

# Wetlands Management in Vietnam: Issues and Perspectives

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# Wetlands Management in Vietnam: Issues and Perspectives



## **Wetlands Management in Vietnam: Issues and Perspectives**

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## Acronyms

5MHRP	5 Million Hectares Reafforestation Programme
ADB	Asian Development Bank
AFTA	Asian Free Trade Agreement
AREA	Association for Research and Environmental Aid
ASS	acid sulfate soil(s)
CPCP	Cc Phuong Conservation Project
CRES	Centre for Natural Resources and Environmental Studies
Danida	Danish International Development Assistance
DARD	Department of Agriculture and Rural Development
DDFE	Don Duong Forest Enterprise
EBA	Endemic Bird Area
EPRC	Endangered Primate Rescue Centre
FFI	Fauna and Flora International
FINNIDA	Finnish International Development Assistance
FiPD	Fisheries Protection Department
FIPI	Forest Inventory and Planning Institute
FPD	Forest Protection Department
FPRDP	Forest Protection and Rural Development Project
FREC	Forest Resources and Environment Centre
GDP	gross domestic product
GEF	Global Environment Facility
HNU	Hanoi National University
ICF	International Crane Foundation
IDRC	International Development Research Center
IEBR	Institute of Ecology and Biological Resources
IUCN	World Conservation Union
JICA	Japan International Cooperation Agency
KNCCN	Korean National Council for Conservation of Nature
MAB	Man and the Biosphere
MARD	Ministry of Agriculture and Rural Development
MCIA	Ministry of Cultural and Information Affairs
MERD	Mangrove Ecosystem Research Division
MOF	Ministry of Forestry (now incorporated within the MARD)
MOF	Ministry of Fisheries
MOSTE	Ministry of Science, Technology and the Environment
MPA	Marine Protected Area
MRC	Mekong River Commission
NEA	National Environment Agency
NEZ	New Economic Zone
NGO	Non-governmental organization
NIAPP	National Institute of Agricultural Planning and Projection
NTFP	Non-timber forest product
PAM	Protected Area Management
PARC	Creating Protected Areas for Resource Conservation Using Landscape Ecology
PC	People's Committee
PEM	Participatory Extension Methodology
REPSI	Resources Policy Support Initiative
RIA	Research Institute for Aquaculture

SDC	Swiss Agency for Development and Cooperation
SFNC	Social Forestry and Nature Conservation in Nghe An Province
Sida	Swedish International Development Cooperation Agency
SNV	Netherlands Development Organization
SWOT	Strengths, Weakness, Opportunities and Threats
UAF	University of Agriculture and Forestry
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VEEM	Sustainable Economic Development in Vietnam
VND	Vietnamese Dong
VNMC	Vietnam National Mekong Committee
VNNEAP	Vietnam National Environmental Action Plan
WRI	World Resources Institute
WRPM	Water Resources Planning and Management
WWF	World Wide Fund for Nature

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# FOREWORD

In the recently concluded *Fish for All* Summit at the WorldFish Center headquarters in Penang, Malaysia, the importance of fish to food security, sustainable livelihoods, poverty eradication and achievement of social equity was highlighted. Experts agreed that such importance should be reflected in national development plans and policies, multilateral environment agreements, environmental and development assessments, and trade regimes. Regionally, attention was brought to bear on important and vulnerable ecosystems such as coral reefs, lakes, small water-bodies, floodplains, and estuaries. Governments and civil society in both developing and developed countries were enjoined to do their share in ensuring that these ecosystems are properly managed, their fisheries sustained, and access to fisheries resources is available, especially for those living in the margins of society - economically and socially. The Mekong Delta is one such area where there are immense challenges in the use and management of fisheries and other natural resources.

The WorldFish Center has considered the Delta, along with the whole stretch of the mighty Mekong River, as an important region and a repository of valuable resources that should be managed properly so that those who live and toil within its bounds will reap their just share. WorldFish has carried out several projects responding to and anticipating different fisheries and social and economic concerns in the region. The project to which this volume refers is one of them. We will continue to work with governments, NARS, donors and NGOs in the region to achieve fisheries and environmental sustainability.

The chapters in this volume are written largely by Vietnamese wetlands experts concerned with the state of their wetlands. They are members of the academe and the government who are doing relevant research and management interventions. Their efforts deserve the support of other agencies and international organizations. By providing a vehicle for sharing of information and networking, it is hoped that this volume will contribute a small step towards these noble intentions.

Meryl J. Williams

# INTRODUCTION

Wetlands are places of transition: places where water and forest, fishery and farm meet and often overlap. In Vietnam, wetlands directly provide a source of livelihood for millions, and provide environmental services—from flood control to water purification to biodiversity conservation—that indirectly support the broader economy. Yet, the health of wetlands ecosystems is under threat. In the Mekong Delta, the most immediate threats stem from efforts to intensify rice production and expand shrimp aquaculture, driven by new market opportunities, by the local demands of a growing population, and, in many cases, by poverty and lack of alternative livelihoods.

The transitional nature of wetlands means that they defy conventional, sectoral approaches to natural resources management. In Vietnam, no single agency has a mandate to manage the country's wetlands. Rights to their use and access are divided among state, private sector, and community actors, in complex arrangements that often vary by season and by the specific resource at hand. Some areas have official protected status, but the vast majority do not. Arresting the decline in wetlands ecosystems requires cooperation among a wide range of stakeholders from national to village levels. Yet, the mechanisms needed to balance competing objectives, to establish appropriate incentives and to build capacity for sustainable management are in most cases sorely lacking.

What are the underlying trends responsible for the transformation of wetlands ecosystems in Vietnam? Who is affected? And, most urgently, what can be done? This volume compiles and presents side by side the perspectives of many of the researchers and officials at national and provincial levels who are at the forefront of addressing these questions. It includes reviews of the legal and institutional framework, explanations of specific policy initiatives, case studies from the Mekong Delta region, and a host of ideas for meeting the many challenges at hand.

The papers included in this volume are drawn from workshops organized by the WorldFish Center in March 1999 and November 2000, which laid the groundwork for the ongoing project, “Legal-Institutional Framework and Economic Valuation of Environment and Resources in the Mekong River Region: A Wetlands Approach.” The project is funded by the Swedish International Development Cooperation Agency (Sida), and implemented by a network of regional and national partners in the four countries of the Lower Mekong Basin. Apart from the contributions by Torell and Salamanca, Duong Van Ni et al., and Hoang Huu Cai, these papers were written in Vietnamese and translated into English by the faculty of the College of Fisheries at the University of Agriculture and Forestry (Nong Lam) in Ho Chi Minh City.

Blake D. Ratner  
Project Leader

# Wetlands Management in Vietnam's Mekong Delta: An Overview of the Pressures and Responses

Magnus Torell and Albert M. Salamanca

## Abstract

This paper introduces the characteristics of the Delta and outlines the pressures that are impinging on the sustainability of the Delta's wetlands. Although these pressures are non-linear and interacting, three are considered prominent. These pressures stem largely from rice production and the associated large-scale water control infrastructures, shrimp aquaculture, and the inadequacy of the current institutional arrangements. Responses to these pressures are discussed noting the diverse interventions made in the past and the present. Moreover, key points raised by authors in the succeeding chapters in this volume are highlighted and a short description of the WorldFish Center project is provided.

