red River Delta region, 20,842 ha
 ■ North Central region and Ho Chi Minh City, 22,969 ha
 ■ Mekong Delta region, 82,387 ha

Source: Viet Nam Forest Science Institute, 2001

Figure 3: Changes in mangrove forest areas in Viet Nam, 1943-2000 (ha)



Source: Viet Nam Forest Science Institute, 2000

However, mangrove forests are being severely degraded due to their conversion into agricultural and aquacultural land (Picture 7) and due to sea reclamation and coastal bank erosion. More than 200,000 ha of mangrove forests have been destroyed over the last two decades for the purpose of shrimp farming. Specifically, in the Ganh Hao area of Bac Lieu Province, about 7,000 ha mangroves have been lost during a 27-year period (from 1964 to 1991) due to erosion, with an average loss of approximately 259 ha/year (Figure 3).

Loss of mangrove forests could have extremely negative effects, including a loss of richness in biodiversity, loss of habitats and breeding sites, soil acidification, environmental pollution, and coastline and estuary erosion. For instance, in southwestern Ca Mau, after one year of conversion of mangrove forests into shrimp ponds, approximately 20 zoobenthos species were lost while bird species from Bac Lieu and Dam Doi colonies migrated to other areas. In Tien Hai (Thai Binh Province), the conversion of 2,500 ha mangrove forests to shrimp ponds has caused substantial damage to the environment (e.g. H₂S and COD concentrations exceed standards, leading to acidification and salinisation of the soil and water environment over a vast area; as well as erosion and subsequent loss of habitat for migratory birds); in addition, local communities have experienced difficulty in maintaining their livelihoods, and some poor fishermen have lost their jobs.

Coral reefs: Coral reefs are among the most unique marine habitats in the country with a great diversity of species, huge volume of primary production and marvellous landscapes. Coral



Picture 7: Destruction of mangrove forests for conversion into shrimp farming ponds in Tien Toi Commune, Hai Ha, Quang Ninh Province (Tran Dang Quy, 2004)



Picture 8: Coral reefs in Ninh Thuan (Dam Quang Minh, 2002)



Picture 9: *Th.hemprichii* lives together with corals around Truong Sa Island (Nguyen Huy Yet, 1996)



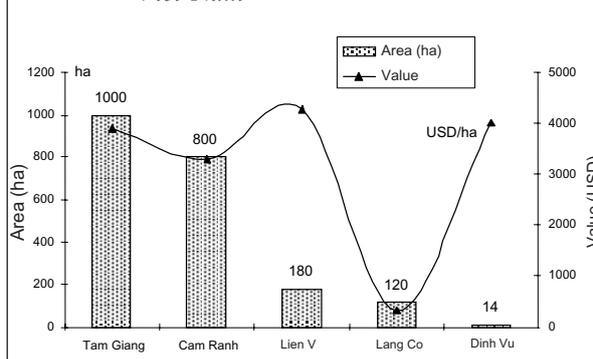
Picture 10: Exploitation of corals for souvenirs in Nha Trang - Khanh Hoa (Mai Trong Nhuan, 2003)

reefs are distributed widely throughout Viet Nam, from the north to the south with an area of about 1,112km², concentrated mainly in the sea of south-central and southeastern Viet Nam, Hoang Sa and Truong Sa Archipelagos (Pictures 8, 9). Viet Nam's coral is unique in its abundance and variety of reefs with more than 350 species of scleractinian (reef building) corals. Approximately 3,000 marine species are closely associated with coral reefs, of which about 2,000 are zoobenthos species, 500 are fish species and many others are economically significant species including lobster (*Panulirus*), abalone (*Haliotis diversicolor*), pearl (*Pteria martensi*), and holothurian (*Holothuria*). In Ha Long Bay, 205 hard corals (*Scleratina*), and 27 soft corals, including *Gorgonacea*, *Alcyonacea* and *Stolonifera* have been identified. In Con Dao Island, 219 coral species from 17 families have been identified. They are concentrated in a large area in which approximately 160 coral fish species can be found. Coral reefs have a very complicated structure and are sensitive to environmental threats, especially those caused by humans, such as cyanide and explosive fishing, over-exploitation (Picture 10), tourism, and other socio-economic development activities. In the last fifteen years, about 15-20% of coral coverage has been lost in Viet Nam, mainly in residential areas such as Ha Long-Cat Ba Bay, the coastal provinces of central Viet Nam from Da Nang to Binh Thuan, and around some islands of Truong Sa Archipelago.

Live coral coverage has been decreasing over time, with some areas losing more than 30% of their coral coverage in a ten-year period, as shown in

Table 3. This indicates that coral reefs are being destroyed and intensively degraded. A loss of and harm to coral reefs could have many subsequent effects, such as degradation of biodiversity and marine environmental quality, loss of livelihood sources for coastal communities and losses for the fisheries and tourism sectors.

Figure 4: Total value of selected seagrass beds in Viet Nam



Source: Nguyen Thi Thu et al



Picture 11: Seagrass beds of *C.rotundatata* in Phu Quy Island (Nguyen Huu Dai, 1999)

Table 3: Decrease in coral coverage in some coastal areas of Viet Nam

	Study area	No. of sites	Change in coral coverage (%)	Period of change
1	Ha Long-Cat Ba		-7.1	1993-1998
2	Cu Lao Cham	5	-1.9	1994-2002
3	Nha Trang Bay	8	-21.2	1994-2002
4	Con Dao	8	-32.3	1994-2004
5	Phu Quoc	5	-3.3	-

Source: Nha Trang Oceanography Institute, 2003.

Seagrass beds: Seagrass beds are ecosystems with high values (Figure 4), providing habitats, breeding and nursery grounds for many species of algae, zoobenthos, and marine fish and mammals. Seagrasses provide food sources for organisms like fish, sea turtles, and dugongs, are also sources of raw materials for the production of paper, chemical fertiliser, and food for livestock, and are good sites for tourism. They play important roles in trapping sediments and in protecting against wave and coastal erosion. Of the sixteen seagrass species present in all of Southeast Asia, fifteen seagrass species have been identified in Viet Nam. Seagrass beds are distributed in coastal tidal areas, around islands, estuaries, mangroves, bays, and in brackish swamps with a depth of 0-20 m, within a salinity concentration of 5-32‰ (Picture 11). In the Tam Giang-Cau Hai Lagoon, seagrass beds cover approximately 1,000 ha with five species of seagrasses present and a total stock of approximately 95,500 tons of fresh seagrass (Nguyen Van Tien, 2003).

However, seagrass ecosystems are very sensitive and are vulnerable to environmental changes. The country's seagrass beds have been severely degraded due to environmental pollution, blast fishing, and agricultural and aquacultural encroachment in alluvial flats, resulting in a reduction of seagrass areas which in turn brings about a loss of habitat for many economically significant fisheries and limits opportunities for seagrass development (Picture 12). In 2003, 6,775 ha of seagrass areas (63% of seagrass areas in 1997) were lost. Seagrasses have disappeared completely in Dong Rui, Chuong Ca, Tuan Chau (Quang Ninh

Province), Trang Cat and Gia Luan (Hai Phong), and have almost disappeared in Vung Bau (Phu Quoc). The degradation and loss of seagrass beds in Viet Nam has increased and considerably affected the country's marine environment, leading to the degradation water and sediment quality, loss of ecological and nutrient balances, loss of biodiversity, reduction of fish stock and fish eggs, reduction of sources of raw materials for industrial and agricultural activities, and a loss of alluvial areas at river mouths, affecting sedimentation and land extension processes.

e. Lacustrine wetlands (reservoirs, natural lakes)

According to the Ramsar Convention definition, lakes are permanent or seasonal/intermittent freshwater bodies with area of over 8 ha, with or without banks, including floodplain lakes.

Typical natural lakes in Viet Nam include Ba Be Lake (Bac Kan Province - Picture 13), Chu Lake (Phu Tho), West Lake (Hanoi), Bien Ho Lake (Gia Lai), Lak Lake (Dak Lak), Don Duong and Dan Kia Lakes (Da Lat) and Bien Lac Lake (Binh Thuan). The 600-ha Lak Lake is home to more than 100 phytoplankton species, 50 zooplankton species, 20 zoobenthos species, 49 fish species, crocodiles, iguana and migratory birds. West Lake has an area of 562 ha with 12 species of phytoplankton and 33 species of *Cypriniformes*. Bien Ho covers 300 ha, and provides habitats for 122 phytoplankton species, 54 zooplankton species, 15 zoobenthos species and 27 fish species. Ba Be Lake is 450 ha in area, and is home to more than 100 phytoplankton species, 24 zooplankton species, 47 zoobenthos



Picture 12: Seagrass degradation in Thuy Trieu Lagoon of Cam Ranh Bay (Nguyen Huu Dai, 1999)



Picture 13: Ba Be Lake

species, 20 macrophytes species, and some reptile and migratory bird species.

Man-made lakes and reservoirs are locations in which water is stored for the purposes of irrigation, hydroelectricity, agriculture, domestic water supply, aquaculture, tourism, and other uses. There are approximately 3,600 freshwater reservoirs in Viet Nam, built by a variety of sectors. Of these, 539 reservoirs can be used for aquacultural development, six reservoirs have an area exceeding 10,000 ha, and 14 reservoirs are between 1,000 and 10,000 ha in area. The largest reservoir in Viet Nam is Dau Tieng (7,200 ha). The reservoirs with the largest designed output capacities are Hoa Binh (19,200 MW), Tri An (420 MW), Da Nhim (160 MW) and Thac Ba (108 MW).

f. Rivers and Streams

Viet Nam has an extensive river and stream system due to a high rainfall regime and unique topographical characteristics, where 75% of the total natural areas are hills and mountains. A typical characteristic of rivers and streams in Viet Nam is the diversity of phytoplankton populations but low abundance. Rivers and streams are important habitats for fish: 243, 134 and 255 fish species are present in the rivers of northern, central and southern Viet Nam respectively. Algae are the most dominant vegetation in streams, providing an important food source for fish and invertebrates. According to scientists, there are high numbers of endemic species of aquatic fauna and flora of stream ecosystems and many species have yet to be discovered. However, dam and embankment construction, mineral (sand and gravel) exploitation, waterway development, waste disposal, and other activities have and continue to destroy much of the environment and natural resources of this ecosystem.

2.1.5. Wetland trends in Viet Nam

a. Changes in area

According to MONRE (2004), Viet Nam has more than ten million hectares of wetlands. Over the last fifteen years, the natural area of wetlands has been reduced while artificial wetlands have increased:

- Natural mangrove forests are being converted into aquacultural ponds, tourism facilities and planted forests. Over the past twenty years, 183,724 ha of mangrove forests have been lost while aquacultural areas have increased to 1.1 million ha in 2003.
- Natural *Melaleuca* forests and seasonally flooded grasslands in the Plain of Reeds have also been disappearing and are being replaced by rice fields and planted *Melaleuca* forests.
- The total area of coastal wetlands in 1982 was 494,000 ha, and has increased up to 606,792 ha in 2000 due to an expansion of shrimp ponds (Do Dinh Sam et al., 2005).
- The area of Bach Dang Estuary has decreased from 64,169 ha in 1934 to 30,729 ha in 1997; tidal wetlands in estuarine areas of the Mekong Delta have decreased in area from 1,473,889 ha in 1995 to 1,409,289 ha in 1999.
- In 1976, the area of rice paddies in the Mekong Delta was 2,062,000 ha, and had risen to 3,815,000 ha by 2004 (Nguyen Sinh Cuc, 2005).
- Data reported by the Southern Institute of Water Resources have shown that more than 50% of the total area of the Mekong Delta (approximately two million ha) is currently affected by salinisation. One of the reasons for this phenomenon is the loss of mangrove forests along the coast.
- Peatlands in U Minh covered about 90,000 ha in 1990, but as of 2005 only about 12,000 ha are left (Southern Sub-FIPI, 2005).

According to the Ministry of Construction's Urban Development Plan for the Mekong Delta to the year 2020, the urban population in the Delta in 1996 was approximately 2.7 million, and the urbanisation ratio was 16.2%. By 2003, these figures had risen to 3.26 million and 19.6% respectively. The plan for year 2020 estimates that the proportion of the population in the Mekong Delta living in urban areas at that time will be 40%, which would lead to an increase in urban area and a reduction in the area of wetlands.

b. Changes in environmental quality

The environmental quality of Viet Nam in general and of wetland ecosystems in particular is being reduced for a number of reasons summarised below.

- *Pollution caused by industrial wastes:* Industrial wastes from vessels and from production and processing plants have severely impacted the quality of wetland ecosystems, particularly rivers, lakes and channels. Industrial and processing parks of the Southern Focal Economic Development Zone dispose of more than 137,000 m³ of waste per day (of which is 90 tons are solid wastes) into Dong Nai, Thi Vai and Sai Gon Rivers.
- *Oil pollution:* Oil pollution is most severe in river mouths and sea ports (Picture 19). Between 1995 and 2000, 30 oil spills poured about 92,000 tons of oil into the sea, causing considerable damage to the coastal and marine environment (World Bank, 2003).
- *Pollution caused by agrochemicals:* The Red River Delta has a very high level of agrochemical utilisation. In Thai Binh Province alone, 152-268 tons of chemicals were used annually from 1990 to 1995. Concentrations of pesticide compounds in the Red River Estuary at low tide during the rainy season always exceed permitted limits by factors of between 23 and 28. DDT and Lindane concentrations in benthic strata of the Sai Gon-Dong Nai River Basin are high, reaching 6-32 mg/kg.
- *Organic pollution:* Concentrations of organic matters, together with nutrients and toxic compounds, have shown an increasing trend, resulting in eutrophication and toxic algal blooms. These phenomena pose a great threat to the biological resources of wetland ecosystems. In 2002, a toxic algal bloom (known as the red tide) occurred in Binh Thuan and Nha Trang, causing widespread death of fishes and significant economic loss (World Bank, 2003). In 2005, toxic algae occurred again in Binh Thuan, causing negative effects to the environment and to tourism activities in this area. The Sai Gon River has become heavily polluted with organic matters, where the BOD level at Nha Rong port is 30 ml/l, exceeding national environmental standards by more than a factor of seven.
- *Application of toxic chemicals in the exploitation of wetland resources:* The use of explosive compounds and cyanide in fishing has caused pollution in the benthic environment and has destroyed the structure of coral reefs in Co To, Bach Long Vi and Con Dao Islands. This kind of practice has destroyed biotic communities and left long-term negative impacts on the environment and biodiversity.

2.2. Values and functions of wetlands in Viet Nam

2.2.1. Functions of wetlands in Viet Nam

Functions of wetlands in Viet Nam include groundwater recharge and discharge, freshwater supply, climate regulation, biomass export, flood protection, wave and storm prevention, shoreline erosion control, coastline stabilisation, and maintenance of biodiversity. Wetlands also provide opportunities for recreation, tourism and a favourable environment for many economic sectors including fisheries, forestry, water transportation, energy production, tourism, and mineral exploitation. Wetlands are vital sources for a major part of Viet Nam's population since they provide many benefits and contribute immeasurable social, economic, cultural and environmental values to the industrialisation and modernisation in Viet Nam.

Recharge and discharge of groundwater: During the rainy season, when there is a surplus of surface waters, wetlands act as storage tanks that allow water to gradually infiltrate into the groundwater systems later during the dry season. This is a continuous process that supplies water for groundwater aquifers. In addition, a continuous process of recharge and discharge of groundwater from wetlands and aquifers also contributes to groundwater purification. For instance, wetlands of *Melaleuca* forests in U Minh Thuong play a role in water storage, humidity regulation and moisture maintenance of the peaty soil layer. They can also prevent soil acidification and act as sources of water for domestic uses.

Trapping of sediment and toxic substances: Wetland ecosystems (especially lakes, mangroves, tidal marshes, and coastal bays) can function as sinks trapping sediments, pollutants, toxic substances or general wastes, in order to purify water and reduce the possibility of marine water pollution.

Nutrient retention: Wetland ecosystems can absorb nutrients, mainly nitrogen, phosphorus and microminerals, which are important for micro-organisms, fisheries and forestry development. This process also reduces eutrophication in the Red River and Mekong River floodplains and some other waterbodies.

Microclimate regulation: This function is particularly evident in areas having seagrasses, mangroves, and coral reefs, where wetlands contribute to balancing O₂ and CO₂ concentrations in the atmosphere, regulating microclimate (temperature, humidity, precipitation) and reducing the greenhouse effect. According to Jim Enright and Yadfon Association (2000), mangrove forests can absorb significant CO₂: a 15-year-old mangrove forest could absorb 90.24 tons CO₂/ha/year, contributing considerably to a reduction of the greenhouse effect.

Flood control: Wetlands (particularly mangroves, natural and man-made lakes) can function as water storage tanks, regulating rainfall and surface runoff, which slows the flow of flood water and reduces floods in surrounding areas of reservoirs such as Hoa Binh, Thac Ba, and Tri An.

Biomass production: Biomass produced in wetlands provides food sources for aquatic organisms, livestock, wildlife and domestic animals. In addition, part of the nutrient source from rotten and decomposed organisms is transported by surface flows and provides food sources to downstream and coastal areas.

Maintenance of biodiversity: Many wetlands, especially mangroves, coral reefs, and seagrasses, are favourable breeding, nursing and growing areas for a variety of wild fauna and flora. Many genetic resources, particularly those of rare and valuable species, are preserved in wetlands.

Wave and storm protection, shoreline stabilisation and coastline erosion control: Thanks to vegetation cover, especially mangrove forests, seagrass beds, and coral reefs, coastal wetlands can protect shorelines from waves, tides, erosion and tsunamis. They

also provide a favourable environment for alluvial deposition which contributes to the stabilisation and extension of alluvial flats. Extensive coral reefs have reduced the intensity of waves that otherwise could effect coastlines and the areas surrounding islands during hurricanes and tsunamis. Recently, many natural wetlands (mangroves, coral reefs, seagrass beds) have been considerably degraded due to over-exploitation and land reclamation activities for agricultural and aquacultural development. Thus, shorelines are undergoing continuous change and coastline erosion has increased, especially along the coast of the Red River Delta, central and south-central Viet Nam, and the Mekong Delta.

Other functions of wetlands: Apart from the functions mentioned above, wetlands play a vital role in providing a favourable environment for economic activities in many sectors including agriculture, fisheries, forestry, water transportation, tourism, and mineral exploitation. Notably, 80% of Viet Nam's population is settled within wetlands.

2.2.2. Values of wetlands in Viet Nam

Economic values of wetlands: Wetlands contribute substantially to the development of agriculture, fisheries, forestry, energy, and water transportation, among other sectors. Permanent flows have created vast and fertile deltas (the most productive agricultural land) where fish fauna is very abundant, providing a good source of food for local communities.

Table 4: Rice cultivation areas and yields of Viet Nam

Year	Area (thousand ha)	Yield (thousand tons)
1990	6,042.8	19,225.1
1995	6,765.6	24,963.7
2000	7,666.3	32,592.5
2003	7,449.3	34,518.6

Source: General Office of Statistics

Since 1989, wetlands have contributed considerably in promoting the socio-economic development of the country. From a country which once imported about one million tons of rice per year (1976-1988), Viet Nam has become a country that not only supplies enough rice for domestic use but also exports up to 3.4 million tons of rice per year (in 2003 - Table 4). This has made Viet Nam the second largest rice exporter in the world. The export value of the fisheries sector has increased constantly which has contributed to the development of other sectors such as the fish processing industry. Near-shore fishing exploitation amounted to 1,434,800 tons in 2002, which enabled the fisheries sector to reach an export value of two billion USD, becoming the third-largest export sector in the country (Table 5). The most notable development during this period was wetlands-based tourism activities. Tourism areas such as Ha Long Bay, Cat Ba Island, Con Dao Island, the beautiful beaches in Phan Thiet and Vung Tau, Phuong Nha-Ke Bang Cave, the historical monument in U Minh Thuong National Park, and ecotourism areas of Xuan Thuy Wetland Nature Reserve and Ba Be National Park have attracted many international and domestic tourists (Pictures 14, 15, 16, 17).