## Introduction

Just before the Mekong River meets the South China Sea through its nine branches, it forms a huge and very productive delta known in Vietnam as Cuu Long Delta but more popularly referred to as the Mekong Delta. The whole Mekong Delta<sup>1</sup> is known to be “the hearth of one of the earliest civilizations in mainland Southeast Asia” where the legendary “Funan” is thought to be located (Fox and Ledgerwood 1999). It is also one of Asia's largest deltas (Van Lap Nguyen et al. 2000). 71% of the delta lies in Vietnam while the rest is in Cambodia. In Vietnam, it covers 11 provinces and an area<sup>2</sup> of around 3.9 million ha. Although representing only 12 % of the country's total land area, it is the most important food-producing region in the country (Chu Thai Hoanh and Thai Dinh Khang 1993; Bui Chi Buu et al. 1995; Van Lap Nguyen et al. 2000). Vietnam's Mekong Delta is home to 16.9 million people with an average annual population growth of 2.2% (Duong Van Ni et al. this volume).

The landscape in the delta is defined by its soil type and hydrology (Chu Thai Hoanh and Thai Dinh Khang 1993; Cantho University 1997; Rothuis 1998). There are 3 main types of soil in the delta (i.e. alluvial, acid sulfate, and saline) and 9 agro-ecological zones (Table 1). Alluvial soils, usually located along main rivers, cover 31% of the total area in the delta and are agriculturally productive. Acid sulfate soils (ASS)<sup>3</sup> are highly acidic and have low fertility. This type of soil covers around 41% of the delta. About 19% of soils in the delta are saline soils due to salt-water intrusion from December to May (i.e. dry season) when the water table is low, rainfall is less and the tidal regimes from the Gulf of Thailand and the South China Sea push saltwater upstream (Chu Thai Hoanh and Thai Dinh Khang 1993; Le Dien Duc 2001). Most saline soils are located along coastal areas and have limited uses (Rothuis 1998). Strong acid sulfate soils are located in the Plain of Reeds (Dong Thap Muoi), Long Xuyen Quadrangle, and Ca Mau Peninsula while saline soils are located along a narrow fringe in the coastal areas of Long An, Tien Giang, Ben Tre, Tra Vinh, Soc Trang, and Minh Hai Provinces (Bui Chi Buu et al. 1995).

1 Unless otherwise stated, any reference to Mekong Delta or the delta in general in this paper refers to the Vietnamese Mekong Delta.

2 The total area of the delta is 5.5 million ha. The rest is located in Cambodia (Van Lap Nguyen et al. 2000).

3 ASS are characterized by their potential to develop high levels of acidity upon exposure to oxygen. Acid is released from the oxidation of the iron sulphide, pyrite (FeS<sub>2</sub>). When it is inert, it is called potential ASS. They become actual ASS when potential ASS is exposed to oxygen through various natural or anthropogenic processes (Hashimoto 2001).

**Table 1. Agro-ecological zones in the Mekong Delta (Adapted from NIAPP 1993 in Bui Chi Buu et al. 1995)**

Zone	Description	Area ('000 ha)
1	Alluvial soils: areas with freshwater	1 200
2	High coastal plain: includes alluvial and acid sulfate soils with saltwater intrusion in the dry season	669
3	Low coastal plain (Ca Mau Peninsula): includes potential acid sulfate soils (sulfaquents or sulfaquepts) and is affected by tidal flood and heavy rain, poorly drained, saltwater intrusion	684
4	U Minh forest (peat soils): largely growing <i>Melalueca</i>	195
5	Tidal coastal plain: includes swampy tidal areas from Long An to Minh Hai growing mangrove forests	216
6	Dong Thap Muoi flooded area: includes large areas of acid sulfate soils (sulfaquepts), deeply flooded from August to November	496
7	Old alluvium area: in Long An and Dong Thap Muoi provinces along the border between Viet Nam and Cambodia	123
8	Ha Tien lowland area: acid sulfate soils, some saltwater intrusion, high organic matter, flooding in rainy season, well drained	218
9	That Son mountain area	42
	<b>Total</b>	<b>3 843</b>

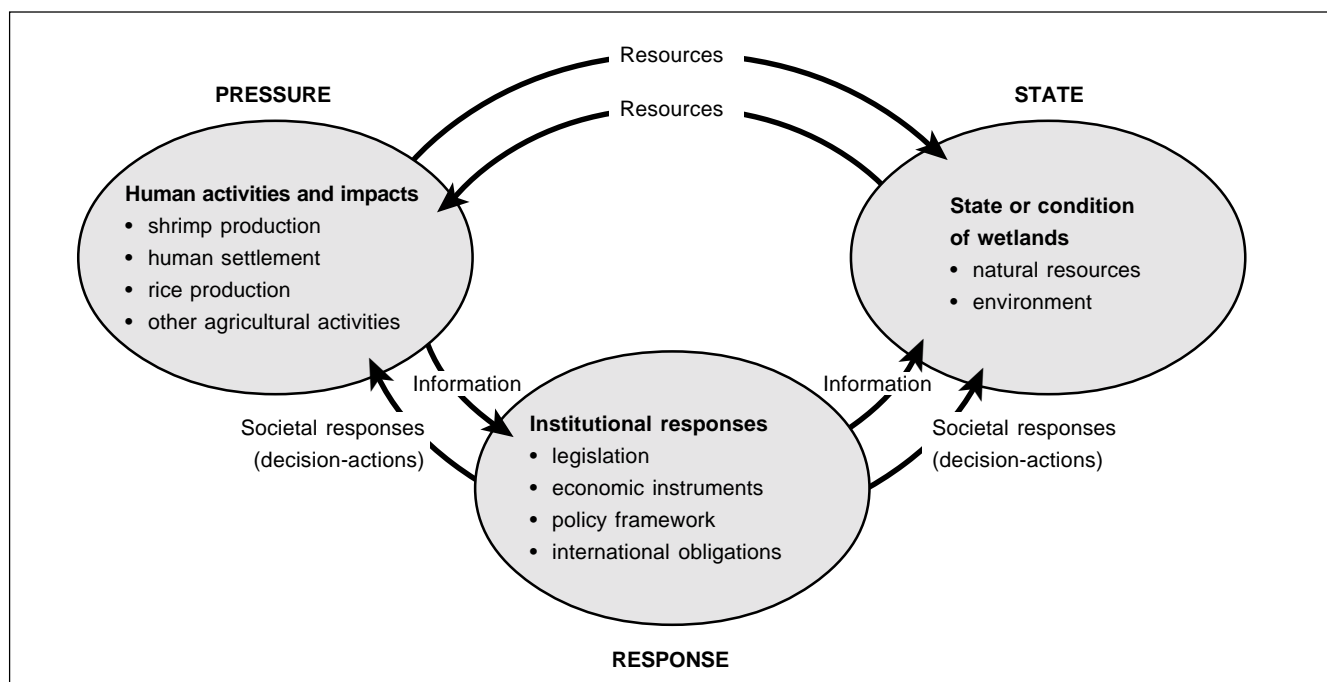
Hydrology defines the vegetation in the delta and local rainfall, river discharge and tidal fluctuations affect the water regimes (Chu Thai Hoanh and Thai Dinh Khang 1993; Rothuis 1998). During August to November, flooding occurs due to high rainfall and overflow of the Mekong River System (Van Lap Nguyen et al. 2000). Tons of sediments are deposited on floodplains during flooding contributing to soil fertility (Rothuis 1998). Although there are regional variations in annual precipitation in the delta, it is generally high. The western part has around 2 400 mm, the central part has 1 300 mm, and the eastern part has 1 600 mm (Bui Chi Buu et al. 1995).

Several factors determine the geological formation in the delta including flooding from the Mekong River system, which brings sediments downstream to the South China Sea, monsoon regimes which affect depositional processes and movement of suspended sediments, tidal regimes which transport sediments onshore, and neo-tectonic movements which lead to uplifts or depression of land masses. Each of these factors interacts in various ways to produce the varied landscape in the delta. The Mekong Delta can be divided into 5 areas based on geological structures and surface landscape features especially the nature of its sediments. These are the Plain of Reeds,

located on the northern bank of the Mekong River and having one of the lowest depressions in the hinterland; the Long Xuyen Quadrangle, on the northwestern bank of the Bassac River; the Central Area, in the central part of the Mekong Delta; the Eastern Coastal Area, a broad coastal plain running from Go Cong, Ben Tre, Cuu Long, Soc Trang and Bac Lieu; and Ca Mau Peninsula, on the southwestern part of the Mekong Delta (Van Lap Nguyen et al. 2000).

The Plain of Reeds is occupied by swamp deposits about 0.5 to 1.0 m high above present sea level (a.p.s.l.). In Long Xuyen Quadrangle, lowland swamp deposits occupy the western part and hills and mountains, made of basement rocks, are formed in the north with elevations of 50 to 716 m a.p.s.l. Fluvial deposits are predominant in the Central Area including channel, bank and flood basin deposits. The sediments in the Eastern Coastal Area are composed mainly of coastal plain deposits especially in areas 2.0-2.5 m a.p.s.l. In areas between 0.5-1.0 m a.p.s.l, mangrove and salt marsh deposits are found. In Ca Mau Peninsula, coastal plain deposits are found at elevations of 2.0 m a.p.s.l and marshy deposits in 1.0 m a.p.s.l. Mangrove forest, 90 km long and 25 km wide, is found on the southern part of the peninsula (Van Lap Nguyen et al. 2000).

**Figure 1. Pressure-State-Response Framework**



Based on human settlements, agriculture, land use and the type of natural resources, there are 3 main types of ecosystems in the Delta: (1) towns and cities including privately owned lands, (2) agricultural lands and (3) natural or semi-natural wetlands. Town and cities cover only 7% of the total land area. Agricultural lands constitute 83% of the area and hold 70% of the population while urban areas occupy 10% of the area and hold 30% of the population (Duong Van Ni et al. this volume).

### Pressure-State-Response Framework

As a way of arraying all the available relevant information on wetlands in the delta into a coherent and logical picture, a framework is needed. In this publication, the pressure-state-response framework is used.

This framework offers a way of understanding the relationships of 3 sets of information: pressure, state and responses. It is a popular framework for reporting environmental indicators and the state of the environment (Dumanski and Pieri 1997; Cockburn Sound Management Council 2001; Kammerbauer et al. 2001). In this framework, pressures (“why is it happening?”) leading to a certain state (“what is

happening?”) are identified together with the responses (“what is being done about it?”). This framework shows the causal relationships and linkages among sets of information. The responses refer to the institutional and policy improvements designed to remedy, reduce or mitigate changes brought about by the pressures and to thus improve the state. Pressures, on the other hand, refer to the set of human activities or institutions that bear on wetland environments while state is the condition of the wetlands and its resources as affected by the pressures.

### State of the Wetlands Environment in the Mekong Delta

With an extensive land area and a dynamic hydrology, it is expected that wetlands would be the prominent feature in the delta’s landscape. Vietnam’s total wetland area is several times bigger than other countries in the Lower Mekong Basin such as Laos or Thailand (Dubois 2000). The different types of wetland -one of the major ecosystems in the delta (Duong Van Ni et al. this volume) – vary depending on the classification use. Existing wetland classification in Vietnam describes wetlands in terms of land use as shown in Table 2. These types can be broadly collapsed into 2 categories: inland and coastal wetlands. Inland wetlands are dominated by



**Table 2. GIS analysis of changes in different land use types in the Mekong Delta between 1993 and 1995 (Adapted from Nguyen Van Nhan 1997)**

	<b>Wetland Unit</b>	<b>1993 (ha)</b>	<b>1995 (ha)</b>	<b>% Change</b>
1	Bare Marine Sub-tidal	857 070	850,607	0
2	Coastal Mudflat	6 451	12 318	+91
3	Coastal Aquaculture	53 357	138 264	+159
4	Coastal Mangrove Plantation	78 660	26 986	-66
5	Coastal Salt Marsh	53 437	4 803	-91
6	Coastal Non-tidal Multiple Rainfed Wet Rice	29 567	70 789	+139
7	Coastal Non-tidal Single Rainfed Wet Rice	350 847	243 294	-31
8	Coastal Non-tidal Other Crops	10 375	11 446	+10
9	Coastal Non-tidal Grassland	28 843	57 307	+99
10	Coastal Non-tidal Aquaculture	5 524	28 009	+407
11	Coastal Saline/Brackish Lagoon	794	2 498	+215
12	Bare estuarine Sub-tidal	290 088	291 007	0
13	Estuarine Mudflat	59 630	67 319	+13
14	Estuarine Saltworks	8 679	10 935	+26
15	Estuarine Aquaculture	16 318	41 897	+157
16	Estuarine Mangrove Plantation	43 105	8 881	-79
17	Estuarine Salt Marsh	19 506	18 374	-6
18	Estuarine Sandy Ridge	38 797	38 797	0
19	Estuarine Non-tidal Multiple Rainfed Wet Rice	230 831	204 504	-11
20	Estuarine Non-tidal Single Rainfed Wet Rice	230 276	207 225	-10
21	Estuarine Non-tidal Other Crops	37 556	40 461	+8
22	Estuarine Non-tidal Grassland	8 573	2 696	-69
23	Estuarine Non-tidal Aquaculture	3 765	15 308	+307
24	Perennial River and Canal	127 833	129 643	+1
25	Riverine Banks and Bars	230 919	208 203	-10
26	Floodplain Grassland	183 401	164 768	-10
27	Floodplain Multiple Irrigated Wet Rice	817 945	825 021	+1
28	Floodplain Single Irrigated Wet Rice	223 345	208 076	-7
29	Floodplain Wet Rice Rotated with Upland Crops	42 069	71 354	+70
30	Floodplain Other Crops	69 680	67 688	-3
31	Seasonally Flood <i>Melaleuca</i> Plantation	59 605	52 850	-11
32	Seasonally Flooded Orchards/Plantation	38 289	35 473	-7
33	Permanent <i>Melaleuca</i> Forest Reservoir	53 513	50 821	-5
34	Seasonal Reservoir	3 442	3 544	+3
35	Seasonally Flooded Grassland	54 146	30 621	-64
36	Seasonally Flooded <i>Melaleuca</i> Plantation	39 528	28 951	-27
37	Seasonally Flooded Single Rainfed Wet Rice	126 935	136 400	+7
38	Seasonally Flooded Multiple Irrigated Wet Rice	140 771	157 398	+12
39	Seasonally Flooded Wet Rice Rotated with Upland Crops	17 871	21 567	+21
40	Seasonally Flooded Other Crops	10 047	16 988	+69
	Non-wetlands types	405 192	514 499	+27
	<b>Mekong Delta Total</b>	<b>5 117 590</b>	<b>5 117 590</b>	