Table 5: Yields from fishing exploitation and aquaculture (thousand tons)

Year	Total yield	Yield from exploitation	Yield from aquaculture
1990	890.6	728.5	162.1
1995	1,584.4	1,195.3	389.1
2000	2,250.5	1,660.9	589.6
2003	2,794.6	1,828.5	-

Source: General Office of Statistics

Nguyen Huu Ninh, Mai Trong Nhuan et al., (2003) conducted a valuation of some typical coastal wetlands in Viet Nam, including Tam Giang-Cau Hai Lagoon, Thi Nai Lagoon, southwest Ca Mau Tidal Flat, and the estuaries of Bach Dang, Ba Lat, Van Uc, Tien, and Day (Kim Son Tidal Flat) (Appendix E). The results have shown that the southwest Ca Mau Tidal Flat has the highest TEV (total economic value) with a value of 4,593.91



Picture 14: Tourist site on the coast of Cu Lao Cau in Binh Thuan Province (Pham Hung Thanh, 2002)



Picture 15: Mussel exploitation in the Hai Ha tidal flat of Quang Ninh Province (Tran Dang Quy, 2004)



Picture 16: Seagrass harvesting in Cua Hoi, Xuan Thanh, Nghi Xuan, Ha Tinh (Tran Dang Quy, 2004)



Picture 17: Exploitation of ilmenite in the low tidal flat of Cam Xuyen, Ha Tinh (Mai Trong Nhuan, 2004)

USD per hectare, followed by Tien Estuary, Ba Lat Estuary and Tam Giang-Cau Hai Lagoon with TEV of 2,301.21 USD/ha. Van Uc Estuary, Thi Nai Lagoon and Bach Dang Estuary have the lowest TEV values at 503.57 USD/ha. According to statistical figures from the Xuan Thuy Ramsar site, total economic value from mussel exploitation was estimated to be about 7-10 million USD, contributing considerably to local livelihoods.

Cultural values of wetlands: Wetlands provide important cultural, historical, religious and archaeological values to local communities as well as the whole country. One can say that the wetlands of Viet Nam are the origins of the wet rice civilisation, or "water civilisation" in a broader sense. Wetlands and their resources are a source of inspiration for many Vietnamese writers, poets, painters, and musicians. Many national symbols are closely related to wetlands. For instance, the Lotus - a typical wetland plant - has become a common symbol in the carving works of temples and pagodas, in folk songs and dances, and has recently become the logo of Viet Nam Airlines. The Demoiselle (or crane) and dragon are two species of animals closely associated with wetland habitats and have been historically classified among four sacred animals in Viet Nam. Vietnamese traditional water puppetry is a unique art with a direct connection to wetlands. Wetlands preserve many items from wars of resistance (like those from battle at Bach Dang estuary), and have a close linkage with historical sites (including Ba temple of the Red River Estuary and U Minh Thuong historical monument). In addition, wetlands have great environmental and historical educational value, as well as scientific research value.

2.2.3. Biodiversity

Located in a tropical region, Viet Nam is considered one of the biodiversity hot spots in the world. Biodiversity has immeasurable importance since it is the foundation for the survival of all organisms, providing food, medicines for humans, and materials for industry and construction, as well as protecting human health and maintaining cultural and aesthetic values.

Large inland wetlands such as the Plain of Reeds, U Minh and river and stream systems are home to many endemic species. Coastal wetlands

Box 5: Wetlands species in Viet Nam

Aquatic species in freshwater wetlands

- 157 species of protozoa
- 403 species of algae
- 190 species of crustaceans
- 147 species of bivalves
- 546 species of fish

Species in coastal wetlands

- 460 species of scleractinian corals
- 15 species of seagrass
- 667 species of seaweeds
- 94 species of mangroves
- ~1,300 other species of fish and migratory birds

(mangroves, coral reefs, seagrasses, seaweeds) are habitats of many fish, migratory birds, seagrass, weeds and algal species. Lagoon systems in central Viet Nam also provide habitats for fish and migratory birds, are unique in the landscape and have a rich biodiversity.

Currently, fisheries yields in the country exceed 2.536 million tons, of which 1.426 million tons are from marine fish catch and 1.110 million tons are from aquaculture. Biodiversity maintains and provides valuable genetic sources of species like pearl (*Pteria martensi*), abalone (*Haliotis diversicolor*), sea turtle (*Eretmochelys imbricata*), and dugong (*Dugong dugon*).

However, a loss of biodiversity has occurred in recent years. The main reason for this trend is a decline and loss of habitat due to:

1. anthropogenic disturbance, such as mangrove forest destruction (Picture 18) and fish exploitation using destructive methods;
2. natural incidences, such as forest fires, storms, hurricanes, and outbreaks of disease;
3. fish exploitation using destructive methods;
4. over-exploitation caused by over-population and poverty; and
5. environmental pollution in some watercourses and on land from industry, domestic use, near-shore mineral exploitation and agricultural chemical use (Table 6, Figure 5).

In 2002, a forest fire in U Minh Thuong National Park caused a loss of 4,000 ha, posing negative impacts on many other species in the area. There have been some other causes of forest loss,

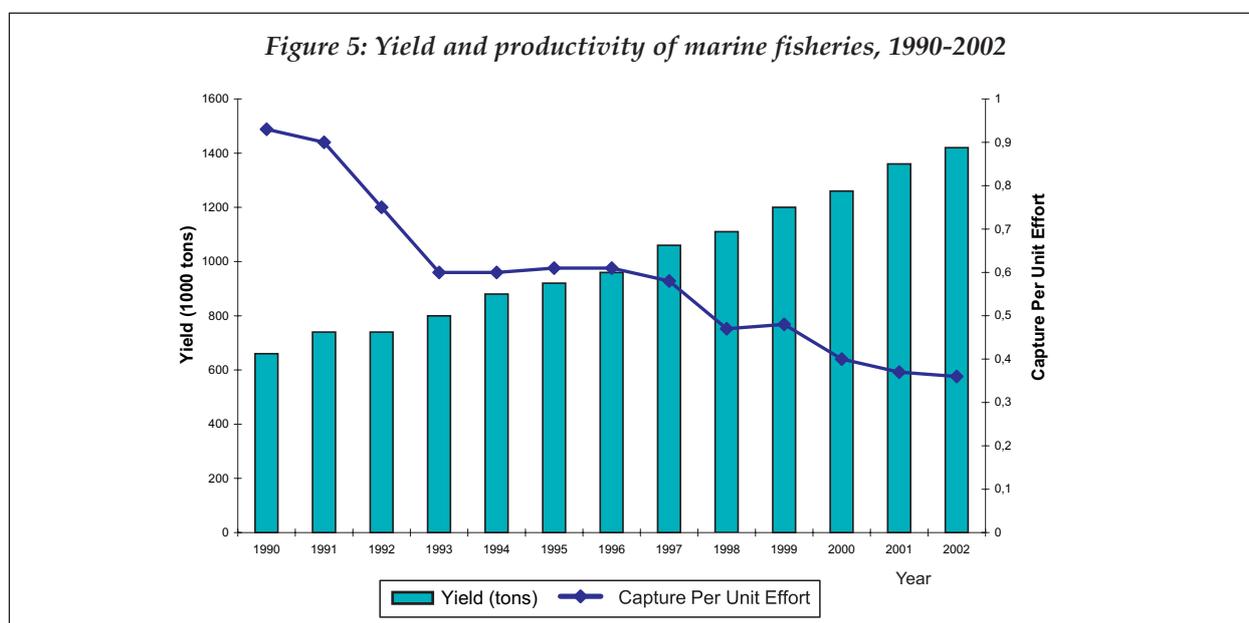
including impacts from toxic chemicals released during the war, introduction of alien species, and a lack of proper management policies.



Picture 18: Mangrove destruction for shrimp farming in Thai Binh Province (Mai Trong Nhuan, 1999)



Picture 19: Oil pollution in Chut point - Phan Ri (Pham Hung Thanh, 2002)



Source: Ministry of Fisheries, 2005.

Table 6: Total wastes disposed into the sea from selected river systems (tons/year)

River system	Parameter							
	Cu	Pb	Zn	As	Hg	Cd	NO ₃	PO ₄
Thai Binh	1,101	154	3,352	120	17	164	10,466	9,888
Red River	2,817	730	2,015	448	11	118	24,602	14,860
Han	37	16	79				2,475	36
Thu Bon	62	16	192				7,900	2,500
Sai Gon-Dong Nai		102	2,921		26		79,570	10,220
Mekong	1,825	190	12,775	982	13	128	134,750	24,750
Whole country	14,184	2,063	21,739	2,407	133	1,082	273,720	60,971

Source: National Marine Research Programme (coded KT.03.07)

3. Wetland management in Viet Nam

3.1. Current state of wetland management in Viet Nam

3.1.1. Wetland management at the central level

Prior to 2003, no central institution was solely responsible for wetland management in Viet Nam. Each sector or ministry was mandated by the Government on sector-based management which included wetlands. For instance:

- MARD was responsible for the management of wet rice cultivation land, protected areas (wetland national parks and nature reserves) and water development works (hydraulic systems, reservoirs).
- The Ministry of Fisheries (MOFI) was responsible for the management of wetlands within the category of aquacultural surface waters and coastal areas.

- MONRE was responsible for the management of river basins and served as a national focal point for coordinating activities related to the Ramsar Convention on Wetlands.
- In addition, some other sectors were closely associated to wetlands, such as water transportation, tourism, and hydroelectricity.

On 23 September 2003, the Prime Minister issued Decree number 109/2003/ND-CP, which stipulates the mandates and functions of ministries, sectors and localities on wetland conservation and the sustainable development of wetlands (Box 6).

One important trend is that wetlands in Viet Nam have been resettlement areas for communities for generations, which has helped to form their typical cultural values and farming traditions. As a result,

Box 6: Mandates and functions for wetland conservation and sustainable development: Decree 109/2003/ND-CP

Ministry of Natural Resources and Environment (MONRE)

- MONRE shall resume the function of state management on the conservation and sustainable development of wetlands (Article 5, Clause 2).
- MONRE shall formulate an overall plan for baseline surveys, research and assessment of environmental status of wetlands nationwide; shall lead activities such as surveys, research, and development of conservation and sustainable plans; and shall submit to the Prime Minister requests for the establishment of wetland protected areas, and of wetlands of national and international importance which are located across multiple provinces and related to multiple sectors (Articles 9, 11).
- Within its jurisdiction, MONRE shall formulate, submit and issue policies and legal documents on wetland protected areas; shall undertake inspection and examination on implementation of wetland-related legislation; and shall serve as a national focal point for implementation of the Ramsar Convention (Article 15).

Ministry of Agriculture and Rural Development (MARD)

- MARD shall organise investigation, research and preparation of planning for the conservation and sustainable development of wetlands within its sector which have national or international importance and are located across multiple provinces (Articles 9, 11).
- MARD shall take a lead and organise the management of sector-based wetland protected areas having national and/or international importance (Article 15).

wetland management cannot be separated on a sectoral basis, nor can it be separated from community development. The challenge is that planning of wetland development has not been synchronised and there has been a lack of coordination between sectors in integrated wetland management. Wetland management and wise use of wetlands require synchronised and integrated policies and measures.

3.1.2. Wetland management at the provincial level

Viet Nam has 64 provinces and centrally run cities. The Provincial People's Committee (PPC) is the highest administrative authority in a province, under which departments are organised following a similar vertical structure to the central level. Thus, wetland management at the provincial level is similar to that at the central level. In other words, each provincial sector/department is responsible for state management on their respective issues, including wetlands-related issues, according to the laws and duties assigned by the PPC. Specifically, the Decree 109/2003/ND-CP has stipulated the following:

- PPCs of provinces and centrally run cities shall organise management of those wetland protected areas that do not fall under the management responsibility of ministries and that belong administratively to these provinces and cities.
- The Departments of Natural Resources and Environment of provinces and centrally run cities shall take a lead in surveys, research, conservation planning and sustainable exploitation of wetlands of provincial and local importance.

Currently, technical capacity in the conservation and sustainable development of wetlands within provincial institutions is limited. Thus, there is a need for local awareness-raising in this regard.

3.1.3. Activities undertaken and trends in wetland conservation

Priorities have been set for the conservation of natural wetlands that have high biodiversity value

Box 7: Wetlands special use forests in Viet Nam

National Parks

Wholly covered by wetlands

1. Xuan Thuy
2. Tram Chim
3. U Minh Thuong
4. Ca Mau Cape

Partially covered by wetlands

1. Ba Be
2. Bai Tu Long
3. Cat Tien
4. Con Dao
5. Phu Quoc
6. Lo Go - Sa Mat

Nature Reserves

Wholly covered by wetlands

1. Thanh Phu
2. Lung Ngoc Hoang
3. Kien Luong
4. Bac Lieu
5. Tien Hai
6. Vo Doi
7. Hoa Binh Reservoir
8. Cam Son Reservoir
9. Lak Lake
10. Nui Coc Reservoir

Partially covered by wetlands

1. Binh Chau - Phuoc Buu
2. EaRal
3. Trap Kso
4. Van Long

and unique ecosystems. There are two protected area systems in Viet Nam: a system of special use forests which belongs under the management mandate of MARD, and a marine protected area system under the management of MOFI. Most of the current wetland protected areas are special use forests. As of March 2004, there were 126 special use forests approved by the Prime Minister, among which 28 were national parks, 59 were nature reserves, and 39 were landscape protected areas.

Viet Nam has four wetland biosphere reserves declared by UNESCO, including Can Gio Mangrove, Cat Tien, Cat Ba Islands and the coastal wetlands of the Red River Delta.

In 2001, MONRE proposed 68 wetland sites of high biodiversity and environmental value in Viet Nam, including natural and artificial lakes and reservoirs, marshes, lagoons, estuaries, bird colonies, mangrove forests and seasonally inundated grasslands. Of these wetlands 17 belong to the special use forest systems, which have been approved for establishment by the Prime Minister.

In August 2005, Bau Sau and the seasonal wetlands of Cat Tien National Park were designated as Viet Nam's second Ramsar site.

Substantial effort has gone into the rehabilitation of selected degraded wetlands in Viet Nam, including the reforestation of mangroves in aquacultural ponds in Tien Hai, Giao Thuy, and Ca Mau, among others.

Since 1989, some wetlands have increased in area, including Xuan Thuy, U Minh Thuong, and Phu Quoc National Parks, and Lung Ngoc Hoang, Lo Go-Xa Mat, and Nui Chua Nature Reserves. This has demonstrated effort and commitment on behalf of the Government of Viet Nam in the conservation of natural wetlands with high biodiversity and natural landscape values, against a background of rapid growth in population and land exploitation for economic development purposes.

3.1.4. Wetland utilisation and trends

According to preliminary statistics, more than 50% of the total area of Viet Nam's wetlands has been used for cultivation (mainly wet rice) with a very high land use rotation rate (2-3 cropping seasons per year); 25% of the total area of Viet Nam's wetlands has been used for aquaculture; 10% are rivers and streams; and 10% are artificial lakes and reservoirs for hydroelectricity and hydraulic purposes. This latter use is undergoing an increasing trend.

The total area for wet rice cultivation in the country is 4.1 million hectares. From 1989 to 2004, more than 45 million tons of rice were exported, equivalent to a total value of 10 billion USD. The export value of fisheries products in 2002 exceeded two billion USD.

Revenues from wetland-based tourism activities in such areas as Ha Long Bay, Cat Ba, Phu Quoc, Con Dao, Phong Nha-Ke Bang, Ca Mau Cape, and the Mekong Delta are undergoing steady increases.

Thanks to the government's policy on the rational and effective utilisation of wetlands, the economic values of wetland ecosystems have increased since 1989. Economic values of wetlands are also reflected in their contributions to farmers' livelihoods and a reduction in the poverty rate. Wetlands can thus be shown to be of profound social and political importance in Vietnamese society.

Most areas of wet rice cultivation and aquaculture are used by households in the traditional manner of the area. The remaining wetland areas are managed by state institutions, mainly through investment projects or management plans that have been approved and financed by the government. Wetland utilisation starts with land use planning at the central, regional, provincial and local levels, and is based on the wetland's physical and socio-economic characteristics as well as the development targets for each region or province as set out by the Government. However, at the household level, shortcomings in effective land use remain due to a lack of investment capital and limited knowledge about the wise use of wetlands. Many households in coastal areas have failed in shrimp production due to a lack of investment capital and knowledge about aquaculture, leading to negative impacts on the environment. Therefore, in order to contribute to the wise use of wetlands, it is necessary to provide knowledge about wetlands and experience in using wetlands sustainably to experts in planning and policy making, and in agricultural, forestry, and fishery extension, who can then train farmers in economically and environmentally effective techniques in sustainable wetland utilisation.

Wetland areas used for aquacultural purposes have increased while coastal mangrove areas are being reduced. This trend may have negative environmental and ecological impacts, but it contributes to an increase in the export value of Viet Nam's fisheries sector. In addition, the wetland areas of rice fields have increased to meet national food security policies and agricultural development targets.

There are currently no separate management regulations for each wetland type. National parks and nature reserves that are wholly or partly wetlands shall be managed following a regulation on the management of special use forests. In these areas, the "wise use of wetlands" approach has not been applied because conservation (rather than use) has been the major focus. In addition, although it has not yet been done, the management practices of each wetland area should be put within the hydrological regime of the broader region since hydrological factors have an impact on the soil, fauna and flora of a wetland area.

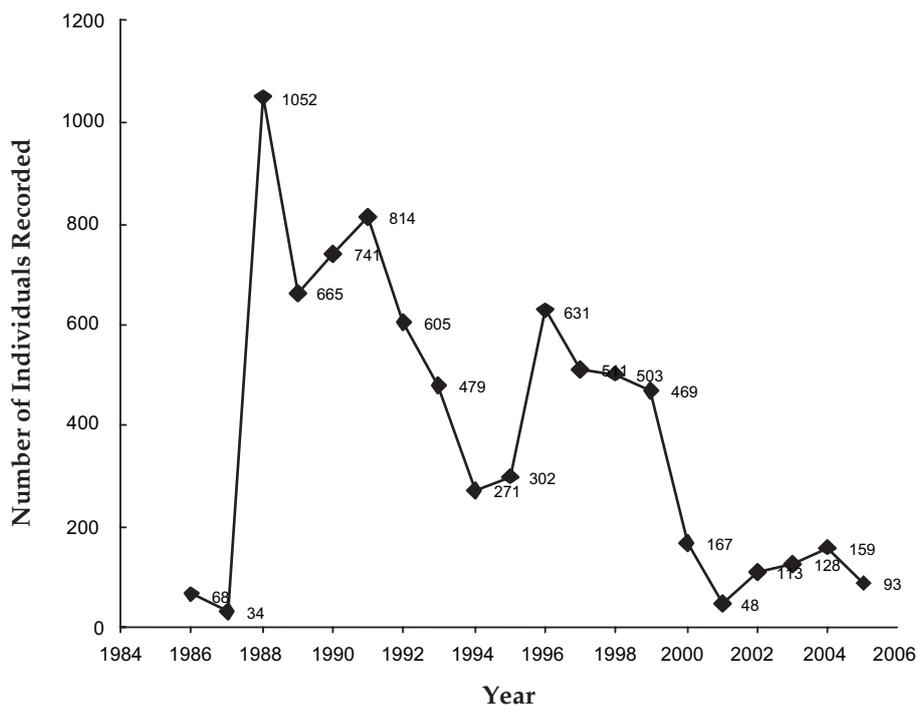
Most wetland protected areas face a shortage of investment capital. Their main source of income is a limited annual budget from the province. Some areas receive direct or indirect financial support from other governments through projects that are implemented by international organisations. There is usually a lack of money for such activities as organising inspections, data collection and monitoring changes in biological resources. Thus, it is difficult to have reliable data to assess changes in biodiversity.