**Table 3. Globally threatened and near-threatened bird species in the Mekong delta (Adapted from Buckton et al. 1999)**

English Name	Scientific Name	Threat Category
Bengal Florican	<i>Houbaropsis bengalensis</i>	Endangered
Chinese Egret	<i>Egretta eulophotes</i>	Endangered
White-shouldered Ibis	<i>Pseudibis davisoni</i>	Endangered
Asian Dowitcher	<i>Limnodromus semipalmatus</i>	Near-threatened
Asian Golden Weaver	<i>Ploceus hypoxanthus</i>	Near-threatened
Asian Openbill	<i>Anastomus oscitans</i>	Near-threatened
Black-headed Ibis	<i>Threskiornis melanocephalus</i>	Near-threatened
Eastern Curlew	<i>Numenius madagascariensis</i>	Near-threatened
Grey-headed Lapwing	<i>Vanellus cinereus</i>	Near-threatened
Oriental Darter	<i>Anghinga melanogaster</i>	Near-threatened
Painted Stork	<i>Mycteria leucocephala</i>	Near-threatened
Sarus Crane	<i>Grus antigone</i>	Near-threatened
Lesser Adjutant	<i>Leptoptilos javanicus</i>	Vulnerable
Spot-billed Pelican	<i>Pelecanus philippensis</i>	Vulnerable

floodplain wet rice, seasonally flooded grassland, and *Melalueca* forests while coastal wetlands are generally dominated by mangrove forests. Only 3 types of wetlands can be considered semi-natural. The rest are far from being in a truly natural state. These are the seasonally inundated grassland, mature semi-natural mangrove forest, and mature semi-natural *Melalueca* forest (Buckton et al. 1999).

The state of the wetlands in the delta is succinctly summarized in a World Wildlife Fund publication:

“The wetlands of the Mekong Delta were once extensive and varied. Today, much of the Delta has lost its natural habitat, although remnants of the once extensive peat swamp forests, freshwater forests and flooded grasslands are represented in these wetlands. As the last representation of these significant habitats, important for distinctive plant communities, threatened bird communities and other significant animals, conservation efforts are now highly critical and are an urgent priority.” (Baltzer et al. 2001)

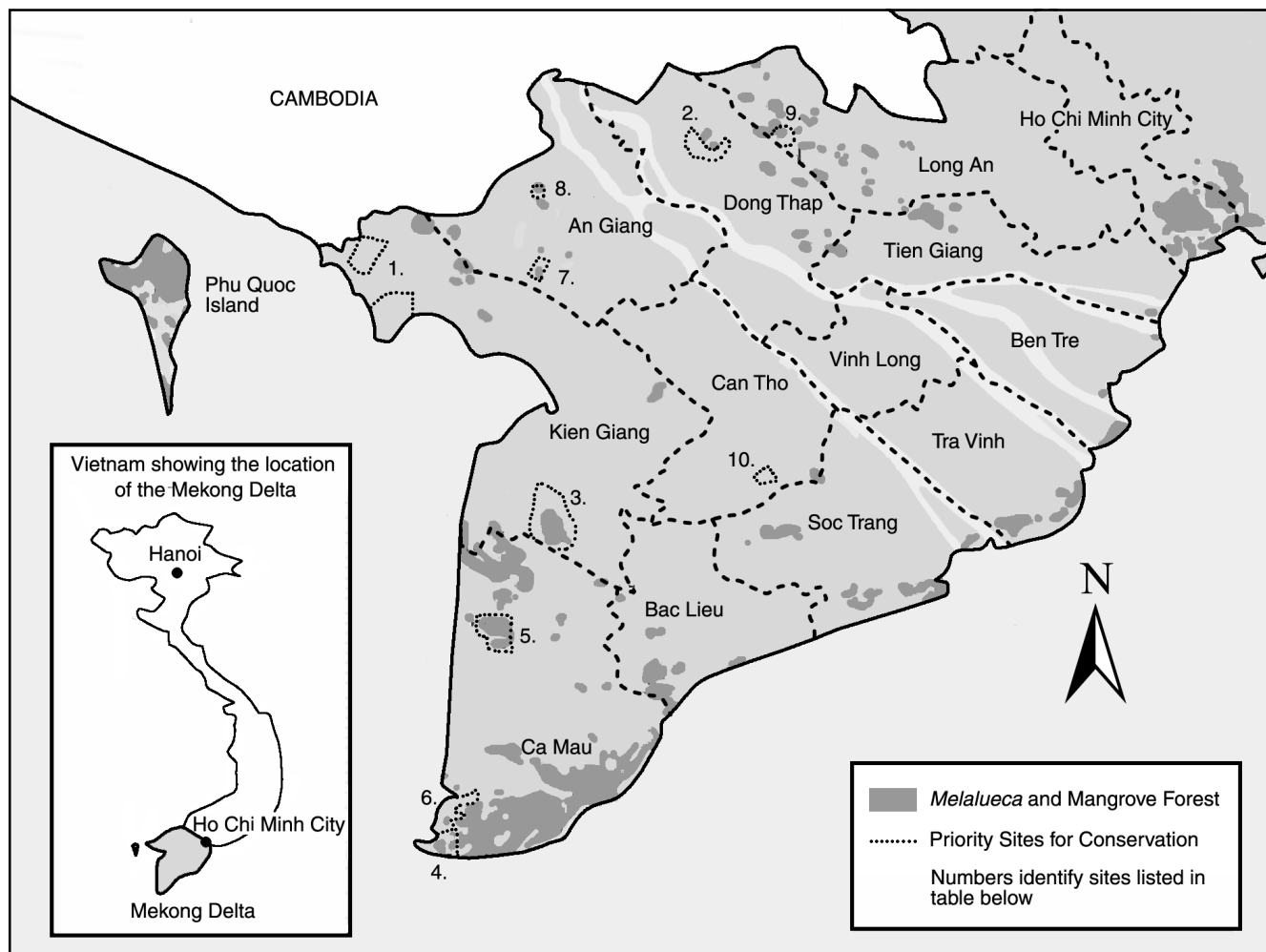
A Birdlife International study showed that seasonally inundated grasslands and swamps, and mature semi-natural *Melalueca* forest have the highest number of bird species as well as supporting high numbers of globally threatened and near-threatened bird species. Of the

194 species recorded in the delta, 14 (Table 3) are globally threatened (Buckton et al. 1999).

As a result of these threats, 10 priority wetland sites are in need of conservation in the delta (Figure 2). The seasonally inundated grasslands of the Ha Tien Plain, Kien Giang Province, demand the highest priority as their unique biodiversity is being threatened by agricultural intensification (Figure 2) (Buckton et al. 1999).

Agricultural intensification to increase rice production and aquaculture are among the major causes of physical changes in the wetlands environment in the delta (Cantho University 1997; Rothuis 1998; Safford et al. 1998; Buckton et al. 1999; Tran Triet et al. 2000; Le Dien Duc 2001). As shown in Table 2, it is in the aquaculture and rice production sectors that the biggest percentage change in land use is manifested. But that is only half the story. Unsustainable economic development goals, global demands, poverty and shortcomings of current institutional arrangements are causing as much change in the wetland environment of the delta as agricultural intensification and aquaculture. In short, the problem is non-linear, and caused by various interacting factors which need to be untangled, so that their roles in the destruction of wetlands in the delta can be understood, and management of the wetlands improved.

**Figure 2. 10 key priority wetlands sites for conservation in the Mekong Delta<sup>4</sup>**  
 (Adapted from Buckton et al. 1999)



1. (highest priority)	Seasonally inundated grasslands of the Ha Tien plain
2.	Tram Chim National Park
3.	U Minh Thuong Nature Reserve
4.	Dat Mui Nature Reserve
5.	Vo Doi Nature Reserve
6.	Bai Boi
7.	Tinh Doi
8.	Tra Su
9.	Lang Sen
10. (lowest)	Lung Ngoe Hoang

<sup>4</sup> Map is adapted from (Buckton et al., 1999) online version at <<http://www.wing-wbsj.or.jp/~vietnam/pdf/report12.pdf>>.

## Pressures on the Wetlands Environment

As highlighted previously, intensification in agriculture - primarily in the production of rice - and aquaculture - primarily in the production of prawns - together with demographic, social and institutional factors are the major pressures leading to changes in the wetlands in the delta. This is largely driven by the current economic policy of the government, *doi moi* (renovation), to revitalize the agriculture sector and to alleviate poverty. This section will start by discussing the economic policy of the government and then highlight the associated pressures which the policy brings.

When the war ended in 1975, Vietnam was a country in shambles and its economy needed serious repair. A policy known as *doi moi* was introduced by the 6<sup>th</sup> National Congress of the Party in 1986 to bring a market orientation to the Vietnamese economy. Central planning was slowly replaced with market-driven approaches toward integrating Vietnam into a new sphere of international relations, foreign policy and trade. Some of the key reforms initiated during the 1980s and early 1990s were: the decollectivization of agriculture, the return to family-based farming and the effective privatization of the agricultural sector; the devaluation and unification of exchange rates; the liberalization of most prices; a tightening of the budget constraint on state-owned enterprises, their significant rationalization and an increase in related managerial autonomy; the development of a two-tier banking system; the increase and maintenance of significantly positive real interest rates to encourage domestic

savings; a significant reduction in subsidies and the state budget deficit; and an open door policy on foreign direct investment, official development assistance and external (UNDP-Vietnam 1997).

In the years after *doi moi* was launched, economic growth was impressive with real GDP growth at around 9 to 10 % per annum. The budget deficit and the annual inflation rate were remarkably reduced. There was also an expansion in foreign trade and the floodgates for foreign direct investment were opened resulting in increased production and income for the economy. Vietnam also became the world's third largest rice exporter, a huge leap from being a net rice importer (UNDP-Vietnam 1997). On the poverty-alleviation front, UNDP reckoned that *doi moi* led to a significant reduction in rural poverty especially when compared to the years prior to *doi moi* (UNDP-Vietnam 1997). Though all these improvements were sustained during the 1997 financial crisis, any neo-liberal economic framework may be threatened by political (e.g. terrorism) and economic (e.g. technology meltdown) factors in today's global economy, unless a strong and accountable government ensures effective economic management (Adger, Kelly et al. 2001a).

Observers (e.g. UNDP-Vietnam 1997; Adger, Kelly et al. 2001a, b; Adger, Kelly, Nguyen Huu Ninh et al. 2001) believe that the gains of *doi moi* need to be deepened in order to make substantial improvements in Vietnamese society and the economy. While lofty achievements have been made, a lot remains to be done to truly revolutionize the lives of ordinary Vietnamese.

**Table 4. A chronology of major political changes in Vietnam since reunification in 1975 (Adapted from Adger, Kelly et al. 2001a; and others)**

Unified Period	
1975-79	Expansion of collectivized agriculture in Southern Vietnam
1979	Chinese invasion of northern Vietnam
1979	Limited introduction of household contract system in agriculture
1981	National application of household contract system under Directive 100; cooperatives and work point system still operating
1986	<i>doi moi</i> introduced following Party Congress
Renovation Period	
1988	Agricultural reforms under Decree 10. Collectivization of farms in Mekong Delta. Land allocation on lease system. Cooperatives to act as a service operation to household agriculture
1988-93	Land ownership still with the state. A rental market for land emerges even though illegal
1993	Land Law instigates 20-year and longer leases of agricultural land

In the area of wetlands management in the Mekong Delta, two parallel processes associated with *doi moi* need to be understood, as they put pressures on the future state of the wetlands. These are agricultural intensification, primarily through rice production, and aquaculture production, primarily through shrimp aquaculture. Associated with these two main pressures is the increasing use of large infrastructure projects to ensure rice and shrimp production. These projects are bringing additional pressures to bear on wetlands resources.

### Pressures Associated with Intensification of Rice Production

Agriculture occupies 83% of the delta and its development in the Mekong Delta has always been associated with the production of paddy rice, which was made possible through an extensive network of canals, connecting villages and depression areas and providing

for irrigation and drainage (Duong Van Ni et al. this volume). Agricultural output in the Delta is highest compared with the rest of the country (Table 5), as it is relatively land abundant and highly irrigated; thus it is also relatively well-off compared with other regions (Minot 2000).