Data collected from some wetland areas have shown that the individual numbers of some species have a declining trend. For instance, individual numbers of the Eastern Sarus Crane in Tram Chim National Park have changed substantially since 1986, with 1,052 individuals recorded in 1988 and only 48 individuals recorded in 2001. A major reason for this change was hydrological regime regulation and pressures from the buffer zone (Figure 6).

The buffer zone of Thanh Phu Wetland Nature Reserve has been under great pressure from poor

households due to threatened livelihoods from a lack of available cultivation land. Flora and fauna resources of the core zone (strictly protected zone) in this reserve have been severely damaged, resulting in a recent decision by the Prime Minister (Decision No. 57/2005/QD-Ttg on 23 March 2005) to reduce the area of this zone from 1,788 ha to 668 ha. A forest fire in the 2002 dry season affected 3,212 ha of the 8,038 ha U Minh Thuong National Park, and 2,703 ha of *Melaleuca* forests and 194 ha of peatland were destroyed. The primary reason for this fire was local carelessness. The Lung Ngoc Hoang Nature Reserve is experiencing negative impacts from a process of conversion from brackish to freshwater land in the Quan Lo-Phung Hiep region, because a change in water characteristics leads to a change in ecosystems. In recent years, exploitation and utilisation of wetlands have been undertaken without any control or proper planning. Conversion of wetlands and destruction of mangroves for rice cultivation, aquacultural farming, urbanisation, extension of industrial parks, and waterway transportation development have all contributed

Figure 6: Variation in individual numbers of Eastern Sarus Crane in Tram Chim National Park, 1986-2005



Source: Tram Chim National Park

to a decrease in natural wetlands areas, a reduction in their resource base, an increase in erosion, sedimentation and environmental pollution (e.g. pollutions by oil, heavy metals, agrochemicals and disease-causing microorganisms), and a loss of biodiversity. In the absence of immediate and effective counter-measures, these trends are likely to continue.

3.2. Legal framework for wetland management in Viet Nam

3.2.1. Legal and policy systems relating to wetland management

Over the last fifteen years, the Government of Viet Nam has paid great attention to the formulation and completion of a legislation system that would set a legal foundation for national governance, and would create favourable conditions for international integration. A number of these regulations are related to wetland management.

Legislation on environmental protection and nature conservation has contributed significantly to wetland protection. Viet Nam has passed more than 500 regulations on environmental protection and nature conservation since 1976. However, of these, only about ten refer directly to wetlands, while the rest are indirectly related through the protection of various components of wetlands such as water resources and wildlife protection. The Land Law (1993) does not define wetlands as a separate land type. Instead, wetlands can be understood as "land for wet rice cultivation", "land for salt production", "land for aquacultural farming", "special use forest land as national parks and nature reserves" and "rivers, streams, creeks, springs, and special use water surfaces". Legal documents that directly regulate wetlands are presented in Appendix F.

Recently, Viet Nam has formulated and organised the implementation of an action plan relating to the conservation and development of wetlands. Some key documents of relevance to this action plan are as follows:

- Strategy on planning, rational utilisation and protection of water resources in Viet Nam.

- Management strategy to the year 2010 of the protected area system in Viet Nam.
- Government Decree No. 109/2003/ND-CP issued on 23 September 2003, and Circular No. 18/2004/TT-BTNMT issued on 23 August 2004 on the conservation and sustainable development of wetlands.
- Decision No. 04/2004/QĐ-BTNMT issued by the Minister of MONRE on 5 April 2004 on the approval of the Action Plan on Conservation and Sustainable Development of Wetlands for the 2004-2010 period.
- The Viet Nam Biodiversity Action Plan to the year 2015 and vision to the year 2020 (currently being drafted).
- A draft "National Action Plan to Reverse Environmental Degradation Trends in the South China Sea and the Gulf of Thailand to the year 2010" which has been formulated within the framework of the UNEP/GEF project "Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand". This Action Plan includes componential action plans for mangroves, seagrasses, coral reefs, coastal wetlands, protection of fisheries resources, and prevention of pollution originating from inland sources.

3.2.2. Summary of Viet Nam's participation in international conventions related to wetlands (Table 7)

After joining the Ramsar Convention, Viet Nam issued a number of legal documents to demonstrate its compliance to obligations defined by the Convention. In 1989, Viet Nam designated the Xuan Thuy wetland site in Giao Thuy District of Nam Dinh Province to the List of Wetlands of International Importance. Xuan Thuy was the first Ramsar site in Southeast Asia, and the 50th Ramsar site in the world. This site, with a total area of 12,000 ha, has since been conserved following international regulations. Viet Nam is in the process of designating more sites to the List, as well as establishing more wetland nature reserves. Among the 68 wetlands identified as having environmental and biological values, 17 areas have

Table 7: International Conventions and Treaties related to wetlands

Ramsar Convention on Wetlands	
<p>The Convention's mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world.</p> <p><i>Signed on 2 February 1971 in Ramsar, Iran.</i></p> <p><i>146 Contracting Parties to the Convention.</i></p> <p><i>www.ramsar.org</i> <i>(see Appendix A)</i></p>	<p>The Convention aims to stem the progressive encroachment on and to halt the loss of wetlands now and in the future, in order to ensure biodiversity of waterfowl of national and international importance. Ramsar was the first of the modern global intergovernmental treaties on conservation and wise use of natural resources, and its provisions are relatively straightforward and general compared with more recent treaties. Over the years, the Conference of the Contracting Parties has further developed and interpreted the basic tenets of the treaty text and succeeded in keeping the work of the Convention abreast of changing world perceptions, priorities, and trends in environmental thinking. As a Contracting Party of the Ramsar Convention, Viet Nam has considered its international responsibilities for the conservation and wise use of wetlands in full compliance with international regulations, and has designated some wetlands within its territory for inclusion in the List of Wetlands of International Importance according to Ramsar criteria ("Ramsar sites"). Xuan Thuy Nature Reserve was accepted as a Ramsar site in 1989.</p>
Convention on Biological Diversity (CBD)	
<p>The objectives of this Convention are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.</p> <p><i>Signed at the 1992 Rio Earth Summit in Rio de Janeiro, Brazil.</i></p> <p><i>188 Contracting Parties to the Convention.</i></p> <p><i>www.biodiv.org</i></p>	<p>Biodiversity conservation and sustainable development of biodiversity's components, including wetlands and its components, are the most important objectives of the CBD. Among the Convention's successes is the acknowledgement that biodiversity conservation should be undertaken at the three levels of gene, species and habitats, of which genetic conservation is the most important. By recognising the sovereign right of States over their genetic resources (Article 15), the Convention has provided the legal basis for contracting parties to develop regulations on genetic resources. This is also a foundation for the development of cooperation between countries in the exploitation of genetic resources, including rare and precious genetic resources from species in wetland ecosystems.</p>
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	
<p>CITES aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.</p> <p><i>Signed on 3 March 1973 in Washington, DC (USA), and entered into force on 1 July 1975.</i></p> <p><i>169 Contracting Parties to the Convention.</i></p> <p><i>www.cites.org</i></p>	<p>In order to effectively implement regulations on the management of wildlife species, the Convention has stipulated necessary measures that should be taken by Contracting Parties, including penalties for the trade or possession of specimens and the designation of one or more Management Authorities and one or more Scientific Authorities to meet the obligations of the Convention. However, only one of the measures of the Constitution is related to wetland conservation. The Convention does not yet fully regulate activities on the conservation of wild endangered species, including those of wetland ecosystems.</p>

United Nations Convention on the Law of the Sea (UNCLOS)	
<p>The Convention is an unprecedented attempt by the international community to regulate all aspects of the resources of the sea and uses of the ocean.</p> <p><i>Signed on 10 December 1982 at Montego Bay, Jamaica and entered into force on 16 November 1994.</i></p> <p><i>148 Contracting Parties to the Convention.</i></p> <p><i>www.un.org/Depts/los</i></p>	<p>An important principle in natural resource exploitation is stated in Article 193: "States have the sovereign right to exploit their natural resources pursuant to their environmental policies and in accordance with their duty to protect and preserve the marine environment". This Convention focuses on the protection of habitats for marine biological resources. Its provisions are directly associated with the conservation and sustainable use of coastal wetlands and of watercourses with depths exceeding 6 metres.</p>
Agreement on Cooperation for the Sustainable Development of the Mekong River Basin (The Mekong Agreement)	
<p>The Mekong Agreement determines to cooperate in a mutually beneficial manner for sustainable development, conservation, utilisation and management of the Mekong River Basin water and related resources.</p> <p><i>Signed in April 1995 by the four riparian countries of the lower Mekong Basin, including Thailand, Viet Nam, Lao PDR, and Cambodia.</i></p>	<p>In recent years, Viet Nam has been an active member in most activities initiated by the Mekong River Commission (MRC). Since 2005, Viet Nam has participated in the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme, financed by UNDP/GEF and others. In addition, a system of legal documents that regulate a number of issues relating to the conservation, management and sustainable use of wetlands is being completed.</p>
Kyoto Protocol	
<p>The objective is the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.</p> <p><i>Adopted in December 1997 in Kyoto, Japan.</i></p> <p><i>157 Contracting Parties to the Protocol.</i></p> <p><i>unfccc.int/resource/docs/convkp/kpeng.html</i></p>	<p>The goal of the Protocol is for developed nations to commit to reduce their overall emissions of greenhouse gases (carbon dioxide - CO₂, methane - CH₄, nitrous oxide - N₂O, hydrofluorocarbons - HFCs, perfluorocarbons - PFCs and sulphur hexafluoride - SF₆) by at least 5.2% below 1990 levels by 2012. Specific reduction levels are applied for each country, where levels for the EU, USA and Japan are 8%, 7% and 6% respectively. Viet Nam signed the Kyoto Protocol on 3 December 1998 and ratified it on 25 September 2002. The Protocol defines three flexible mechanisms that enable developed nations to meet their commitment in reducing greenhouse gas emission. These mechanisms include Joint Implementation, Emissions Trading and Clean Development Mechanisms (CDMs). The conservation of wetland resources, especially of their vegetation cover and mangrove forests, contributes significantly to the carbon sequestration process, through which it is hoped that global warming could be mitigated.</p>

been approved by the government and 20 areas have been recommended for inclusion in the country's system of forest protected areas.

Although it is not yet available, the country has initiated preliminary steps in developing a National Strategy on Wetlands to meet

international obligations, especially those of the Ramsar Convention, including a National Action Plan on the Conservation and Sustainable Development of Viet Nam's Wetlands. Viet Nam has also passed and implemented a Biodiversity Action Plan (BAP) since 1995 with several

considerable achievements. Viet Nam's BAP to the year 2015 is currently being developed.

The Government of Viet Nam has assigned MONRE to be the national focal point for implementation of United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol in Viet Nam. MONRE has undertaken some activities in this regard, including the establishment of a Working Group and a Technical Experts Group to implement projects on climate change; the development and assessment of options in reducing greenhouse gases; the recommendation of adaptation measures to global warming; and the formulation of a legal framework to enable activities relating to CDM.

3.3. Measures and methods in wetland management

Wetland management in Viet Nam remains sector-based, and a system of integrated technical tools is lacking. Some technical measures relating to sector-based wetlands have been issued:

- The agricultural sector has issued technical procedures on the production of plants and on livestock and agro-extension techniques.
- The forestry sector has issued technical procedures on forest management, including forests relating to wetlands, especially special use forests. In particular, the Prime Minister has issued a regulation on the management of special-use, protected and production forests, including those in wetland areas.
- The water resources sector has issued technical procedures on the management of water development works, on the calculation of water balances, on flood control and on water supply for agriculture and aquaculture.
- The fisheries sector has issued technical procedures on the management of fisheries resources and aquacultural practices in saltwater and freshwater areas.
- The health sector has issued technical procedures on hygiene and public health,

including issues related to clean water in rural areas.

In addition, some scientific and training organisations as well as some management institutions in wetland areas have applied new approaches and methods in wetland resource management at different levels. They include:

- Community-based natural resources management in Xuan Thuy, Tien Hai and Thi Nai.
- Co-management of natural resources in Tam Giang-Cau Hai Lagoon, Phong Dien and Da Krong.
- Integrated conservation and development projects in Cat Tien and U Minh.
- Intersectoral multi-stakeholder management approaches in wetland protected areas in development, planning and implementation of projects.
- Ecosystem-based management in Cat Tien, Tam Giang-Cau Hai, Chau Truc and Thi Nai.

Box 8: Steps in ecosystem-based management

1. Description of major components of the ecosystem
2. Analysis of functions, linkages and boundaries of the ecosystem
3. Analysis of opportunities, challenges, causes and effects
4. Identification of objectives of ecosystem management
5. Description of management measures that will be applied in order to address opportunities and challenges
6. Analysis of expected outputs of key management activities
7. Description of monitoring methods, including indicators, principles of measurement and methods of analysis
8. Definition of requirements for adaptive management
9. Institutional arrangements and policy-making process
10. Reporting and communication
11. Finance and budget allocation

Of those measures mentioned above, ecosystem-based management is the most integrated and comprehensive approach (Box 8). This approach seeks a way to organise the utilisation of ecosystems in order to benefit from natural resource exploitation while maintaining the ecosystem's capacity in supplying those benefits at a sustainable level.

In addition, other tools and methods have been applied in the conservation and management of wetlands, including Rapid Rural Appraisal (RRA), economic valuation, geographic information system (GIS), remote sensing, information technology and modelling.

3.4. Wetlands research, communication, education and awareness

3.4.1. Activities undertaken

a. Research

National and international scientists have conducted substantial research on wetlands in Viet Nam since 1989. Aspects of particular research interest include natural conditions, ecological and biodiversity characteristics, functions and values, mapping, management, conservation, utilisation and inventory of wetlands.

The number of staff, organisations, and research and inventory projects has been increasing, as has investment in wetlands research. However, the usefulness of research results remains limited as results are kept by various institutions and individuals without a central database, resulting in ineffective utilisation of available information and data.

Major obstacles include the lack of a master plan for the conservation and sustainable development of wetlands, the lack of an integrated management plan for wetlands with full participation of the various sectors, the lack of a wetlands database, and an insufficient number of researchers and inventory staff to meet the demands for wise use, conservation and sustainable development of wetlands.

b. Communication, education and awareness raising

Viet Nam has undertaken a number of communication, education and awareness-raising



Picture 20: Awareness-raising for local communities on integrated coastal zone management in Nam Dinh (Hoang The Anh, 2003)

activities related to wetlands, including the use of mass media to publicise wetlands, their functions and values, management issues, and policy and institutional arrangements at the central and local levels on conservation and sustainable development of wetlands. Agricultural, forestry and fisheries extension activities have also been undertaken through the production of technical manuals relating to wetland utilisation.

Every year, VEPA organises activities to celebrate World Wetlands Day (2 February), including printing posters, brochures, and leaflets for general publicity, and publishing articles about wetlands in the Environmental Protection Journal and other relevant journals and publications. However, these education and communication activities still need to be strengthened.

A number of training courses and workshops on management, utilisation and conservation of wetlands have been organised, including courses on economic valuation of wetlands, community-based wetland management, and integrated coastal zone management (Picture 20). Some universities, such as the Viet Nam National University in Hanoi and Can Tho University, teach courses related to wetlands, but there are not yet any universities in Viet Nam offering graduate or post-graduate programmes on wetlands. Most wetland experts in Viet Nam were educated overseas or gained their expertise through years of experience with internationally funded projects. Formal training should be an important consideration in the development of human resources in wetland management in Viet Nam.

3.4.2. Trends in wetlands knowledge and awareness

Prior to 1989, knowledge about wetlands in Viet Nam was rather limited. Since 1990 however, international organisations have assisted Viet Nam in the implementation of wetlands or wetland-related projects. Thus, Vietnamese experts who participated in these projects had an opportunity to gain exposure to wetland issues and gained knowledge and experience. The National Environment Agency (now VEPA) became the national focal point for wetlands. In 1990, Patrik J. Dugan's book *"Conservation of wetlands"* was translated into Vietnamese by the National Environment Agency, enabling many people to increase their knowledge about wetlands. Also during this time, Le Dien Duc published an *"Inventory of Wetlands in Viet Nam"* and participated in the development of a Directory of Asian Wetlands. Since 2000, wetlands and biodiversity issues have received the attention of many agencies at both the central and local levels, through such initiatives as the formulation of a wetlands strategy and an action plan on the utilisation, conservation and management of wetlands. Viet Nam's National Mekong Committee has established a working group for investigation and research on wetlands of the Mekong Delta, facilitating the development of a classification system and the mapping of wetlands in the region. Various aspects relating to wetlands have been addressed in a number of research projects and programmes, including the development of a classification system, formulation of management and conservation plans, community participation, institutional arrangements, policy, and economic, cultural and historical values.

Thus, knowledge and awareness about wetlands have increased since 1989, thanks to local, national and international efforts. However, one significant remaining challenge is that most local people living within wetland areas do not yet have a clear understanding of wetlands issues. It is these communities who use wetland resources directly, and who may potentially play a very important role in the conservation and sustainable development of wetlands.

3.5. Achievements and challenges relating to wetland management in Viet Nam

3.5.1. Achievements

The following achievements in wetland management in Viet Nam should be highlighted:

- The Government of Viet Nam has promulgated a number of relevant policies in order to enhance effectiveness of conservation, utilisation and management of wetlands in the country.
- Many regulations on institutional structure, mandates, and responsibilities within the wetland management system at the central level have been issued and have gradually been elaborated upon. In particular, the Law on Government Structure (2001) and Government Decree No. 91/2002/ND-CP (2002) stipulate the extended functions, responsibilities and power of MONRE over land and water resources as well as its organisational structure. This has contributed to the legal foundation for the formulation of a state management organisational system on wetlands. The Government Decree No. 109/2003/ND-CP issued on 23 September 2003 institutionalised state management of wetlands through a delegation of responsibilities to ministries and provinces.
- There is increasing involvement of organisations and agencies in the conservation and management of wetlands. Under the guidance of the Government and with the former Ministry of Science, Technology and Environment (MOSTE, now MONRE) as focal point, ministries and agencies at the ministerial level have made initial progress in coordinating works related to wetland issues. Cooperation between MOSTE and MARD in the management of wetland protected areas, a consolidation of management structures for environment and natural resources, and a process of policy formulation on wetland conservation have ensured that Viet Nam is effectively implementing and participating

in international commitments relating to wetlands.