Rice is both a cash crop and a staple food in Vietnam. It accounts for 78% of the annual cropland and 90% of staple food production in the country. It also provides for 75% of the calorie intake of a typical Vietnamese household and almost 30% of the value of consumption expenditure (Ryan 2002). Rice production in the Mekong Delta, and for the rest of Vietnam for that matter, is a major source of income among its agricultural households. It accounts for 31.5% of household income. Ninety-five percent of rice surpluses are produced in Vietnam's Mekong Delta while the rest come from the Red River Delta. Other regions such as

**Table 5. Profile of farming households in Vietnam, by region (1992-93) (Adapted from State Planning Committee and General Statistical Office 1994) quoted in Shintani (2001)**

	Northern Uplands	Red River Delta	North Central	Central Coast	Central Highlands	South-east	Mekong Delta	Whole Country
Agricultural output value (1 000 VND (US \$ 0.07))	3 783	3 820	2 952	3 097	5 071	5 250	6 942	4 365
Paddy output (kg)	1 192	1 638	1 375	1 596	946	2 406	4 456	2 071
Value of product of husbandry (1 000 VND (US \$ 0.07))	1 455	1 483	1 128	1 320	860	1 795	1 685	1 451
No of household members (persons)	4.9	4.1	4.5	4.9	5.7	5.0	5.2	4.8
Persons of labour participation age	2.0	2.2	2.6	2.5	2.4	2.5	2.4	2.4
Agricultural and forestry land (ha)	0.737	0.280	0.399	0.422	1.128	0.930	1.105	0.638
Annual crop land (ha)	0.438	0.243	0.312	0.372	0.710	0.611	0.907	0.486
Production equipment (1 000 VND (US \$ 0.07))	362	236	348	549	3,410	1 995	1 637	803
Value of animals owned (1 000 VND (US \$ 0.07))	828	597	916	949	638	1,295	732	800
Crop cultivation expenses (1 000 VND (US \$ 0.07))	378	605	525	743	918	1 607	2 095	934
Husbandry current expenses (1 000 VND (US \$ 0.07))	172	333	280	485	302	921	638	409

the North Mountain, North Central Coast, South Central Coast, Central Highlands and Southeast have rice deficits (Minot and Goletti 1998).

Rice exports (Table 6) were boosted during *doi moi* as the government liberalized its markets, prioritized agriculture and exports, promoted international trade and decollectivized agricultural production, although large scale rice exports had been initiated during French colonial rule (Pingali and Vo-Tong Xuan 1992; Minot and Goletti 1998; Ryan 2002). During 1985-95, rice production grew by 5% annually (Ryan 2002), and now generates 15% of Vietnam's export earnings (Ni and Xuan 1998). Rice exports from Vietnam account for 11-13% of the world's rice exports. Yet a short-run increase in the price of rice would greatly affect the majority of Vietnamese as six out of ten households and five out of seven regions are net buyers of rice, even though poverty has been reduced (Minot and Goletti 1998). As the situation is now, poverty is still severe in the countryside and the quest for institutionalizing poverty alleviation by the government necessitates capitalizing on its comparative advantages in which rice production obviously is pre-eminent.

Intensification of rice production is the avowed goal of government policy in order to strengthen the country's economy, alleviate poverty and ensure food security. In so doing, vital institutional and policy infrastructures are being put in place to jumpstart the process. Vital policy changes include reduction of the export duty on rice, strengthening of individual property rights, land reform, adoption of high yielding varieties and an increase in the export quota (Ryan 2002). On the

physical infrastructure side, large-scale water control projects have been initiated, especially in the Mekong Delta, to support the intensification of rice production (Hashimoto 2001) and reclamation of acid sulfate soil (ASS) areas through leaching (Minh et al. 1997). All these developments have led to a rapid and remarkable transformation in the Delta from broad grasslands to rice paddy fields (Koji 2001)<sup>5</sup>.

While these projects have brought benefits in terms of increased productivity, they have also brought new pressures to the wetland environment in the Delta and heightened the potential for environmental degradation. These pressures need to be properly considered so as not to subvert the goals which these developments target. The projects include large-scale dry season irrigation schemes; flood and drainage control measures mostly in the form of canals, dikes and sluice gates; and land reclamation in ASS areas.

Canals serve many functions such as irrigating cropping areas, draining floodwater and runoff from cropping areas to main channels, and transporting and disposing of waste. Canals are also used to remove acid water from ASS. Even prior to the war, canals were being built in the Delta primarily for transportation, defense and rice cultivation (Koji 2001). But the intensity of canal building has increased in recent years and by the 1990s, virtually all waterways in the Delta formed a single network with a total length of around 5 000 km. Dikes, on the other hand, prevent or delay the flooding of cropping areas and human settlements. Dikes also impound water, which may be useful for certain fishery or aquaculture activities as well as providing platforms

**Table 6. Production and trade of rice in Vietnam (Adapted from Ryan 2002)**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Paddy production (metric tonnes)	19.0	19.2	19.6	21.6	22.8	23.5	25.0	26.3	27.6	28.3
Actual export quota (metric tonnes)	N/A	N/A	N/A	1.9	1.6	1.9	2.0	2.9	3.6	4.0
Rice exports (metric tonnes)	1.4	1.5	1.0	2.0	1.7	2.0	2.0	3.0	3.6	4.0*

\* Originally the quote was set at 4.0 million tonnes, but in mid-1998 the government revised this down to 3.6 million tonnes due to concerns about drought and food security.

5 However, the next section will show that the transformation of the delta did not end with rice production. Certain parts of the rice producing areas of the delta especially those located along the coastal areas became shrimp farms.

for land transport. Sluice gates are mechanisms to control the flow of water in and out of canals and to regulate the water level in cropping areas (Hashimoto 2001). Reclaiming ASS for rice production and other agricultural products is done through leaching, which is a means of transferring acidity to the surrounding area (Minh et al. 1997).

The environmental impacts of these projects are manifold. Leaching ASS, which accounts for 40% of the Delta's land type, has the potential for acid pollution, which, in turn, affects aquatic organisms, fisheries, crops and other domestic uses of water (Minh et al. 1997) as there is a threshold which these can withstand. In relation to ASS, the water-control projects, especially canal construction, has exposed through excavation large volumes of potential ASS to the air, leading to pyrite oxidation, hence to seasonal soil acidity and increased mobility and deposition of potential toxins such as manganese and aluminium. Such an increase in soil acidity may affect the growth of crops and changes the biodiversity of the area, especially with respect to the succession of acid-tolerant species over intolerant ones (Hashimoto 2001).

When acid pollution is flushed through waterways, it can cause mass mortality, disease, disfigurement and reduced growth rates of aquatic organisms aside from encouraging the growth of toxic blue-algae. In addition, the natural pattern of downstream flow of floodwater over the delta plain is fragmented and complicated, resulting in a potentially massive deposition of sediments in main channels – which makes canal maintenance costly – and increasing the duration and depth of inundation. Overbank flooding on the delta plain brings sediments which may be important in maintaining the productivity of the soil, but the addition of dikes in the landscape prevents this from occurring. There are also cases where land reclamation associated with these water-control projects has led to the destruction of some of the last remaining stands of *Melaleuca* forests. These impacts seriously threaten the sustainability of the wetlands in the delta (Hashimoto 2001).