- Institutional arrangements of state management at the local level have been organised under dual supervision: under technical management at the central level and provincial management at the local level. This has facilitated effective management of a number of local wetlands.
- Government investment and international support in wetland conservation and sustainable development has increased steadily. The number of national and international projects relating to wetlands has also increased. Generally they have generated positive impacts, although some of them were not very well managed and their impacts not very good.
- The Government of Viet Nam has approved a national system of protected areas, including wetlands areas, and has approved a system of marine protected areas. Protected areas contribute to the conservation of the functions, values and biodiversity resources of wetlands.

3.5.2. Issues and challenges in wetland management in Viet Nam

a. Legislative system

Viet Nam lacks a specific law on wetlands, regulations on the conservation, management, wise use and sustainable development of wetlands, and clear and detailed regulations on the state management system. In addition, there remains a lack of agreement on coordination mechanisms between ministries, sectors and localities in activities relating to wetlands and a lack of enforcement measures for implementation. Existing legal documents directly related to the conservation and management of wetlands are issued primarily by ministries and provincial authorities while documents promulgated at a higher level, such as Government Decrees, are still limited. Decree No. 109/2003/ND-CP is currently the highest piece of legislation directly addressing a division of mandates on wetland management.

Current legislation does not yet meet the requirements of conservation and sustainable development of wetlands. Documents issued by Provincial People's Committees have mainly focused on administrative measures, and there has been a lack of sanctions to mobilise community participation in wetland exploitation.

The system of policies and regulations on wetland management has not been completed or synchronised. Specific provisions in legal documents relating to wetlands often overlap, and are also often scattered within different pieces of legislation. They lack scientific detail and do not take into account a number of socio-economic factors, which prevents their effective implementation.

Many terms and concepts relating to wetlands have been not clearly defined or explained in the legal documents and policies of Viet Nam. Existing documents have not comprehensively covered the variety of issues faced by wetland conservation and management work, but instead have addressed such things as:

- classification and division of the management mandates within wetland protected areas (National Parks or Nature Reserves);
- economic aspects (addressed in such legislation as the Fisheries Law and other regulations issued by local authorities);
- protective measures, including punishment of violators and banning of destructive practices in the exploitation of biological resources; and
- conservation activities for some species, especially waterfowl whose habitats are wetlands.

Monetary fines for violations are low and do not reflected current socio-economic conditions of the country. As a result, punitive measures are not effective in deterring violations. Sanctions applied for the violation of regulations on biodiversity conservation are often irrelevant or inappropriate.

There is currently no clear policy regarding protection, extension or reduction of wetland areas, nor does any existing policy involve local

communities in wetland management. Many wetlands are still considered as wasted land due to a lack of proper knowledge on the roles and values of wetlands. Some existing policies aim to convert natural wetlands into artificial ones (reservoirs, aquacultural ponds, or rice fields) or industrial, residential and urban areas, and there is a lack of legislation on planning and wise use of wetlands. These legislative limitations have led to environmental pollution and degradation of biodiversity resources.

Viet Nam has developed a system of legal documents and policies to implement the Ramsar Convention as well as other international commitments relating to the conservation and sustainable development of wetlands. However, these documents do not yet meet Ramsar Convention requirements on the wise use of wetlands. Effectiveness in the implementation of international obligations as defined in international conventions is assessed through the formulation and implementation of legislation and policies on conservation and management of wetlands.

The implementation of the Law on Forest Protection and Development and the Regulation on Conservation of Special Use Forests has generated problems in the planning, management and conservation of wetlands. The Fisheries Law is not feasible in the core zones of protected areas, and the wise use principle promoted by the Ramsar Convention has not yet been institutionalised.

b. Wetlands management

Some of the big challenges to conservation and sustainable management of wetlands are a rapidly increasing population (at a rate of about 1.32% per year), heavy population density in many wetland areas (for example, a population density of 276 persons/km² in coastal districts) and a rapid and uncontrolled rate of urbanisation (estimated to be about 33% by 2010).

Managers and beneficiaries do not yet fully understand the social, economic and ecological functions and values of wetlands, or the role of conservation and management in their preservation. Therefore, decisions relating to the utilisation of wetlands have not been feasible.

Wetland management in Viet Nam remains sector-based, overlapping, uncoordinated, scattered, and

a management mandate on wetlands has not yet been clearly defined.

Policies on wetland management have been inconsistent and unsystematic, with changes over time which have had negative effects, including loss of biodiversity, environmental degradation and pollution. One example is that Dam Doi experienced land use changes five times between 1975 and 1985, which has led to a severe loss of natural resources.

Conflicts in wetland utilisation and degradation of wetlands resources have resulted from a lack of a master plan regarding wetland management, and from detailed wetlands plans that are inappropriate to the physical and socio-economic conditions of each region. Regional planning, economic development, transportation, water resources development, hydro-electricity and tourism have changed and sometimes prevented the effective management of wetlands. A top-down approach in wetland management hinders local initiatives and participation in wetland protection and sustainable use.

Wetlands of high value have not been conserved and managed effectively. According to an inventory taken by VEPA in 2001 titled "*Wetlands of high biodiversity values and environmental importance*", proper wetland conservation and management policies have not been put in place in such areas as: Chu Lake (Phu Tho), Cam Son Lake (Bac Giang), Thai Binh Estuary (Tien Lang District, Hai Phong), Nui Coc Lake, Ba Be Lake, Hoa Binh Reservoir, Cau Hai Lagoon (Thua Thien Hue), Tra O and De Gi Lagoons (Binh Dinh), Nui Mot Lake (Binh Dinh), Lak Lake, Bien Ho (Central Highlands), Dankia Lake (Lam Dong), and Da Nhim and Dau Tieng Reservoirs (Ho Chi Minh City).

Investment in human resources for conservation and sustainable development of wetlands has not corresponded to the values and potentials of wetlands. Many kinds of investment have been unreasonably limited and imbalanced, including human resources development, scientific research, and development of models on sustainable development, conservation, and protection of wetlands and their resources.

Research and integrated surveys on wetlands have not been carried out in a synchronised and

systematic manner. There has been limited investment in capacity building and training for research and survey work. Advanced research methods are not being considered for application or modification for the specific conditions of Viet Nam. A good database on wetlands in the country is still lacking, and existing wetland inventory and assessment work does not meet the requirements for wetland conservation, management, and sustainable development.

Knowledge and awareness about the functions and values of wetlands, and about their conservation and management, are rather limited. Communication and awareness-raising activities have not received proper attention and have not always been suitable to the various target groups. Wetlands are not yet included in the environmental education programme.

3.5.3. Recommendations for wetland management in Viet Nam

a. Formulation and implementation of a national strategy on the conservation and sustainable development of wetlands

A national strategy on the conservation and sustainable development of wetlands which could provide national benefits and improve the welfare of local communities should be formulated and implemented nationwide. In addition, each ecoregion or province should develop its own action plan with its own specific characteristics in mind. These action plans could go into higher detail than the national strategy, with local relevance and high feasibility.

b. Enhancing the effectiveness and validity of the institutional and legislative system in wetland management

A synchronised and systematic system of institutions, legislation and management mechanisms for wetlands must be developed at all levels.

A National Coordination Committee on Wetlands should be established and operated under the direct guidance of the Deputy Prime Minister. This Committee would be an intersectoral body responsible for coordination and cooperation

between line ministries dealing with wetlands, including MONRE, MARD, MOFI, the Ministry of Transportation, the Ministry of Culture and Information, the Ministry of Planning and Investment, the Ministry of Finance, the Ministry of Justice, the Ministry of Education and Training, and other related agencies. A Technical Advisory Council would be established to support the National Coordination Committee's activities. Specialised bodies within these related sectors and ministries need to be allocated with clear mandates and power. In particular, attention should be paid to the consolidation of local authorities that directly manage wetland areas, such as People's Committees at the commune and district levels.

A policy on capacity building for wetland management agencies is needed, ensuring training, modernisation of facilities, and development and consolidation of the organisational structure.

A system of wetland protected areas needs to be established and developed. Management and action plans at different levels should be reviewed and assessed, and important wetlands that currently lack sustainable planning and management would be identified.

A model on wetland management relevant to the practical conditions of Viet Nam should be developed. In existing wetland protected areas, there should be a focus on technical capacity building and on completion of the management structure.

c. Implementation of supporting measures in wetland management

Attention should be paid to:

- Providing human resource training to meet the requirements of wetland conservation and wise use.
- Communication and awareness-raising on the functions and values of wetlands and on developing skills in conservation and sustainable use of wetlands.
- Promoting incentives and supporting policies to ensure local communities' livelihoods and enable them to participate in

the management and sustainable use of wetlands as guided by the Ramsar Convention.

- Providing financial support for wetland sustainable use activities.
- Establishing a wetland conservation fund. Sources of revenue could come from agricultural taxes, tourism, eco-tourism and other services relating to wetlands.
- Scientific research, inventory and monitoring of wetlands at the national and ecoregional levels as well as in wetland areas having high biodiversity and environmental values, especially those of national and international importance.

d. Development of measures for the conservation, utilisation and management of wetlands

The following activities should be undertaken:

- Development and issuance of a list of criteria for a wetlands classification system.
- Establishment of a management and action mechanism for the conservation of wetlands of high value.
- Implementation of policies and activities relating to the conservation and sustainable use of wetlands.
- Creation of a rehabilitation plan for degraded wetlands.
- Provision of incentives for the protection and improvement of clean water sources.
- Development of wise use models such as ecological aquaculture and other environmentally friendly models.
- Strict implementation of regulations on conservation and sustainable use of wetlands.

- Enforcement and punishment of violators.
- Development of a website and regularly updated national database on wetlands of Viet Nam.
- Undertaking of research on the development and application of advanced methods in wetland management, such as the ecosystem-based approach, co-management, intersectoral management and community-based management.

e. Planning for conservation and sustainable use of biodiversity in coastal and estuarine areas

A series of wetlands maps at different scales should be produced (e.g. 1:1,000,000 for a nationwide map; 1:250,000 for ecoregional maps; 1:100,000 for provincial maps; and between 1:10,000 and 1:25,000 for maps at each wetland site). A master plan on conservation and sustainable development of wetlands at the national level and at the ecoregional level should also be developed.

f. Formulation and implementation of regulations on wetlands resource management

The formulation of such regulations would play a decisive role in the management of fisheries within wetland areas. Its contents would include the following key issues:

- Regulating relationships between wetlands managers; and
- Budget allocation for management of fisheries and wetlands resources.

According to the Ordinance on Fisheries Resource Management, any fisheries activities (including catching, aquaculture, research on fisheries resources) need to obtain permission from the provincial department of fisheries resources management.

4. Conclusions

- 4.1. Wetlands of Viet Nam are very diverse and distributed widely over all ecoregions. They play a key role in and contribute value to socio-economic development, national defence, poverty and hungry alleviation, cultural maintenance and development, disaster prevention, environmental protection, and preservation and development of biodiversity.
- 4.2. Wetland ecosystems in Viet Nam are very sensitive, vulnerable and unable to adapt to sudden changes, which may result in a loss of ecological balance. They have been degraded in terms of habitat destruction, environmental pollution and a severe erosion of biological resources.
- 4.3. Major challenges to wetlands in Viet Nam include: rapid population increase; practices and poverty of people living within and around wetland areas; an inconsistent policy and legislative system for wetland management; a lack of coordination and intersectoral approach to wetland management; unsustainable exploitation; imbalanced utilisation and conservation of wetlands; limited or misdirected investment sources for activities such as human resource training, scientific research, development of wise use models, conservation and environmental protection; lack of comprehensive wetlands data to meet the requirements of wetland management and sustainable development; low knowledge and awareness about conservation and management of wetlands; impacts of natural disasters such as erosion, floods, storms, forest fires, and salinisation; and impacts globalisation and global environmental changes.
- 4.4. Wetlands in Viet Nam have been changed dramatically following the trends below:
- a. The number of wetland types and areas of artificial wetlands (e.g. reservoirs, aquaculture ponds, rice fields, wastewater treatment wetlands, etc.) has increased, while areas of natural wetlands, especially mangroves, seagrass beds, coral reefs, tidal mud flats, *Melaleuca* forests and natural lakes, have been rapidly decreasing.
 - b. The role and value of wetlands in relation to socio-economic development, environmental protection and disaster prevention has increased.
 - c. The quality of environment and wetland ecosystems in suburban areas, industrial zones, aquacultural and rice cultivation regions, mangrove forests, seagrass beds and coral reefs has degraded, resulting in a rapid reduction of biodiversity.
 - d. There is an increasing number of threats to wetlands, such as: natural disasters, war, population pressure, over-exploitation, irrelevant management mechanisms, structure and methods, lack of linkage between economic development policy and environmental and natural resource protection.
 - e. Awareness about the functions and values of wetlands has been continuously enhanced, however it is not yet sufficient to meet the requirements of the principle of wise use and sustainable development.
 - f. Wetland management tools and approaches are becoming more diverse and advanced. The number of legal documents relating to wetlands, as well as a number of wetland management agencies has increased, however coordination, effectiveness, efficiency and positive effects of the management system have not increased sufficiently.

- g. The number of projects and scientific work relating to wetlands has increased, together with an increase in scientific potential in terms of the number of scientific agencies, number of scientists and equipment. Despite this, research results have not been applied and brought into play effectively.
 - h. Communication and education about wetlands has received increasing attention, but formal training about wetland issues has not received proper attention. This work has not met the requirements of wetland conservation, utilisation and management.
 - i. The number of international wetlands-related projects and organisations with which Viet Nam is collaborating has been increasing. This has resulted in positive outcomes related to conservation and management of wetlands.
- 4.5. Different sectors and authorities at different levels should pay attention to conservation and sustainable use of wetlands. A long-term strategy on wetland management together with a relevant legal and institutional framework should be formulated and put into practice.
- 4.6. Viet Nam's membership of the Ramsar Convention and its efforts to implement the required obligations of the Contracting Party have played an important role in promoting conservation, management and sustainable development of wetlands in the country. However, conservation and sustainable development of wetlands in Viet Nam is in the early stages and therefore requires the support and assistance from donors, as well as national and international organisations.

5. Recommendations

In order to use wetlands wisely and manage them sustainably to prevent negative ecosystem changes, the following recommendations are made:

- 5.1. Promote the implementation of Government Decree No. 109/2003/ND-CP on conservation and sustainable development of wetlands, and the National Action Plan on Conservation and Sustainable Development of Wetlands for the period 2004-2010, issued by MONRE in 2004.
- 5.2. Develop and issue the criteria and classification system of wetlands; produce wetland maps for the whole country as well each ecoregion (at different scales); promote research in wetlands, including on forecasting trends of wetland changes in Viet Nam.
- 5.3. Formulate and implement a National Strategy and Master Plan on conservation and sustainable development of wetlands.
- 5.4. Develop and apply relevant models on wise use of wetlands.
- 5.5. Complete policy and institutional systems, as well as wetland management mechanisms, tools and methods.
- 5.6. Promote wetlands-related awareness raising, education and training activities that are suitable to Vietnamese conditions while meeting the demands of international integration.
- 5.7. Promote communication and education about wetlands; human resources training; capacity building in wetland inventory, survey and research; modernisation of facilities for training, research and management to meet the requirements of wetland conservation and sustainable development.
- 5.8. Promote and enhance international cooperation on conservation and sustainable development of wetlands.
- 5.9. Develop a national database and website about the wetlands of Viet Nam to meet the demand for inventory, research, education, training, management, utilisation, conservation and sustainable development of wetlands.
- 5.10. Select and complete documents, and designate new Ramsar sites.

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Appendix A:

Summary of the Ramsar Convention

1. Mission Statement

The Convention's mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world.

2. Commitment of Parties to the Convention

By taking part in the Convention, nations are contributing to international efforts in the conservation and wise use of wetlands. The Convention consists of four commitments as follows:

2.1. The list of internationally important wetlands

At the time of joining the Convention, each Contracting Party undertakes to designate at least one site for inclusion in the List of Wetlands of International Importance. The inclusion of a site in the Ramsar List will ensure the conservation and wise use of wetlands in this site. The selection of internationally important wetlands is based on ecological characters, diversity of flora and fauna systems, or hydrographical conditions at the wetlands. All contracting parties must accept specific criteria and regulations on identifying

wetlands of international importance as set by the Convention.

2.2. The wise use of wetlands

Contracting Parties agree to formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.

Conference of the Parties accepts the guiding principles and guidelines about the sustainable and wise use of wetlands.

2.3. Reserves and training

Members of the Ramsar Convention have responsibility to establish nature reserves within wetlands, regardless of whether they are classified as internationally important or not. In additions, contracting parties are required to promote training courses in the fields of research, management and wetlands monitoring.

2.4. International cooperation

The Contracting Parties shall consult with each other about implementing obligations arising from the Convention especially in the case of a wetland extending over the territories of more than one Contracting Party or where a water system is shared by Contracting Parties.

Appendix B:

Wetlands Classification System by MARD

MINISTRY OF AGRICULTURE
AND RURAL DEVELOPMENT
No. 646/QD/BNN-KHCN

THE SOCIALIST REPUBLIC OF VIET NAM
Independence - Freedom - Happiness
Ha Noi, 17 March 2004

DECISION
BY THE MINISTER OF AGRICULTURE AND RURAL DEVELOPMENT
Re: Issuance of sectoral standards on wetlands

THE MINISTER OF AGRICULTURE AND RURAL DEVELOPMENT

- Pursuant to Decree No. 86/2003/ND-CP dated 18 July 2003, by the Government stipulating functions, responsibilities, authorities and organisational structure of the Ministry of Agriculture and Rural Development;
- Pursuant to Decree No. 109/2003/ND-CP dated 13 September 2003, by the Government on conservation and sustainable development of wetlands;
- Pursuant to Regulations on formulation, approval and issuance of sectoral standards which was promulgated by Decision No. 135/QD/BNN-KHCN dated 1 October 1999;
- Following the request by the Director of the Department of Science and Technology.

DECIDES

Article 1: To issue herewith this decision the sectoral standards 04TCN67-2004 on Wetlands Classification System.

Article 2: These standards are the basis for management, conservation, sustainable use and development of wetlands under the management responsibilities of the Ministry of Agriculture and Rural Development. These standards shall come into force 15 days from the date of signing.

Article 3: The Head Ministry Office, Director of Department of Science and Technology, and heads of concerned institutions assume responsibility to implement this decision.

c/c:

- As defined in Article 3
- Ministry office for filing

For and on behalf of the Minister of
Agriculture and Rural Development

Vice Minister

Prof. Dr. **Bui Ba Bong**
(Signed)

MINISTRY OF AGRICULTURE
AND RURAL DEVELOPMENT

No. 646/QD/BNN-KHCN

THE SOCIALIST REPUBLIC OF VIET NAM

Independence - Freedom - Happiness

SECTORAL STANDARDS

04TCN 67-2004

WETLAND CLASSIFICATION SYSTEM

(Issued together with Decision No. 646/QD/BNN-KHCN dated 17 March 2004)

1. Scope of application

These standards set forth the wetland classification system as a basis for inventory, study, planning and projection of wetlands conservation and sustainable development in sectors related to agriculture, forestry, and water resources including wetlands as national parks, nature reserves, wetlands planned for agricultural purposes, and wetlands with functions of water supply and water balancing for the purposes of socio-economic development, environmental protection, and biodiversity and landscape conservation.

2. Terms definition/explanation

"Wetlands" used in this classification system includes:

- a. Ecosystems which are habitats such as: marsh, peat-land, floodplain, rivers and lakes.
- b. Coastal areas such as salt pans, seagrass beds, coral reefs and other sea areas which are not deeper than six metres at low tide.
- c. Artificial wetlands such as: reservoirs, wastewater treatment ponds.

3. Wetland classification system

The wetland classification system consists of four hierarchies:

Hierarchy one includes two systems which are differentiated based on the properties of water:

1. Saltwater wetlands
2. Freshwater wetlands

Hierarchy two includes six sub-systems which are classified based on geomorphological features:

1. Marine/ coastal saltwater wetlands
2. Estuarine saltwater wetlands
3. Palustrine saltwater wetlands
4. Riverine freshwater wetlands
5. Lacustrine freshwater wetlands
6. Palustrine freshwater wetlands

Hierarchy three includes 12 classes which are classified based on hydrological characteristics (permanent or non-permanent):

1. Coastal saltwater wetlands, permanently flooded;
2. Coastal saltwater wetlands, non-permanently flooded;
3. Estuarine saltwater wetlands, permanently flooded;
4. Estuarine saltwater wetlands, non-permanently flooded;
5. Palustrine saltwater wetlands, permanently flooded;

6. Palustrine saltwater wetlands, non-permanently flooded;
7. Riverine freshwater wetlands, permanently flooded;
8. Riverine freshwater wetlands, non-permanently flooded;
9. Lacustrine freshwater wetlands, permanently flooded;
10. Lacustrine freshwater wetlands, non-permanently flooded;
11. Palustrine freshwater wetlands, permanently flooded;
12. Palustrine freshwater wetlands, non-permanently flooded;

Hierarchy four includes 69 sub-classes which are classified based on land-use characteristics, of which:

- Saltwater wetlands system contains 42 sub-classes
- Freshwater wetlands contain 27 sub-classes.

For and on behalf of the Minister of
Agriculture and Rural Development
Vice-Minister

Prof. Dr. **Bui Ba Bong**
(Signed)

WETLANDS CLASSIFICATION SYSTEM OF VIET NAM

System: Saltwater wetlands (directly influenced by the marine environment)

Sub-system: Marine/ coastal saltwater wetlands

- I. Class: Coastal saltwater wetlands, permanently flooded:
 - 1. Coastal saltwater wetlands, permanently flooded, no vegetation;
 - 2. Coastal saltwater wetlands, permanently flooded, aquatic vegetation;
 - 3. Coastal saltwater wetlands, permanently flooded, coral reef;
 - 4. Coastal saltwater wetlands, permanently flooded, aquaculture;
 - 5. Coastal saltwater wetlands, permanently flooded, permanent flow;
 - 6. Coastal saltwater wetlands, permanently flooded, other.
- II. Class: Coastal saltwater wetlands, non-permanently flooded:
 - 7. Coastal saltwater wetlands, non-permanently flooded, rocky beds ;
 - 8. Coastal saltwater wetlands, non-permanently flooded, sandy, gravel, and shingle beds;
 - 9. Coastal saltwater wetlands, non-permanently flooded, soil and muddy bed, no vegetation;
 - 10. Coastal saltwater wetlands, non-permanently flooded, grass, sedge, reeds, shrubs;
 - 11. Coastal saltwater wetlands, non-permanently flooded, natural forest;
 - 12. Coastal saltwater wetlands, non-permanently flooded, plantation;
 - 13. Coastal saltwater wetlands, non-permanently flooded, aquaculture;
 - 14. Coastal saltwater wetlands, non-permanently flooded, agriculture;
 - 15. Coastal saltwater wetlands, non-permanently flooded, salt-works;
 - 16. Coastal saltwater wetlands, non-permanently flooded, flows;
 - 17. Coastal saltwater wetlands, non-permanently flooded, other.

Sub-system: Estuarine saltwater wetlands

- III. Class: Estuarine saltwater wetlands, permanently flooded:
 - 18. Estuarine saltwater wetlands, permanently flooded, sand bars and sand dunes;
 - 19. Estuarine saltwater wetlands, permanently flooded, mudflat;
 - 20. Estuarine saltwater wetlands, permanently flooded, meadow;
 - 21. Estuarine saltwater wetlands, permanently flooded, aquaculture;
 - 22. Estuarine saltwater wetlands, permanently flooded, flows;
 - 23. Estuarine saltwater wetlands, permanently flooded, other.
- IV. Class: Estuarine saltwater wetlands, non-permanently flooded:
 - 24. Estuarine saltwater wetlands, non-permanently flooded, sandy, gravel, and shingle beds, no vegetation;
 - 25. Estuarine saltwater wetlands, non-permanently flooded, soil and muddy beds, no vegetation;
 - 26. Estuarine saltwater wetlands, non-permanently flooded, meadow, reeds, sedges, and shrubs;
 - 27. Estuarine saltwater wetlands, non-permanently flooded, natural forest;
 - 28. Estuarine saltwater wetlands, non-permanently flooded, plantation forest;
 - 29. Estuarine saltwater wetlands, non-permanently flooded, aquaculture;
 - 30. Estuarine saltwater wetlands, non-permanently flooded, agriculture;
 - 31. Estuarine saltwater wetlands, non-permanently flooded, salt-works;
 - 32. Estuarine saltwater wetlands, non-permanently flooded, flows;
 - 33. Estuarine saltwater wetlands, non-permanently flooded, other.

Sub-system: Palustrine saltwater wetlands:

- V. Class: Palustrine saltwater wetlands, permanently flooded:
 - 34. Palustrine saltwater wetlands, permanently flooded, no vegetation;
 - 35. Palustrine saltwater wetlands, permanently flooded, with grass, shrubs or natural forest;
 - 36. Palustrine saltwater wetlands, permanently flooded, aquaculture;
 - 37. Palustrine saltwater wetlands, permanently flooded, other.
- VI. Class: Palustrine saltwater wetlands, non-permanently flooded:
 - 38. Palustrine saltwater wetlands, non-permanently flooded, no vegetation;
 - 39. Palustrine saltwater wetlands, non-permanently flooded, with grass, shrubs or natural forest;
 - 40. Palustrine saltwater wetlands, non-permanently flooded, plantation forest;
 - 41. Palustrine saltwater wetlands, non-permanently flooded, aquaculture;
 - 42. Palustrine saltwater wetlands, non-permanently flooded, other.

System: Freshwater wetlands (not directly influenced by marine environment)

Sub-system: Riverine freshwater wetlands

- VII. Class: Riverine freshwater wetlands, permanently flooded:
 - 43. Riverine freshwater wetlands, permanently flooded, flows and waterfalls;
 - 44. Riverine freshwater wetlands, permanently flooded, other flows.
- VIII. Class: Riverine freshwater wetlands, non-permanently flooded:
 - 45. Riverine freshwater wetlands, non-permanently flooded, grass or shrubs;
 - 46. Riverine freshwater wetlands, non-permanently flooded, natural forest;
 - 47. Riverine freshwater wetlands, non-permanently flooded, plantation forest;
 - 48. Riverine freshwater wetlands, non-permanently flooded, agriculture;
 - 49. Riverine freshwater wetlands, non-permanently flooded, aquaculture;
 - 50. Riverine freshwater wetlands, non-permanently flooded, flows;
 - 51. Riverine freshwater wetlands, non-permanently flooded, other.

Sub-system : Lacustrine freshwater wetlands

- IX. Class: Lacustrine freshwater wetlands, permanently flooded:
 - 52. Lacustrine freshwater wetlands, permanently flooded, natural;
 - 53. Lacustrine freshwater wetlands, permanently flooded, artificial;
 - 54. Lacustrine freshwater wetlands, permanently flooded, other.
- X. Class: Lacustrine freshwater wetlands, non-permanently flooded:
 - 55. Lacustrine freshwater wetlands, non-permanently flooded, grass or shrubs;
 - 56. Lacustrine freshwater wetlands, non-permanently flooded, natural forest;
 - 57. Lacustrine freshwater wetlands, non-permanently flooded, plantation forest;
 - 58. Lacustrine freshwater wetlands, non-permanently flooded, agriculture;
 - 59. Lacustrine freshwater wetlands, non-permanently flooded, aquaculture;
 - 60. Lacustrine freshwater wetlands, non-permanently flooded, other.

Sub-system: Palustrine freshwater wetlands

- XI. Class: Palustrine freshwater wetlands, permanently flooded:
 - 61. Palustrine freshwater wetlands, permanently flooded, natural
 - 62. Palustrine freshwater wetlands, permanently flooded, artificial
 - 63. Palustrine freshwater wetlands, permanently flooded, other

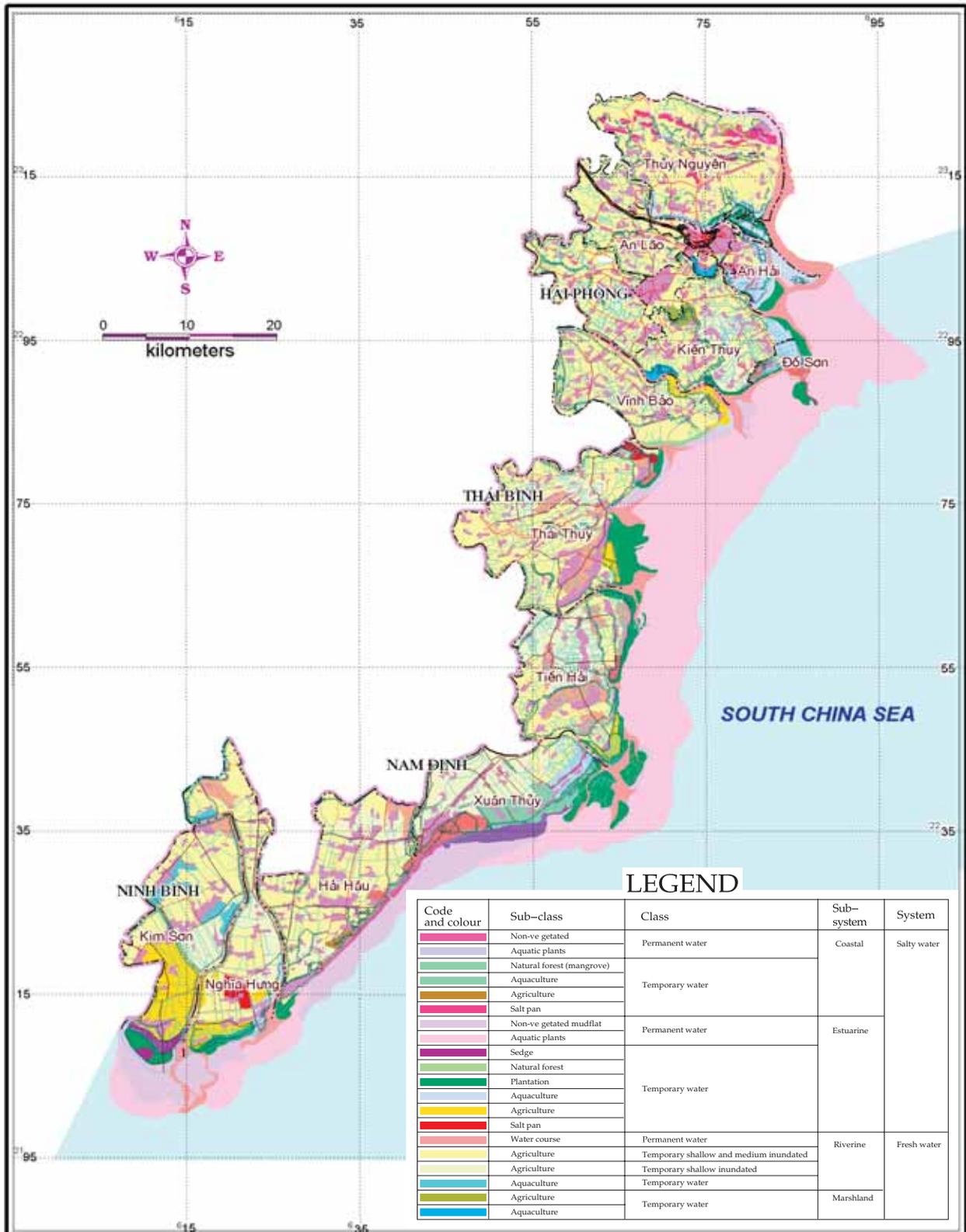
XII. Class: Palustrine freshwater wetlands, non-permanently flooded

- 64. Palustrine freshwater wetlands, non-permanently flooded, grass or shrubs
- 65. Palustrine freshwater wetlands, non-permanently flooded, natural forest
- 66. Palustrine freshwater wetlands, non-permanently flooded, plantation forest
- 67. Palustrine freshwater wetlands, non-permanently flooded, agriculture
- 68. Palustrine freshwater wetlands, non-permanently flooded, aquaculture
- 69. Palustrine freshwater wetlands, non-permanently flooded, other

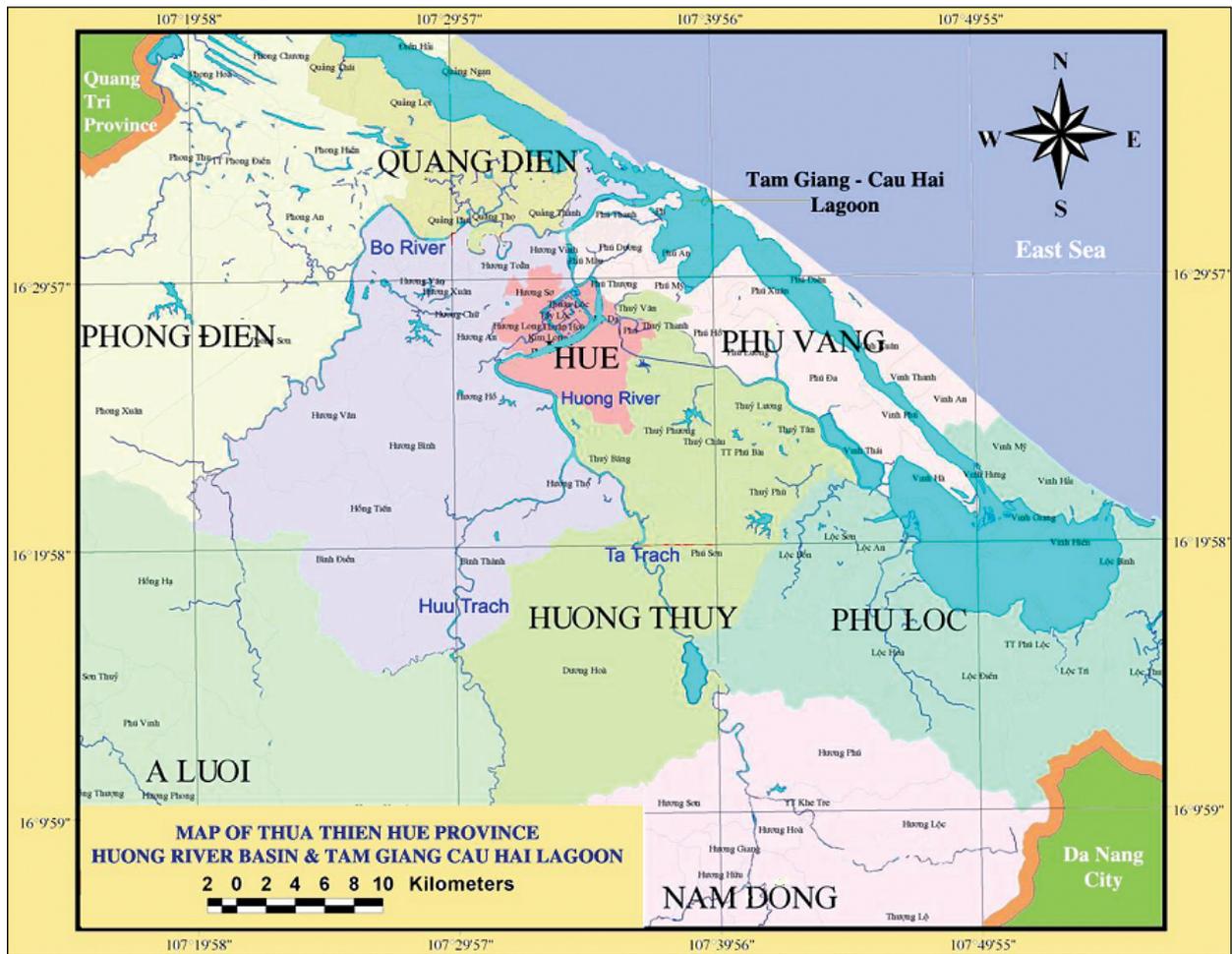
Appendix C:

Maps of Wetlands in Viet Nam

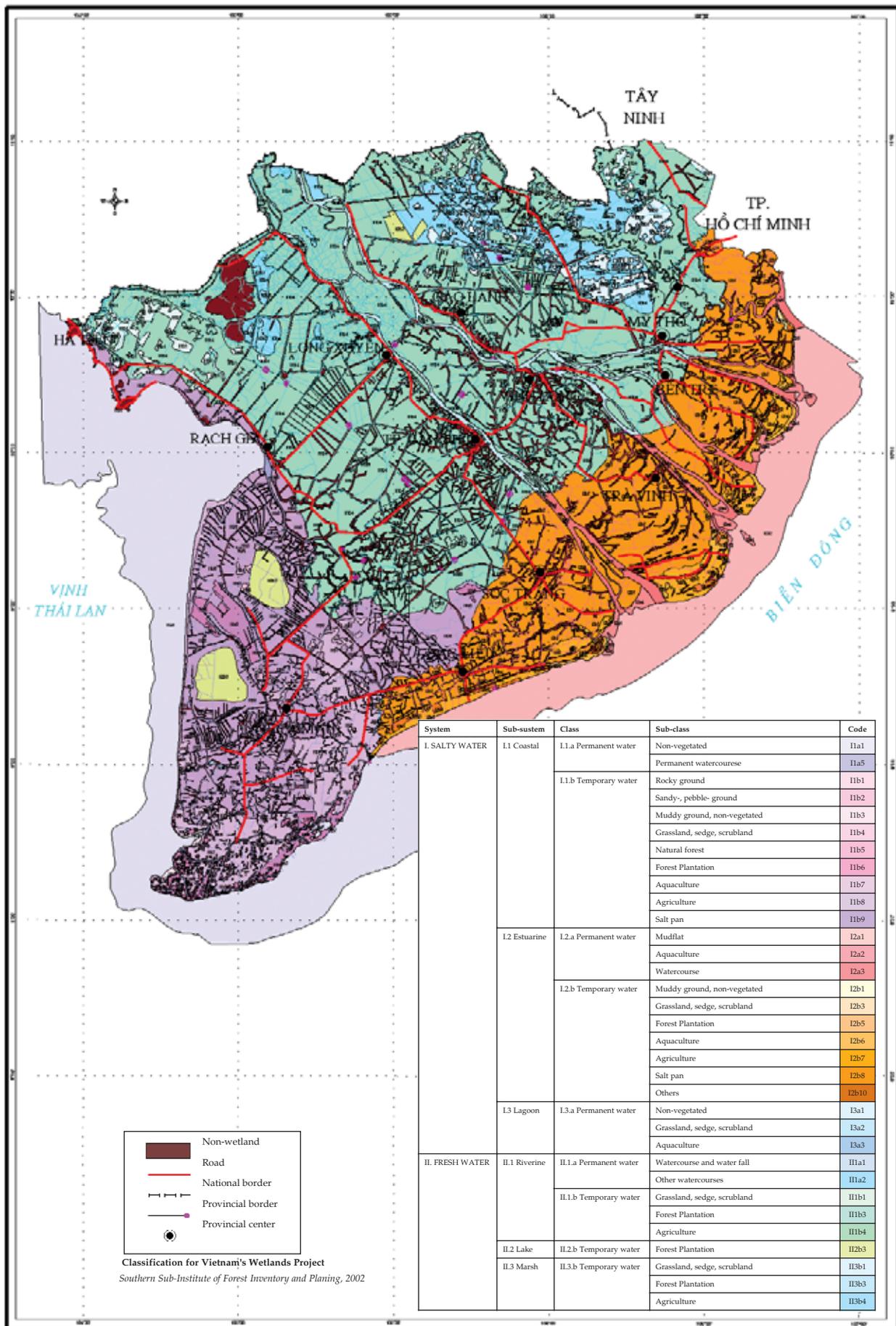
C1: Wetlands Map of the Red River Delta



C2: Map of Tam Giang-Cau Hai Lagoon



C3: Wetlands Map of Mekong River Delta



Appendix D:

Wetland Sites of Biodiversity and Environmental Value in Viet Nam

Wetland Sites of Biodiversity and Environmental Value in Viet Nam

(December 1999)

No	Name	Province	Area (ha)	Coordinates	Characteristics	Recognised by the Vietnamese Government
1.	Hoa Binh Lake	Hoa Binh	72,800	20°00' - 21°30' 103°00' - 106°00'	Reservoir	
2.	Ba Be Lake	Bac Can	450	22°24' 105°37'	Natural reservoir	X
3.	Thac Ba Lake	Yen Bai	19,000	21°41' - 22°05' 104°45' - 105°03'	Reservoir	
4.	Nui Coc Lake	Thai Nguyen	2,600	21°33' - 21°37' 105°46'	Reservoir with migrant birds	
5.	Chu Lake	Vinh Phuc	300	22°24' 105°37'	Natural reservoir with waterbirds	
6.	Chinh Cong Lake	Vinh Phuc	400	21°31' 105°05'	Freshwater reservoir	
7.	Vac Swamp	Vinh Phuc	250	21°18' 105°36'	Natural swamp	
8.	Cam Son Lake	Bac Giang	2,620	21°32' 106°34'	Reservoir with migrant waterbirds	
9.	Dong Mo, Ngai Son Lake	Ha Tay	900	21°05' 105°27'	Reservoir with migrant waterbirds	
10.	Suoi Hai Lake	Ha Tay	1,200	21°07' - 21°25' 105°22' - 105°25'	Artificial reservoir with migrant birds	
11.	West Lake	Ha Noi	526	21°04' 105°50'	Natural reservoir with migrant birds	

Overview of Wetlands Status in Viet Nam Following 15 Years of Ramsar Convention Implementation

No	Name	Province	Area (ha)	Coordinates	Characteristics	Recognised by the Vietnamese Government
12.	Littoral areas in the south of Thuy Nguyen District	Hai Phong	1,000	20°53' - 20°56' 106°44' - 106°46'	Old-growth mangrove forest	
13.	Van Uc Estuary (Tien Lang District)	Hai Phong	1,500	20°40' - 20°41' 106°41' - 106°42'	Mangrove forest with abundance of <i>Sonneratia caseolaris</i> and diversity of waterbirds	
14.	Thai Binh River Estuary (Tien Lang District)	Hai Phong	2,000	20°53' - 20°56' 106°36' - 106°39'	Mangrove forest, intertidal flats with many waterbirds	
15.	Tien Yen Estuary	Quang Ninh	5,000	21°17' 107°27'	Mangrove forest with many migrant birds	
16.	Littoral area of Thai Thuy District	Thai Binh	13,100	20°28' - 20°37' 106°36' - 106°38'	Mangrove forest with many waterbirds	
17.	Tien Hai Wetland Nature Reserve	Thai Binh	12,500	20°17' - 20°22' 106°23' - 106°35'	Mangrove forest, intertidal flats with many waterbirds	X
18.	Xuan Thuy Wetland Nature Reserve	Nam Dinh	12,000	20°10' - 20°17' 106°21' - 106°33'	Mangrove forest, intertidal flats and Casuarina forest with many waterbirds	X
19.	Littoral area of (Nghia Hung District)	Nam Dinh	9,000	19°00' - 19°56' 106°07' - 106°12'	Mangrove forest, intertidal flats with many waterbirds	
20.	Van Long Wetland Nature Reserve	Ninh Binh	3,500	20°21' - 20°26' 105°47' - 105°55'	Natural lake with many migrant birds and waterbirds	
21.	Chinh Cong Swamp	Ha Hoa, Phu Tho	500	21°31' 105°05'	Freshwater swamp with migrant waterbirds	
22.	Ben En Lake (Muc River)	Thanh Hoa	3,000	19°37' 105°32'	Reservoir with waterbirds.	X
23.	Ke Go Lake	Ha Tinh	3,000	18°13' 105°55'	Reservoir	X
24.	Tam Giang Lagoons	Thua Thien Hue	8,000	16°32' - 16°39' 107°20' - 107°37'	Coastal lagoon with many migrant birds	
25.	Cau Hai Marsh	Thua Thien Hue	12,000	16°28' 107°45'	Coastal lagoon	
26.	Phu Ninh Lake	Quang Nam Da Nang	3,600	15°18' - 15°30' 108°23' - 108°35'	Reservoir with waterbirds	
27.	Thach Nham Lake	Quang Ngai	3,600	15°41' 108°32'	Reservoir	

Overview of Wetlands Status in Viet Nam Following 15 Years of Ramsar Convention Implementation

No	Name	Province	Area (ha)	Coordinates	Characteristics	Recognised by the Vietnamese Government
28.	Tra O Marsh	Binh Dinh	1,600	14°11'27" 108°52'08"	Coastal lagoon	
29.	De Gi Marsh	Binh Dinh	600	14°07' - 14°10' 109°09' - 109°50'	Coastal lagoon	
30.	Thi Nai Marsh	Binh Dinh	5,000	13°57'08" 109°17'	Coastal lagoon	
31.	Nui Mot Lake	Binh Dinh	1,100	13°46'00" 108°52'27"	Reservoir	
32.	Chao Lagoon Pool	Phu Yen	5,000	13°26'10" 109°18'06"	Bay with migrant birds	
33.	Cu Mong Lake	Phu Yen	3,000	13°29' - 13°40' 109°12' - 109°19'	Coastal lagoon	
34.	Song Hinh Lake	Phu Yen	4,100	12°29' - 13°19' 109°37' - 109°01'	Reservoir	
35.	Ba Estuary	Phu Yen	1,000	12°56' - 12°59' 109°22' - 109°26'	Estuary	
36.	O Loan Marsh	Phu Yen	1,570	13°13'50" 109°14'30"	Coastal lagoon	
37.	Ro Lagoon Pool	Phu Yen		12°46' 109°27'	Bay with migrant birds	
38.	Nai Marsh	Ninh Thuan	700	11°36' - 11°38' 109° - 109°03'	Bay with migrant birds	X
39.	Bien Lac Lake	Binh Thuan	2,000	11°07' 107°37'	Natural lake	
40.	Yaly Lake	Kon Tum	6,450	14°12' - 15°15' 107°28' - 108°23'	Reservoir	
41.	Bien Ho Lake	Gia Lai	300	14°03' 108°00'	Reservoir with waterbirds and migrant birds	
42.	Ayun Ha Lake	Gia Lai	700	13°25' 108°22'	Reservoir	
43.	Nam Ka Lake	Dak Lak	1,240	12°25' 108°06'	Reservoir with migrant birds and crocodiles	X
44.	Lak Lake	Dak Lak		12°21' - 12°28' 108°08' - 108°18'	Reservoir with migrant birds	X
45.	Ea Ral Lake	Dak Lak	102	13°21' 108°14'	<i>Glyptostrobilus pensilis</i>	
46.	Trap K Sor Lake	Dak Lak	96	13°06'52" 108°17'21"	<i>Glyptostrobilus pensilis</i>	X
47.	Da Teh Lake	Lam Dong	500	11° 106°	Reservoir	

Overview of Wetlands Status in Viet Nam Following 15 Years of Ramsar Convention Implementation

No	Name	Province	Area (ha)	Coordinates	Characteristics	Recognised by the Vietnamese Government
48.	Dan Kia Lake	Lam Dong	300	12° 106°	Reservoir	
49.	Tuyen Lam Lake	Lam Dong	200	12° 106°	Reservoir with waterbirds	
50.	Da Nhim Lake	Lam Dong	900	12° 106°	Reservoir	
51.	Nam Cat Tien	Dong Nai	4,300	11°20' - 11°50' 107°09' - 107°35'	Freshwater, crocodile swamp	X
52.	Tri An Lake	Dong Nai	32,300	11°18' 107°11'	Reservoir	
53.	Dau Tieng Lake	Tay Ninh	5,000	11°15' - 11°32' 106°10' - 106°30'	Reservoir	
54.	Bac Lieu Bird Sanctuary	Bac Lieu	130	9°15' 105°44'	Seasonally inundated area with many waterbird species	
55.	Dam Doi Bird Sanctuary	Ca Mau	129	8°56' 105°13'	Intertidal area with many waterbirds	X
56.	Ong Trang Estuarine Nature Reserve	Ca Mau	1,540	8°43' 104°50'	Ong Trang river mouth with amphibian, reptile and migrant bird species	X
57.	Cai Nuoc (Tra La) Bird Sanctuary	Ca Mau	20	8°58' 105°06'	Mangrove forest mixed with agricultural land with many waterbird species	X
58.	Mui Ca Mau National Park	Ca Mau	4,472	8°37' 104°46'	Mangrove forest, marsh, mudflats with migrant waterbirds, accretion land	X
59.	Vo Doi Nature Reserve	Ca Mau	3,724	9°15' 104°55'	<i>Melaleuca</i> forest, seasonally inundated glassland, many waterbird species	X
60.	U Minh Thuong National Park	Kien Giang	21,800	9°36' 105°05'	Glassland, <i>Melaleuca</i> forest, peat land, seasonally inundated inland marsh with many rare, importance waterbird, flora and fauna species	X
61.	Thanh Phu Wetland Nature Reserve	Ben Tre	4,510	9°50'05" - 9°57'40" 106°32'56" - 106°32'58"	Mekong estuarine, littoral mangrove forest and marsh	
62.	Lang Sen Wetland Nature Reserve	Long An	3,877	10°44' - 10°48' 105°45' - 105°48'	<i>Melaleuca</i> forest, yearly inundated land, seasonally inundated grassland	

No	Name	Province	Area (ha)	Coordinates	Characteristics	Recognised by the Vietnamese Government
63.	Tram Chim National Park	Dong Thap	7,588	10°37' - 10°46' 105°28' - 105°36'	Seasonally inundated land. <i>Grus antigone sharpii</i> .	
64.	An Duong Water Born (Lake)	Hai Duong	10			
65.	Yen My Lake	Thanh Hoa	95			
66.	Phong Nha - Ke Bang National Park	Quang Binh				X
67.	Sen Swamp	Quang Binh	200			
68.	Cam Khanh Lake	Quang Binh	8,590			

Profiles of Selected Wetland Sites

1. Red River Estuarine Wetlands

1.1. General Description

The Red River Estuary is situated in Giao Xuan and Giao Thien Communes, (Giao Thuy District, Nam Dinh Province), Nam Phu Commune (Tien Hai District, Thai Binh Province), and along the coastline bordered by the Lan Estuary to the north and the Phu Hai Estuary to the south. The site supports extensive intertidal mudflats with old-growth mangrove forest, and provides important habitats for wintering waterbirds and numerous aquatic species (fish, shrimp). The site has a total area of 26,397 ha (Nguyen Duc Cu, 1993), which includes 22,625 ha of natural wetland and 3,772 ha of artificial wetland.

During the 1938-1992 period, in the southern portion of the site, the high tidal flats encroached upon 5,350 ha (28-46 m/year on average), and the low tidal flats encroached upon 1,518 ha (3-9 m/year). In the northern portion of the Red River

Estuary, the erosion rate at the same time was 1-6 m/year, and the area lost by erosion was 347 ha. Hence, the Red River Estuary has a tendency to shift southwards.

1.2. Functions and Values

1.2.1. Biodiversity

To date, 971 species of terrestrial and aquatic fauna and flora have been recorded at the site. Of these, the most dominant group is birds (21.3% of the total number of species), followed by insects (18.0%), zooplankton (13.8%) and fish (13.4%).

Zoobenthos species: Zoobenthos species are quite diverse, and include crustaceans (shrimp and crab, 53 species), gastropods (30 species), and bivalves (25 species). 130 fish species have been recorded, of which the most dominant order is Perciformes (23 families, 74 species), followed by Gobiidae (12 species), Engraulidae (9 species), Carangidae and Leiognathidae (7 species each), Clupeidae and Sciaenidae (6 species each), and finally Ophichthyidae, Mugilidae, Theraponidae, Sparidae, Cynoglossidae and Soleidae (4 species each).

Terrestrial species: The two most dominant groups are birds with 113 migratory species (54.1 %) and insects, including Lepidoptera (13 families, 41 species), Coleoptera (13 families, 40 species), Diptera (5 families, 21 species), Hemiptera (10 families, 18 species), and Hymenoptera (9 families, 15 species). The level of diversity of other groups is very low.

Plants: 12 mangrove species and 31 mangrove-dependent species (from 29 families) form important vegetation at the site. Mangrove forests do not only provide coastal protection but also are important habitats for congregations of birds and fishes. The dominant plant species include *Avicennia lantana*, *Excoecaria agallocha*, *Aegiceras corniculata*, *Bruguiera gymnorrhiza*, *Kandelia candel*, and *Sonneratia caseolaris*.

1.2.2. Functions, values and significance

The site has the function of maintaining and developing mangrove ecosystems, resources and environment, aquaculture and fisheries. The mangroves form forests and provide a number of significant indirect values in microclimate regulation, pollution absorption, environmental self-cleaning, maintenance of aquatic genetic resources, and regulation of sedimentation to form tidal flats.

Some flagship species at the site include 'Ngan' grass (*Scirpus kimsonensis*), and waterbird species such as the Common Teal (*Anas crecca*), Northern Shoveler (*Anas clypeata*), Eurasian Wigeon (*Anas penelope*), Northern Pintail (*Anas acuta*), Garganey (*Anas querquedula*), Little Egret (*Egretta garzetta*), Grey Heron (*Ardea cinerea*), Black-tailed Godwit (*Limosa limosa*), Spotted Redshank (*Tringa erythropus*), and Common Redshank (*Tringa totanus*).

The site supports a large fishing ground for the small fishery industry, and a large area of bivalve production grounds with a number of species of high economic value such as *Meretrix meretrix*, *M. lusoria*, *Ostrea rivularis*, *Anadana granosa*, *A. antipa*, *Cyclina sinesis*, *Solen spp.*, *Lingula anatina*, *Sinovacula constricta*, and *Glaucomia chinensis*. The bivalve production ground covers an area of approximately 15,000 ha in Thu and Vanh Islands (Thai Binh Province), and Ngan and Lu Islands

(Nam Dinh Province), with an annual yield of approximately 10,000-15,000 tons.

The Red River Estuary provides breeding and nursery grounds for many fish and mollusc species, as well as passage and wintering habitats for a number of migratory birds in their winter flyway from north to south (storks, cranes, ducks, geese, gulls, etc.). Every year, at least 8 billion prawns of the Penaeidae family are bred naturally in the site (Vu Trung Tang, 1994). The estuary is also a gateway along the sea-river migratory path of fish species such as *Clupanodon thrissa* (sardine) and *Macrura reevesii* (alose) from the Gulf of Tonkin to fresh watercourses for breeding. Finally, the site is an entrance for marine animals travelling inland to contribute to the creation of freshwater animal communities.

1.3. Current Uses

Major activities at the site include:

- Agricultural production: Agricultural production is concentrated in Nam Phu, Nam Hung and Nam Think Communes.
- Aquacultural and fishery activities: 40% of the local labour force is involved in these activities and this rate is continually increasing with the recent district policy of aquacultural industry expansion.
- Forestry production: Another large portion of the local labour force is involved in forestry. With funding from the Government and Danish Red Cross, 3,000 ha of mangrove were planted and the management of this area was gradually allocated to local households.
- Other services: Other services include seafood processing in Nam Think Commune, provision of aquacultural foodstuffs, fishing equipment, ecotourism services, etc.

1.4. Threats

At present, the Red River Estuarine Wetland is faced with the following major threats:

- Population pressure: High population is leading to over-exploitation and depletion of wetland resources.

- Agricultural activities: Overuse of chemical fertilisers and pesticides is leading to pollution of land and water sources, threatening the habitats of numerous plant and animal species.
- Aquacultural and fishery activities involving destructive practices.
- Insufficiency and weakness of the management system, and of mechanisms, practices, regulations and policies.
- Natural disasters (7-10 storms/typhoons every year).

1.5. Solutions for Wetland Management and Conservation

1.5.1. Management institutions

The core zone of Xuan Thuy Ramsar Site is under the management of the National Park's Management Board. The buffer zone communes manage the tidal flats following an identified boundary system, the Management Board of Con Ngan Project manages activities in some mudflats in the buffer zone, and the Red Cross manages the newly planted mangrove areas.

The southern portion of Ba Lat Estuary is managed by different agencies of Nam Dinh Province and Giao Thuy District including the Division of Agriculture and Rural Development, the Division of Natural Resources and Environment, and the Division of Transportation. On the other hand, the northern portion of Lat Estuary is managed by agencies of Thai Binh Province and Tien Hai District including the Division of Agriculture and Rural Development, the Division of Fisheries, the Division of Natural Resources and Environment, the Division of Transportation, and Viet-My Company (which manages approximately 2,000 ha of wetlands for the development of shrimp ponds, which includes some areas of mangrove forest). The linkages and institutional arrangements between agencies are not clear; there are overlaps in their management activities and conflicts in their interests and authority.

1.5.2. Scientific research

A large number of scientific studies have been undertaken in this site by different national and international institutions such as VEPA (1992-

2002), and several NGOs including the Centre for Research and Development (CERED), Mangrove Ecosystem Research Centre (MERC), Centre for Natural Resources and Environmental Studies (CRES), IUCN, WWF, Birdlife International, the Netherlands Foundation for the Advancement of Tropical Research (WOTRO), Hanoi National University, and others. The Ramsar Nature Reserve Management Board (recently changed to Xuan Thuy National Park Management Board) also collaborated with a number of research institutes to implement a number of scientific studies in different subject areas in the site. These studies have contributed to the development of policy for local authorities to manage the site as well as the mutual impacts between people and the environment.

1.5.3. Conservation measures.

a. Conservation situation: The Red River Estuary is one of only two Ramsar sites in Viet Nam, and is also gazetted as a national park. Therefore, it has received the attention of many scientists and international organisations such as IUCN and Birdlife International to support the Management Board in natural resources management and conservation, environmental protection and sustainable socio-economic development.

b. Conservation education: Local and national workshops and training courses have been held to promote conservation at the site. Local authorities have implemented some training and educational programmes to raise local awareness of the importance of wetlands to the development of the local economy and nature conservation.

2. Tam Giang-Cau Hai Lagoon

2.1. General Description

The Tam Giang-Cau Hai Lagoon complex lies in the coastal zone of Thua Thien Hue Province, and stretches from the O Lau River mouth to the foot of Vinh Phong Mountain. The complex opens to the sea through two mouths at Thuan An and Tu Hien. In total, the complex covers 216 km², forming the largest lagoon system in Viet Nam (approximately 40% of the total lagoon area of the country). The lagoon lies in Phu Vang, Huong Tra, Quang Dien and Phong Dien Districts of Thua Thien Hue Province. The natural resources

of the lagoon are used to support the livelihoods of local communities.