### **Pressures from Shrimp Aquaculture**

As with the intensification of rice production, Vietnam's aquaculture industry is expected to be a flagship in the country's quest for economic growth and development under the auspices of *doi moi* and its consequent policies

of liberalization and increased exports. Thus, the government's plan for its aquaculture sector is an expression and result of *doi moi* (SCP Fisheries Consultants Australia 1996; Luttrell 2002). Its faith in the benefits of aquaculture is unequivocal. It believes that economic development and growth is possible through aquaculture as this industry has yet to realize its true potential. Vietnam reckons that its wealth of natural resources such as 445 000 ha of coastal marine habitats, 390 000 ha of brackish-water, 1 million ha of inland waters and 560000 ha of agricultural ecosystems should provide the fuel to achieve its objectives. Its Ministry of Fisheries, the agency in charge of aquaculture development, believes that accelerating investment in aquaculture is possible, as such investment is financially attractive, economically viable and the entrepreneurs are eager to expand operations (Institute for Fisheries Economics and Planning 1997).

Aquaculture is seen to have the greatest growth potential within Vietnam's fisheries sector, as its marine capture fisheries as well as inshore and nearshore areas are already experiencing various degrees of over-exploitation. In the late 1990s, aquaculture contributed 30% of the total fisheries production of 1.3 million tonnes and an export earning of US \$ 250 million. By 2010, most of the increase in earnings from fisheries exports is expected to come from aquaculture. Coastal aquaculture in particular is expected to be where growth in commercial and export-oriented production can occur. Employment in aquaculture is expected to exceed 1 million by 2010, three times its original size, as it is the plan of the government to use this subsector to absorb excess capacity in inshore fisheries and to relieve fishing pressure. The number of people currently employed by this sub-sector is estimated at around 300 000 (SCP Fisheries Consultants Australia 1996).

The massive expansion of brackish-water aquaculture – especially the culture of high valued species such as *P. monodon*, *Penaeus indicus*, and *P. merguensis* (TranTruong Luu 2000) – in the Mekong Delta came in the wake of *doi moi* especially with the decollectivization of land from cooperatives to individual households and land reform. In 1994, there were about 254 000 ha of brackishwater ponds in the country with 237 000 ha used largely for shrimp production. However, expansion has been increasing since then, as for instance in Minh Hai Province in the Mekong Delta, where there were 131 000 ha of ponds

in 1994 and 142 000 ha in 1996. Eighty percent of the country's total land area devoted to aquaculture is in the Mekong Delta (SCP Fisheries Consultants Australia 1996) and covers different production systems and yield (Table 7). The average yield is considered low, ranging from 100 to 400 kg/ha/yr depending on the production system (Cao Thang Binh and C. Kwei Lin 1995).

In saline areas and especially during the dry season, shrimp farming is practised when rice farming is not feasible due to high acidity in the soil. This practice allows farmers to earn extra income during times when earnings from rice farming are not forthcoming. Improved extensive and semi-intensive shrimp production systems (Table 7) are adopted over the same piece of land where a wet season rice crop is grown. The rice field is redesigned with a trench and dike surrounding it to act as a refuge for the shrimps. A flapgate and trap system controls the amount of water flowing between the rice fields and trenches (Tran Thanh Be et al. 1999). This system prevents the acidity of the soil from building up due to long exposure to air and pyrites seeping out from cracked and overturned soil. Integrated farming systems are now being adopted such as salt-artemia-shrimp farming, which allow for the land to be used throughout the year (de Silva 1998).

Good global demands accompanied by high prices and government support (e.g. preferential taxation, credit to infrastructure support to make shrimp production lucrative) underlie its production in the Mekong Delta (SCP Fisheries Consultants Australia 1996; Luttrell

2002). Estimates by de Graaf and Xuan (1998) show that shrimp farming increased by 3 500% between 1976 and 1992. This confirms the shrimp's well-earned reputation as the most important traded commodity by value in Asia (NACA 2000). Elsewhere in the tropics, shrimp production predominates in mariculture (de Silva 1998), less for domestic food consumption than for export and foreign exchange (NACA 2000).

The ambitious plan for the aquaculture sector may have lofty economic objectives, but ironically it brings pressures which can potentially subvert the integrity and sustainability of the very system economic development is anchored on. Already the yield from the country's shrimp industry is in decline due to a host of factors such as viral infections, massive destruction of mangroves, increasing soil and water acidity, poor pond management and overexploitation of natural shrimp stocks (de Graaf and Xuan 1998). If the earlier experience from Vietnam and the lessons from other countries are any indication, intensive shrimp production has huge environmental costs (such as those in Table 9) which several authors have pointed out (see Bailey and Skladany 1991; Primavera 1991; Stonich 1995; Macintosh 1996; Bailey 1997; Clay 1997; Primavera 1997; Stonich et al. 1997; Boyd and Clay 1998; Boyd et al. 1998; Menasveta and Fast 1998; Paez-Osuna et al. 1998; Primavera 1998; Boyd and Schmittou 1999; Flaherty et al. 1999; Stonich and Bailey 2000; Paez-Osuna 2001; Senarath and Visvanathan 2001; Hein 2002; Luttrell 2002)<sup>6</sup>.

**Table 7. Area and output of different shrimp production systems in the Mekong Delta (Adapted from Cao Thang Binh and C. Kwei Lin 1995)**

System	Area (ha)	Farm size (ha)	Production (kg/ha/yr)
Extensive shrimp/fish	160 000	1-10	395
Improved extensive	1 100	1-4	357
Semi-intensive	800	0.5-1.0	1 670
Shrimp-mangrove	26 000	2-10	342
Salt-shrimp	6 000	2-20	100
Others	11 300	–	–
<b>Total</b>	<b>204 350</b>		

<sup>6</sup> Cognizant of the environmental impacts of shrimp aquaculture on mangroves, civil society groups such as the Mangrove Action Network and the International Shrimp Action Network are actively campaigning on this issue.



**Table 8. Environmental impacts of extensive shrimp culture on mangrove forests in the Mekong Delta (Adapted from Phillips 1998)**

Environmental Impact	Specific Details
Coastal erosion	Increased coastal erosion in Tien Giang, Ben Tre, Cuu Long and Minh Hai Provinces
Salinity intrusion	Removal of mangroves has led to increased vulnerability to storm damage and saline intrusion. In 1991, more than 2000 ha of rice fields at Can Gio District, Ho Chi Minh City were damaged by saline intrusion
Shrimp post-larvae	Declining availability of post-larvae has resulted in decreased yields from extensive shrimp ponds although over-fishing may also be important
Mud crab <i>Scylla serrata</i> abundance	Mud crabs are an important export crop, relying on mangrove habitats. The populations are reported to be declining, a combination of over-exploitation and habitat loss
Acidification of pond water/soils	Removal of mangroves from extensive shrimp ponds has led to declining yields of shrimp
Declining shrimp pond yields	Related to the decrease in shrimp larval abundance and deteriorating habitat, pond yields have decreased. From 1986, yields from extensive shrimp ponds declined from 297 kg ha <sup>-1</sup> to 153 kg ha <sup>-1</sup> in 1988

In the Mekong Delta, shrimp farming occurs in the intertidal areas along its coast as farmers rely on tidal water exchange to bring nutrients and seeds to the ponds (Lovatelli 1997) especially in extensive systems. Hatchery-produced post larvae and supplementary feeding were gradually introduced during the early 1990s as the production systems intensified (de Graaf and Xuan 1998). Because of its location on the coastal zone and the nature of the activity, significant environmental impacts are starting to emerge such as those listed in Table 8. Yet these impacts pale in comparison with those being reported in other countries, especially Thailand, Bangladesh and India; impacts include nutrient and organic loading; intensive use of chemicals; groundwater removal; decline in biodiversity associated with wild fry bycatch and introduction of exotic species (Primavera 1998).