2.2. Functions and Values

2.2.1. Biodiversity

Phytoplankton: 357 Phytoplankton species of 6 orders were recorded. Of them, Cyanophyta order has 19 species (accounting for 5.3% of the total number of species), Heterokontophyta has 241 species (67.5%), Chlorophyta has 3 species (0.8%), Dinophyta has 72 species (20.2%), Euglenophyta has 2 species (0.6%), and Chlorophyta has 20 species (5.6%).

Macrophyte: 16 vascular plant species of 11 genera and 6 families were recorded. Of them, 3 species belong to the Magnoliopsida class (accounting for 18.75% of the total number of species) and 13 species belong to the Liliopsida class (81.25%).

Aquatic higher plants: The number of species is relatively low, however, the living mass and volume of the plants are both high. Abundant species are *Valisneria spiralis* with a living mass of 3.5 kg of fresh plant per square metre, *Najas indica* (2.8 kg/m²), *Halophila beccarii* (2.5 kg/m²), and *Cymodocea rotundata* (1.8 kg/m²).

Zooplankton: Average density is 3,115 organisms/m², and 34 species have been recorded. Of them, Copepoda is most dominant (28 species of 12 families), followed by Diaptomidae (1 species), Pseudodiaptomidae (5 species), Paracalanidae (1 species), and Pluteidae (4 species). The Copepoda species contribute to 90% of the living volume of zooplankton, the remainder of which is the Cladocera species.

Zoobenthos: Four groups have been recorded. The Polychaeta class of the Anelida division is the most diverse with 25 species (38.5% of the total number of species), followed by the Mollusca division with 24 species (36.9%), Crustacea class with 15 species (23.1%), and Insecta class with 1 species (1.5%). The mean density is 1,384 organisms/m², equivalent to 133 g/m². In this living mass, the crustacean group is the most dense with 660 organisms/m² (47.70%), followed by Polychaete with 561 organisms/m² (40.52%) and molluscs with 163 organisms/m² (11.78%).

Fish: 171 species have been identified. Of them, the Perciformes order is most abundant with 97

species (56.73% of total species), followed by the Mugiliformes order with 14 species (8.19%), and the Clupeiformes order with 10 species (5.58%).

Birds: 73 species of 53 genera, 29 families, and 11 orders were recorded. Of them, 39 are resident species (53.43%) and 34 are migrant species (46.57%). 30 bird species present are ranked as strictly protected by the EC, and one species is listed in the Viet Nam Red List of Endangered Species.

2.2.2. Values of the lagoons

Lagoon products such as fish, crabs, shrimps, bivalves, and marine plants are important resources not only for local consumption but also for export with high economic value. The total fish yield of the lagoon complex reaches 3,600 tons/year. Gracilaria algae is also a valuable aquatic product in the site.

2.3. Current Uses

The lagoon complex is bordered by a large area of agricultural land consisting of approximately 37,000 ha of rice paddies. There are over 54,000 ha of agricultural land in the area. However, food productivity is low at approximately 1.5 tons/year (Tran Duc Thanh et al. 1999). Aquacultural and fishery activities are well developed with about 3,000 ha of aquacultural land (9.3% of total production land area). The Vinh Hung, Vinh My, Vinh Giang, Vinh Hai and Vinh Hien Communes are famous for their agricultural and aquacultural industries.

2.4. Threats

Increasing population, coupled with increasing demand for economic development, is leading to the over-exploitation of aquatic products (for example, the fish yield reduced significantly from 4,515 tons/year in 1973 to 2,700 tons/year in 1997). Destructive fisheries activities, poorly planned aquacultural development, and hunting of waterbirds are activities threatening the environment of the lagoon. Irrigational infrastructure, such as the Thao Long Barrage and the dike system in Phong Dien District, is strongly impacting the circulation of sediments, preventing the migration of aquatic species, and leading to habitat loss and fragmentation. In addition, indirect threats on the wetland site are posed by the weaknesses of the management and legal framework and by natural disasters.

2.5. Solutions for Wetland Management and Conservation

2.5.1. Management institutions

This wetland site is under the management of the People's Committees of Quang Dien, Huong Tra, Phu Vang, Phong Dien, and Phu Loc (Thua Thien Hue Province) and their coastal communes. Various provincial agencies manage specific activities in the site, including the Department of Agriculture and Rural Development (DARD), the Department of Natural Resources and Environment (DONRE), the Department of Fisheries (DOFI), and the Department of Transportation.

2.5.2. Conservation measures

To date, no biodiversity conservation plan is being implemented in the Tam Giang-Cau Hai Lagoon complex. However, a number of scientific research projects have been implemented by national and ministerial institutes, international organisations (UNDP, IUCN) and foreign governments (Canada, Netherlands). Some national and local projects have made initial assessments of the economical potential and values of this wetland site.

3. Mui Ca Mau Wetland

3.1. General Description

Mui Ca Mau Wetland is situated at the southernmost tip of Viet Nam in Ngoc Hien District, Ca Mau Province, about 100 km south of Ca Mau Town. The wetland ecosystems of this site are typical for the coastal ecological zone with large areas of tidal mudflats inhabited by a number of mangrove-dependent organisms. The site has an important role in biodiversity conservation and maintenance of the ecological balance. The site has a total area of 41,862 ha of various wetland types including shallow seas of depths not exceeding 6 m at low tide with sandy and mudflats, sandy beaches, sandy bars and capes, intertidal sandy and mudflats, and swampy mangroves.

3.2. Functions and Values

3.2.1. Biodiversity

Mui Ca Mau supports a diversity of fauna and flora. Thirteen mammal species from nine families were recorded including two species on the IUCN Red List of Endangered Species: the Long-tail Macaque (*Macaca fascicularis*) and Silvered Langur

(*Trachypithecus cristatus*) as well as four species on Viet Nam's Red List. 74 bird species from 23 families were recorded, including five species on the IUCN Red List and seven species on Viet Nam's Red List. 28 migratory bird species were recorded, of which many were rare migrants including the Chinese Egret (*Egretta eglophotes*), the Spot-billed Pelican (*Pelicanus philippensis*), and the Painted Stork (*Mycteria leucocephala*). Seventeen reptile species from nine families were recorded, of which two species were listed in IUCN Red List, and six species were listed in Viet Nam's Red List. Five amphibian species from three families were recorded. The vascular plant flora of the site consists of all dominant mangrove species of Viet Nam. 22 plant species were recorded in Ong Trang Island. The most dominant plant communities are *Rhizophora* spp., *Kadelia* spp., and *Avicennia* spp.

3.2.2. Cultural and social values

Mui Ca Mau Wetland is important for supporting the small fishery industry, biodiversity conservation, dynamic landform stabilisation and coastal protection.

The wetland provides a series of products for the livelihoods of local people including medicine and food such as fishes and shrimps. In addition, the mangrove ecosystems of the site are tourist attractions for recreational purposes as well as for nature education.

3.3. Current Uses

Mui Ca Mau National Park has been divided into the following functional zones: 12,203 ha of strictly protected area (5,998 ha of forest land, 6,110 ha of tidal flats, 95 ha of other land), 2,859 ha of ecological rehabilitation area, 200 ha of administrative and service area; and 26,000 ha of marine protected area. There are 6,000 ha of natural mangrove and 44,291 ha of mangrove plantation in Ngoc Hien District (Vu Trung Tang, 2001). This area has been exploited for aquacultural expansion, timber and firewood exploitation and fisheries. The inland area was converted for cultivation of agricultural plants and industrial trees.

3.4. Threats

Mui Ca Mau National Park faces threats from aquacultural development, over-fishing, and over-

exploitation of natural resources. In addition, increasing population and economic development demands and illegal immigration have also contributed to changes in the ecological characteristics of the site in recent years.

At present, the site is also threatened by pollutants from the wastewater of agricultural activities in Ngoc Hien and neighbouring districts. With the recent flux of industrialisation and modernisation in Ca Mau Province, industrial pollution is posing new challenges for site conservation.

Illegal exploitation of natural resources, especially by destructive fishing methods such as dynamite fishing or the use of small-grid nets, has shown an increasing trend in recent years. The illegal hunting of waterbirds is still observed in the park. Although park managers have made many efforts for conservation of the site, a lack of manpower and other resources to prevent illegal activities means that conservation interventions have not been effective.

3.5. Solutions for Wetland Management and Conservation

3.5.1. Management institutions

The wetland is under the management of the District People's Councils of Ngoc Hien and Dat Mui, the Management Board of Mui Ca Mau National Park, and the Commune People's Councils of Dat Mui, Vien An (Ngoc Hien District), Dat Moi (Dat Mui District). Various provincial agencies manage specific activities in the site, including DARD, DONRE, DOFI, and the Department of Transportation. The Provincial Forest Protection Department is responsible for the management and protection of the mangrove forests in the site.

3.5.2. Conservation measures

a. Implemented measures: A number of environmental and natural resource management activities were proposed in the investment plan for the establishment, protection and development of the Mui Ca Mau National Park and in the project Protection and development of the coastal wetlands in the east of the Mekong Delta, Viet Nam. These activities include forest management and protection, forest rehabilitation on the mudflats, awareness-raising and education on forest and wetland ecosystems, boundary demarcation, setting up a signboard of the Park's

regulations, construction of observation towers and guard stations, provision of essential equipment, setting up the concrete fences at the ends of the main channels, and prevention of erosion in the East Sea.

b. Proposed measures: Proposed measures that have not yet been implemented include research and monitoring of wildlife populations, conservation research on marine species, policy setting for marine management and conservation, strengthening of management capacity, and training to increase the knowledge and skill sets of management.

c. Research implemented: Research and piloting of models for best aquacultural and reforestation practices have been conducted at the site. Many natural plant products were also studied and their uses tested.

4. Ba Be Lake

4.1. General Description

Ba Be Lake is a natural lake situated in a limestone area and created by karst tectonics. The lake is approximately 500 ha in area and located in Ba Be National Park, Ba Be District, Bac Kan Province. Ba Be Lake is surrounded by a series of limestone mountains elevated at 570-893 m above sea level. The lake is connected to Nang River by a stream that helps to regulate its water level. There are a number of limestone caves at the site, the most famous of which is the Puong Cave, where the Nang River flows through a limestone mountain.

4.2. Functions and Values

4.2.1. Biodiversity

The unique and important features of the fauna of the park are presented by the occurrences of the Francois Langur (*Semnopithecus francoisi*), Owston's Palm Civet (*Hemigalus owstoni*), and especially the Tonkin Snub-nosed Monkey (*Pithecus avunculus*), a primate species that was believed to be extinct before rediscovery in Na Hang Nature Reserve in 1992. In addition, one endemic and globally threatened amphibian species, the Vietnamese Salamander (*Paramesotriton deloustali*), was recorded in the south of the park.

The most notable plant species recorded in Ba Be National Park include *Annamocarya sinensis*, *Burretiodendron tonkinense* and *Calocedrus macrolepis*.

In Ba Be National Park and surrounding areas, 70 reptile and amphibian species have been recorded, eleven of which were ranked as globally threatened, including the Big-headed Turtle (*Platysternon megacephalum*), the Black-breasted Leaf Turtle (*Geoemyda spengleri*), the Keeled Box Turtle (*Pyxidea mouhoti*), the Chinese Soft-shell Turtle (*Pelodiscus sinensis*), and the Vietnamese Salamander (*Paramesotriton deloustali*). There are 370 bird species recorded for the site. The 94 mammal species recorded include eighteen species listed in the 2004 IUCN Red List of Globally Threatened Species. Ba Be is considered a natural lake that supports the most abundant fish fauna in Viet Nam. 87 fish species of 61 genera, 17 families and 5 orders have been recorded in the lake (Nguyen Trong Hiep, Nguyen Huu Duc, 2003).

4.2.2. Cultural and social values

a. Local population and ethnic minorities: The local population includes Tay people (inhabiting the riverbanks and lakesides and representing 44% of the population), H'mong people (inhabiting the mountainous areas and representing 54% of the population), and Dao, Nung and Kinh ethnic groups (representing 2% of the population). Each ethnic group has their own culture and farming practices. The Tay people often live in wooden stilt houses and they are experts in fishing and textiles. The H'mong people often practice shifting cultivation and are experts in wildlife hunting.

b. Agricultural production: Both paddy field and terrace rice farming are practiced in the area. The local average income is 298 kg rice per person per year. Terrace rice fields are mostly mono-crops, and other food plants are cultivated in the alluvial plains along the streams, rivers and lakesides. Due to frequent alluvial deposition, this area for secondary crops is also solely for mono-crops and provides low productivity.

c. Forestry production: From 1994-2001, 3,000 ha of forest land in the ecological rehabilitation zone were contracted to 592 local households for rehabilitation and plantations. This provided alternative livelihoods and income for local people, contributed to raising awareness on the

environment and nature conservation, and reduced human pressures on the core zone of the national park.

d. Animal husbandry: Animal husbandry has yet to be developed in the region. The major domestic animal species are cow, buffalo, goat, pig and chicken. Animals are kept in the traditional way with little attention paid to veterinary requirements, and the revenue from husbandry is therefore not high. Because of insufficient investment in animal husbandry, the growth rate of domestic animals is low and these animals are only for domestic use.

e. Tourism and trade: The community-based ecotourism model (in which tourists stay in the stilt houses of the Tay people) is effectively running. It is not only an alternative income source for local households but also helps to raise local awareness about environmental protection.

4.3. Current Uses

The national park has a total area of 10,048 ha, of which 7,303 ha is forest land (73% of total area, including 4,058 ha of undisturbed forests, 2,690 ha of disturbed forests and 555 ha of generating forests), 448 ha is agricultural land (4%), 120 ha are upland fields, and 506 ha are water surfaces.

During the ten years since national park establishment, the forest areas were protected and have gradually expanded. In particular, the total area of good forest has increased from 1,073 ha to 4,058 ha, including undisturbed forests and well-rehabilitated forests. However, there are 1,719 ha of bare land in the park in which suitable forestry measures for rehabilitation should be applied.

4.4. Threats

The main threats to biodiversity in the site are hunting, fishing, logging, forest clearance for shifting cultivation, increasing sedimentation in the lake (due to forest destruction in the river catchments), and insufficient enforcement of protected area regulations.

In recent years, national park rangers have investigated and prosecuted over 5,000 cases of illegal logging and hunting, and have confiscated hundreds of cubic metres of illegal wood and over 400 guns. In particular, in only the five first months of 2004, there were 100 violations, of which the

most common was the transportation of the illegal forest products (56 violations).

Every month, at least 1-2 incidences of dynamite or electric fishing in Ba Be Lake occur. Encroachment on forest land for cultivation is increasing every year.

The development of tourism services is unregulated and poses adverse impacts on the national park from an increasing number of motorboats on the lake, causing pollution and disturbances to wildlife populations.

4.5. Solutions for Wetland Management and Conservation

4.5.1. Management institutions

Ba Be National Park is under the management of the Bac Kan Provincial People's Committee via the Provincial DARD and DOFI.

4.5.2. Conservation measures

a. Forest management, protection and development

Organisation and management: The National Park Management Board was established and currently comprises a Directorate Board and functional divisions, Forest Protection Section and ten guard stations. Additional guard stations and sub-stations (guard boxes), such as Cao Thuong and Khuoi Luong Guard Stations and Khau Qua, Buoc Lom, Ban Tau, Ban Lom and Na Han Sub-Stations, have been established in hotspot areas of the park.

Protection: Boundary demarcation has been completed. 7,303 ha of forest of the park have been well protected (including 3,000 ha protected through forest protection contracts with local households). 1,443 ha of forested land were identified for rehabilitation. A 50-ha botanical garden was planted. The area of shifting cultivation was reduced from 1,553 ha in 1990 to 120 ha in 2003. Park managers are also assisting local communities to prepare village forest protection agreements.

b. Infrastructure development

Essential infrastructure of Ba Be National Park has been completed, including 1,175 m² of housing (offices, dormitories, guest houses, etc.), and about 70 km of internal and local roads in the buffer zone

communes. The Management Board is also relatively well equipped with two cars, three speedboats, fifteen motorbikes, computers and other office equipment.

c. Socio-economic stabilisation and development

Aware of the importance of reducing pressures from economic activities on the national park, a number of projects on socio-economic stabilisation and development have been implemented in the site in recent years. These projects have assisted park managers in infrastructure development, community-based ecotourism development, establishment of a Conservation Fund, and the moving of 74 households out of the core zone of the park and stabilising their livelihoods.

d. International programmes

The GEF/UNDP-funded *Creating Protected Areas for Resource Conservation using Landscape Ecology* project was the biggest internationally supported conservation project implemented in Ba Be National Park. Other international projects that were also implemented in the park included the Netherlands Government-funded project *Sustainable Use of Non-timber Forest Products*, a Helvetas-funded project that aimed to investigate and analyse the local institutional arrangements and environmental rights, and projects on the development policies and rural livelihood systems in Ba Be District, Bac Kan Province.

e. Proposed measures

Other measures that have been proposed but not yet implemented are to supplement and complete the essential infrastructure for the guard stations, to strengthen community participation in the conservation of the park, and to prepare the World Natural Heritage documents for Ba Be National Park to submit to UNESCO for its approval.

f. Scientific research

The first mammal surveys in the Ba Be Lake area were conducted by Dao Van Tien et al. beginning in 1963. To date, a number of studies on different aspects have been done for the site. They include a series of fauna and flora monographs compiled by the Hanoi National University, the Institute of Ecology and Biological Resources, and the Forest Inventory and Planning Institute that aimed to

contribute to the preparation of an investment plan for Ba Be National Park.

g. Education

Fifty teachers from local schools were trained in environmental education to enable them to teach the 3,141 pupils in their schools. In collaboration with the colleges of the Ministry of Agriculture and Rural Development, park managers held training courses on conservation and biodiversity monitoring skills for protected area managers.

A series of awareness-raising campaigns on forest protection and environment were organised for over 500 farmer households in Khang Ninh and Nam Mau Communes (Ba Be District, Bac Kan Province) and Da Vi Commune (Na Hang District, Tuyen Quang Province). Awareness-raising and environmental education materials were produced for visitors, school pupils and local people. A painting contest on the forest and environmental topics was organised with the participation of over 600 students.

5. Con Dao National Park

5.1. General Description

Con Dao National Park is located in Con Dao District, Ba Ria-Vung Tau Province, consisting of an archipelago with fourteen large and small islands. Con Son Island is the only inhabited island, with a population of approximately 4,000. Most island inhabitants practice coastal fishing, agriculture, small trade, and other services.

The Con Dao marine area is rich in marine biological resources with high biodiversity values and ecosystem diversity (including ecosystems of mangroves, seagrasses, tidal rock banks, tidal sandy flats, and coral reefs), and supports a number of endemic species to Viet Nam.

5.2. Functions and Values

5.2.1. Biodiversity

Con Dao National Park supports two main ecosystem types: terrestrial forest ecosystems and marine and coastal ecosystems. Recent surveys recorded 882 forest plant species, 144 forest animal species, and 1,300 marine species in Con Dao National Park. Based on data from Hai Phong's

Oceanography Institute, the coastal zone of the park supports 23 mangrove species, 127 algae species, 9 seagrass species, 157 phytoplankton species, 115 zooplankton species, 258 coral species, 130 polychaete species, 116 crustacean species, 187 mollusc species, 75 echinoderm species and 5 species of sea mammals and reptiles.

The mangrove ecosystems are well developed along the west coasts of Con Son, Hon Ba, Hon Bay Canh, Hon Tre Lon, and Hon Cau Islands, forming beautiful scenery on those islands. The dominant mangrove species include *Kandelia candel*, *Rhizophora apiculata*, and *Sonneratia ovata*. The mangrove ecosystems support a number of crustacean and mollusc species such as *Ocypoda ceratophthalma*, *Upogebia carcincauda*, *Thalamita crenata*, *Thalamita danae*, *Planaxis sulcatus*, *Cerithium echinatum*, *C. nodulosum*, and *C. asperum*.

The seagrass vegetation covers almost the entire bed of the Con Son Gulf and provides habitats for other marine species. Of them, the most famous is the Sea-cow (*Dugong dugong*), and other seagrass-dependent species including sea snails such as *Cerithidae cingulata*, *Architectonica perspectiva*, *Cerithium tenuifilosum*, and *Nassaruis goudiosus*, and bivalves such as *Paphia malabarica*, *Mactra violacea*, *Asaphis violascens*, and *Gafrarium pectinatum*.

5.2.2. Cultural and social values

The Con Son archipelago in general and Con Dao National Park in particular is a marine area of many historical, cultural and social values.

The historical relics of the site, including the prison and "tiger cages" (called '*chuong cop*') that were once used for the incarceration and torture of the revolutionaries and patriots who struggled for nation's independence in the Viet Nam Wars, were gazetted as national historical monuments by the Ministry of Information and Culture. The Hang Duong Cemetery where thousands of revolutionaries and patriots were buried was also gazetted as a national historical monument.

5.3. Current Uses

Con Dao National Park has a total area of 19,998 ha consisting of 5,998 ha of inland protected areas and 14,000 ha of marine protected areas. The park is divided into the following functional zones:

a. Inland strictly protected area (5,446 ha): Main objectives are to strictly protect the forest plant and

animal resources, and to ensure the natural growth of forest ecosystems without human intervention.

b. Inland ecological rehabilitation area (500 ha): Main objectives are to rehabilitate the forest plant and animal resources and forest ecosystems using suitable technical forestry measures and nature conservation interventions.

c. Marine species protection area (14,000 ha): Main objectives are to protect the coastal and marine ecosystems, to conserve the marine biological resources, especially the threatened species, and to conserve the wetlands around the islands.

d. Inland administrative and service area (52 ha): The headquarters and essential infrastructure serving the national park's management and operation, tourism services and community education are housed within this area.

5.4. Threats

The wetland ecosystems of the site are under threat from fishing and tourism activities, pressure from population increases, infrastructure development and danger of forest fires.

A number of boats from other areas enter the site for fishing and shelter from the strong winds and storms, posing a severe risk to the safety of the marine ecosystems in Con Dao. The increase in population and number of tourists are also potential obstacles to marine resources management efforts.

5.5. Solutions for Wetland Management and Conservation

5.5.1. Management institutions

Con Dao National Park is under the management of the Ba Ria-Vung Tau Provincial People's Committee and its agencies including DARD, the Sub-Department of Forest Protection, DONRE, DOFI, the Department of Investment and Planning, the Department of Finance, and other relevant authorities.

5.5.2. Conservation measures

a. Implemented measures

Functional zoning plans to manage the marine biological resources define the locations of different activities. At each location, the level and methods of marine product exploitation are regulated, and restrictions and penalties for

violation have been announced. Maps and documents on the park's natural resources have been distributed to local authorities and fishermen, and training courses were held for disseminating park regulations.

Park rangers conduct intensive patrolling activities to investigate and respond to violations on the park's forest and marine resources.

An environmental interpretation centre was established to introduce the park's forest and marine resources, the endemic and threatened species present, and the park regulations. A signboard system was set up in public areas to disseminate the importance of protected areas to the public.

An investment plan for ecotourism development in association with protection of forest and marine resources was prepared. This plan was assessed by the Ministry of Agriculture and Rural Development and approved by the Chairman of the Ba Ria-Vung Tau Provincial People's Committee for implementation.

b. Proposed measures

Several measures on marine species and wetlands conservation have been approved, but have not yet been implemented, including boundary demarcation for the marine species protection areas, annual monitoring of marine species status (with a focus on coastal wetlands and threatened and endemic species), and establishment of the national park's Fishery Protection Division which will be in charge of patrolling and will have a jurisdiction over the punishment for violations of relevant laws.

c. Scientific research

Several scientific research projects were implemented by the Con Dao National Park Management Board with financial support from the government and international organisations. For instance, a scientific research project on forest resources rehabilitation focused on the *Chukrasia tabularis* population, a national red-listed plant species that was severely depleted during Typhoon Linda in 1997, and a WWF-funded project focused on research and conservation of the sea turtle species, and on conservation planning and marine resources management.

Through these projects, essential equipment for marine research was provided to the National Park Management Board, including diving and underwater survey equipment and speedboats.

d. Conservation education

The following conservation education activities have been implemented by the Con Dao National Park Management Board:

- Establishment of an environmental interpretation centre to introduce the park's forest and marine resources, its endemic and threatened species, and park regulations to local people and visitors.
- Production and dissemination of materials to introduce Con Dao National Park to local people, school pupils, local authorities and visitors to raise their awareness and knowledge of the conservation of the park's natural resources.
- Establishment of a signboard system in public areas such as the district centre, harbours, and airport to disseminate the importance of protected areas to the public.

Appendix E:

Economic Valuation of Selected Wetlands in Viet Nam

(Nguyen Huu Ninh, Mai Trong Nhuan et al., 2003)

1. Economic Valuation of Bach Dang River Mouth

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
	Direct values				
1	Wood	65,840	4.30	74,500	4.87
2	Firewood	28,000	1.83	32,500	2.12
	Indirect values				
1	Aquaculture	5,625,000	367.65	6,432,000	420.39
2	Marine benefits**	850,000	55.56	1,150,000	75.16
3	Medicinal plants	n/a	n/a	n/a	n/a
4	Tourism	12,400	0.81	15,600	1.02
	Environmental values				
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
	Total economic value /ha	6,581,240	430.15	7,704,600	503.57

2. Economic Valuation of Van Uc Estuary

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	85,250	5.57	92,450	6.04
2	Firewood	46,500	3.04	52,400	3.42
Indirect values					
1	Aquaculture	8,530,000	557.52	9,520,000	622.22
2	Marine benefits**	1,564,000	102.22	1,645,000	107.52
3	Medicinal plants	14,200	0.93	15,600	1.02
4	Tourism	9,800	0.64	11,200	0.73
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
Total economic value /ha		10,249,750	669.92	11,336,650	740.96

3. Economic Valuation of Ba Lat Estuary

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	103,620	6.77	108,200	7.07
2	Firewood	82,500	5.39	86,400	5.65
Indirect values					
1	Aquaculture	13,500,000	882.35	15,000,000	980.39
2	Marine benefits**	2,640,000	172.55	2,860,000	186.93
3	Honey	112,000	7.32	132,000	8.63
4	Medicinal plants	15,600	1.02	18,500	1.21
5	Tourism	12,000	0.78	15,000	0.98
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	15,100,000	986.93	16,400,000	1,071.90
Total economic value /ha		31,565,720	2063.12	34,620,100	2,262.75

4. Economic Valuation of Day Estuary (Kim Son)

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	105,200	6.88	112,400	7.35
2	Firewood	74,500	4.87	80,420	5.26
Indirect values					
1	Aquaculture	10,560,000	690.20	11,260,000	735.95
2	Marine benefits**	1,256,000	82.09	1,450,000	94.77
3	Medicinal plants	12,500	0.82	13,500	0.88
4	Tourism	14,500	0.95	16,400	1.07
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
Total economic value /ha		12,022,700	785.80	12,932,720	845.28

5. Economic Valuation of Tam Giang-Cau Hai Lagoon

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	n/a	n/a	n/a	n/a
2	Firewood	n/a	n/a	n/a	n/a
Indirect values					
1	Aquaculture	16,850,000	1101.31	18,450,000	1,205.88
2	Marine benefits**	14,260,000	932.03	16,740,000	1,094.12
3	Medicinal plants	n/a	n/a	n/a	n/a
4	Tourism	15,200	0.99	18,500	1.21
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
Total economic value /ha		31,125,200	2,034.33	35,208,500	2301.21

6. Economic Valuation of Thi Nai Lagoon

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	n/a	n/a	n/a	n/a
2	Firewood	n/a	n/a	n/a	n/a
Indirect values					
1	Aquaculture	8,452,000	552.42	10,520,000	687.58
2	Organised fishing	5,200,000	339.87	6,345,000	414.71
3	Marine benefits**	n/a	n/a	n/a	n/a
4	Tourism	16,450	1.08	17,500	1.14
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
Total economic value /ha		13,668,450	893.36	16,882,500	1,103.43

7. Economic Valuation of Tien River Mouth

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
Direct values					
1	Wood	145,600	9.52	158,200	10.34
2	Firewood	86,500	5.65	92,000	6.01
3	Coal	n/a	n/a	n/a	n/a
Indirect values					
1	Aquaculture	2,145,000	1,401.96	2,248,000	1,469.28
2	Organised fishing	16,500,000	1,078.43	18,200,000	1,189.54
3	Marine benefits**	4,850,000	316.99	6,270,000	409.80
4	Tourism	160,000	10.46	220,000	14.38
Environmental values					
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
Total economic value /ha		43,192,100	2,823.01	47,420,200	3,099.36

8. Economic Valuation of Southwest Ca Mau Tidal Flat

	Values	Estimated low value		Estimated high value	
		VND	USD	VND	USD
	Direct values				
1	Wood	123,500	8.07	138,800	9.07
2	Firewood	124,300	8.12	145,000	9.48
3	Coal	56,200	3.67	75,000	4.90
	Indirect values				
1	Aquaculture	19,394,000	1,267.58	22,459,000	1467.91
2	Organised fishing	28,485,000	1,861.76	32,031,000	2093.53
3	Marine benefits**	9,495,000	620.59	12,677,000	828.56
4	Tourism	2,456,000	160.52	2,761,000	180.46
	Environmental values				
1	Microclimate stabilisation, atmosphere and water improvement, high water mark restriction	n/a	n/a	n/a	n/a
	Total economic value /ha	60,134,000	3,930.33	70,286,800	4,593.91

Notes:

** Households carry out unorganised aquaculture seasonally.

(+) TEV (Total economic value) is calculated based on the total area of the specific wetland;

n/a: data is not available.

Appendix F:

List of selected legal documents related to wetlands

Legal documents related to the use of wetlands

Document	Main contents
Decision No. 97-HDBT of the Council of Ministers, 29/05/1982	To assign organisations and individuals to the use of wetlands for aquaculture and fishery exploitation and protection. Organisations and individuals who use waterbodies must be registered with relevant authorities. Organisations and individuals are encouraged to use water bodies effectively.
Decree No. 30-HDBT of the Council of Ministers, 23/03/1989	Article 23: Regulations on the uses of bare lands.
Inter-ministerial Circular No. 5-TT/LB, 18/12/1991	Guidelines for the management and utilisation of waterbodies for aquaculture.
Inter-ministerial Circular No. 5-TT/LB, 18/12/1991	Guidelines for the management and utilisation of waterbodies for aquaculture.
Government Decree No. 64-CP, 27/09/1993	Regulations on long term allocations of agricultural land to households and individuals for agriculture, forestry and aquaculture.
Land Law, 15/10/1993	Article 47: Regulations on the uses of interior waterbodies for aquaculture, fisheries and other purposes. Article 48: Regulations on the uses of coastal waterbodies for agriculture, forestry, and aquaculture.
Government Decree No. 90-CP, 17/08/1994	Regulations on compensation for reclamation of land by the State for the purpose of defense, security, or national and public benefits.
Prime Ministerial Decision No. 773-TTg, 21/12/1994	Programme on the exploitation and utilisation of uncultivated land, alluvial deposits, and waterbodies in plains and basins.
Government Decree No. 01/CP, 04/1995	Regulations on land allocation for state enterprises for agriculture, forestry, and aquaculture.
Government Decree No. 22/1998/ND-CP	Article 9: Regulations on compensation for damages where agriculture lands, forestry lands, salt-made lands, and aquaculture lands are recovered by the Government. Article 23: Compensation for agricultural losses.

Document	Main contents
Official Letter No. 1558/DC-DDBD, 13/10/1999	On agriculture land statistics, including water bodies for aquaculture. Statistics should be carried out separately for waterbodies for aquaculture and for waterbodies for other purposes.
Prime Ministerial Decision No. 224/1999/QD-TTg, 08/12/1999	Policies on the uses of land and waterbodies for aquaculture. Allocations or leases of planned lands, waterbodies, bays, lagoons and reservoirs to sectors for aquaculture purposes. Transformation of salt-lands, low-lying fields, and waterlogged lands for aquaculture purposes.
Resolution No. 03/2000/NQ-CP, 02/02/2000	Long-term State policies on the farm economy in which the State strongly encourages investment in and effective use of bare lands on midland, mountain, border, and island areas and to make use of bare lands, ponds, lakes, lagoons, and alluvial grounds for extensive agriculture, forestry and aquaculture.
Ordinance on Aquaculture Protection and Development	Article 4: State agencies, societies, organisations, and individuals are allowed to exploit natural fisheries in accordance with this Ordinance.
Law on Environmental Protection	Article 11: The State encourages and promotes organisations and individuals in the use and reasonable exploitation of environmental components. Article 15: Application of methods to restrict and prevent erosion, landslides, soil salination and alkination, unplanned desalination, laterisation and desertification.

Legal documents on wetlands management and conservation

Document	Main contents
Decision No. 97-HDBT of the Council of Ministers, 29/05/1982	Every type of waterbody, including ponds, lakes, rivers, canals, and bays, belongs to the people and is managed by the State. Promotes education and encourages organisations and individuals to protect aquaculture and habitats for aquaculture species.
Directive No. 169-CT of the Chairman of the Council of Ministers, 18/05/1992	Implementation of urgent measures to protect <i>Grus antigone</i> and wetland biodiversity in the Plain of Reeds.
Land Law, 15/10/1993	Article 50: The management and use of inshore alluvial lands is regulated by the Government. Article 71: The State allocates waterbodies to suitable households and individuals according to the identified utilisation purposes. The Government regulates the management and utilisation schemes of these areas.
Law on Land Use Taxes, 10/07/1993, and the accompanying Decree No. 74-CP, 25/10/1993	Article 2: Waterbodies for aquaculture are subject to agricultural taxes. Article 7: Agricultural and aquacultural lands are divided into six categories. Article 9: Annually imposed tariffs are calculated by kilogram of rice per hectare for each land category, including land with waterbodies for aquaculture. Article 19: Tax exemption for newly exploited land in mountainous regions, marshes, and land reclaimed from the sea for seven years. Marshes and land reclaimed from the sea will be exempted for an additional six years.

Government Decree No. 80/CP, 06/11/1993	<p>Defining cost norms for each land category for:</p> <ul style="list-style-type: none"> • Tax on the transfer of land use rights • Money collection when there is a change in land use rights • Land rental • Value of assets within the property • Compensation for land reclamation, including reclamation of land with waterbodies for aquaculture
Government Decree No. 175-CP, 18/10/1994	<p>Article 21: The uses and exploitation of national parks, nature reserves, and historical and cultural monuments require approval from relevant authorities.</p> <p>Article 35: Financial support is provided for conservation and restoration projects for those ecosystems that are of importance for the long-term social-economic development and maintenance of biodiversity.</p>
Prime Ministerial Decision No. 845/TTg, 22/12/1995	<p>Protection of unique ecosystems of Viet Nam, as well as fragile ecosystems that have either been reduced in area or destroyed as a result of economic activities. Protection of those components of biodiversity that are threatened or depleted. The identification and promotion of values and uses of biodiversity for the benefit of sustainable use of natural resources and national economic development objectives.</p>
Prime Ministerial Directive No. 359/TTG, 29/05/1996	<p>Introduction of urgent measures to protect and develop wild animal populations.</p>
Government Decree No. 46/CP, 29/04/1997	<p>Article 7: Aquacultural co-operatives are obliged to manage and use lands and waterbodies allocated by the State in accordance with the law.</p>
Government Decree No. 14/1998/ND-CP, 06/03/1998	<p>Regulations on the management of lands and other natural resources.</p>
Prime Ministerial Decision No. 253/1998/QD-TTg, 29/12/1998	<p>Upgrading Tram Chim Wetland Nature Reserve (Dong Thap Province) to the status of National Park and approving the Investment Plan for Tram Chim for the period 1999-2003.</p>
Prime Ministerial Decision No. 1026 /QD-TTg, 13/11/1998	<p>Approval of the investment plan for the establishment of Thanh Phu Wetland Nature Reserve (Thanh Phu District, Ben Tre Province). Main objectives of this nature reserve are to protect the biodiversity of the wetland ecosystem, to preserve typical coastal wetland habitats, and to provide nutrients and habitats for aquatic species. Creation of coastal protection forests to uphold the role of environmental protection, erosion control and to promote coastal deposition.</p>
Criminal Code No. 5/1999/QH10, 21/12/1999	<p>Articles 182-191: Regulation of crimes and penalties for environmental violations (destruction of aquaculture, deforestation, violations of wild animal protection law, violations in protected areas).</p>
Government Decree No. 38/2000/ND-CP, 23/08/2000	<p>Article 6: Regulations on payments for transformation of land use purposes. 40% of the value of the used land will be paid by individuals and households when transforming land from agricultural land, forestry land, water surface land for aquaculture, or salt marshes into residential land according to approved plans.</p>
Decision No. 189/2000/QD-BTC, 24/11/2000	<p>Regulations on land, water surface, and sea surface rental applied to foreign investors in Viet Nam, including definition of the unit price of land with water surfaces for aquaculture.</p>
Decision No. 24/2001/QD-TTg, 01/03/2001	<p>Provides an inventory of the total area of all land types including wetlands (land with water surfaces for aquaculture or to be used for other purposes, including rice and other crop cultivation).</p>

Prime Ministerial Decision No. 08/2001/QD-TTg, 11/01/2001	Regulations on the management of special-use, protection and production forests. According to this regulation, forest is defined as natural forests on forestry land, comprising plants, animals and other natural elements related to forestry (mountains, rivers, lagoons, wetlands, etc.).
Prime Ministerial Decision No. 11/2002/QD-TTg, 14/01/2002	Upgrading U Minh Thuong (Kien Giang Province) Nature Reserve to National Park status. The main purposes of this National Park are to preserve a unique ecosystem type (alkaline cajuput forest on peat land), to preserve the biodiversity of the wetland ecosystem, and particularly rare wild animals and eight bird species that are of global importance.
Prime Ministerial Decision No. 13/2002/QD-TTg, 14/01/2002	Assigning the Can Tho People's Committee to directly manage Lung Ngoc Hoang Nature Reserve to promote the sustainable use and exploitation of natural resources of wetlands and to maintain the ecological balance and increase forest cover, ensuring environmental security and development of the Mekong Delta.
Ordinance on Fisheries Protection and Development	<p>Article 2: The State manages aquaculture benefits and living environments. Aquaculture living environments include water area, wetland surface and the land where aquaculture species live.</p> <p>Article 3: The protection and development of aquaculture is associated with the protection of the natural environment.</p> <p>Article 5: Strictly forbids activities that may destroy the benefits, living environment, protection and development of aquaculture.</p> <p>Articles 8, 9: Strictly forbids extermination activities, exploitative activities in the spawning seasons, and other similarly destructive activities.</p>
Law on Environmental Protection	Article 12: Organisations and individuals are responsible for the protection of plants, wild animals, biodiversity, forests, seas and ecosystems.