The conversion of mangroves for shrimp culture has been reported in the Delta (de Graaf and Xuan 1998) and represents the most pernicious impact of shrimp aquaculture (Primavera 1998). The World Bank estimated in 1994 that its environmental cost over the past 10 years was US \$ 279 million. This comes from the opportunity cost of improperly designed and managed shrimp ponds, loss of sustainable mangrove forest activities, loss of capture fisheries, and the increased cost of dike maintenance (SCP Fisheries Consultants Australia 1996). It is estimated that in the 1940's there were 400 000 ha of mangroves in Vietnam, 250 000 ha of which were in the Mekong Delta. The

country's mangroves were reduced to 290 000 ha by the 1950's as wood, charcoal and firewood use intensified. When the Vietnam war erupted, 104 939 ha were further destroyed especially in Ca Mau Cape, where defoliants and herbicides were used (Phan Nguyen Hong and Hoang Thi San 1993; TranTruong Luu 2000). From here onwards, mangrove conversion for shrimp aquaculture predominates until recently when conversion to rice production began to catch up (Tran Thanh Be et al. 1999).

In rice-shrimp farming systems in the Delta, practices associated with shrimp farming have led to two major environmental problems: salinization of rice-shrimp fields and the neighbouring rice-monoculture fields, and sedimentation in rice-shrimp fields. Salinization occurs when rice-shrimp farmers inundate their rice fields with salty water for a period of 4-5 months a year to enable shrimp culture. In rice monoculture areas, saline water has two impacts. One on bare fields during the dry season when it leaches or washes over the area; another on the growth of an existing rice crop. As the soil is already salty due to periodic saline intrusion, the inundation of salty water dramatically increases the salinity level and leaching fails to remove the salts locked in the soil. As a result, rice yield is affected, as there is a certain salinity threshold that rice can tolerate. Also the amount of time for the rice-cropping season is affected, as rice-shrimp farmers need sufficient time to flush the soil (Tran Thanh Be et al. 1999). A similar situation has been widely reported in the case of inland shrimp

farming in Thailand where transportation of saline water has had serious impacts on soils and freshwater systems (Flaherty et al. 1999). On the other hand, sedimentation happens when sediments are deposited by river water during the dry season. This causes rapid shallowing of rice-shrimp fields necessitating extra labour to remove the sediments and allow for water to be properly impounded for the rice to grow (Tran Thanh Be et al. 1999).

Aside from the above-mentioned impacts, shrimp farming also has negative socio-economic impacts which can be gleaned from the experiences of other countries. In particular, it has led to loss of mangrove goods and services; it has led to land conversion, privatization and expropriation of fragile coastal ecosystems for private interests; it has led to marginalization, rural unemployment and rural-urban migration to seek better work opportunities; and to food insecurity as pond-produced shrimp is unaffordable in poor households (Primavera 1998). In the Mekong Delta, there are signs that these problems are beginning to emerge as in the case of Nam Hai Commune in Tinh Binh District, Ca Mau Province.

In this commune, shrimp farming has led to upheaval in the social structure, a lowering of water quality and the destruction of existing vegetation. Originally, Nam Hai Commune was a rice growing area but when it failed to provide sufficient income, residents converted all their rice lands to shrimp farms in the mid-1980's to ride with the shrimp boom. Profit from this new venture was only good until there was a dramatic fall in shrimp yield during the early 1990s and from then on, profits were poor. Some shrimp farmers are now thinking of reconverting their ponds to rice fields but this is not easy, as it requires more money to move earth back into the pond and build dikes. Thus, the shrimp boom has led to the collapse of household economies of poor shrimp farmers, to high debts, and has sharpened the division between rich and poor households as the former were able to adapt more easily (i.e. they have more options) than the latter. In acts of desperation and resistance, some poor shrimp farmers marginalized by the decline of the industry and lack of other employment opportunities have resorted to theft (Luttrell 2002).

**Table 9. A summary of positive and negative impacts of the shrimp expansion in Vietnam and its subsequent failure (Adapted from Luttrell 2002)**

<b>Positive impacts</b>
<ul style="list-style-type: none"> <li>• Increased foreign earnings for Vietnam</li> <li>• Livelihood diversification in an area where rice returns are low owing to salinity and problems of acid sulfate soil.</li> <li>• Opportunities for credit and preferential taxation for shrimp farming households.</li> <li>• Increased earnings for local authorities from selling contracts over previously 'unused' land and resources.</li> <li>• Increased trading opportunities and other multiplier effects in the area.</li> </ul>
<b>Negative impacts</b>
<ul style="list-style-type: none"> <li>• Rivers affected by chemical, heat and sediment pollution owing to runoff from shrimp ponds, thus adversely affecting natural products.</li> <li>• Enclosure of open-access areas restricting livelihood sources for the poorest.</li> <li>• Increased landlessness as households which cannot afford the capital investment needed for shrimp farming are pushed off the land.</li> <li>• Little benefit accrues to the area as many of the shrimp farmers who are able to profit from shrimp farming are from outside the commune.</li> <li>• Increased conflict over land.</li> </ul>
<b>Impacts of the subsequent failure of shrimp farming</b>
<ul style="list-style-type: none"> <li>• High levels of debt in all shrimp farming households, restricting transfers to other income-generating activities.</li> <li>• Forced diversification of livelihoods.</li> <li>• Increased tree planting on private land as the value of the shrimp ponds decreases.</li> <li>• Increased landlessness as poorer pond owners are forced to sell the land to pay debts.</li> <li>• Falling land prices, richer households selling the land and a lower income group moving in.</li> </ul>

Table 9 summarizes the impacts of shrimp expansion and its failure in Vietnam. It appears that, while some benefits accrued to the national economy, household security is seriously threatened, and there are indications that social upheaval may become a possibility if current trends are not corrected and social safety nets are not in place.

### **Pressures from Inadequate Institutional Arrangements**

Legislation on wetland management in Vietnam consists of a number of laws and regulations which include those on agriculture, forestry, environment and fisheries (Doan Nang, this volume). Thus, there is no single legislation covering the use, development, management or conservation of wetlands. The Land Law of Vietnam defines wetlands as “lands with waterbodies”. The precise meaning of wetlands is not elaborated in the Land Law. The focus of these wetland provisions is on their economic use rather than on their protection or conservation value.

Artificial wetlands are not covered by this legal framework. The protection of wetlands environment is covered under general environmental legislation such as the Law on Environment Protection (1993). Out of more than 500 environmental protection regulations enacted since 1976, only ten cover wetlands directly. As wetlands are the interface between land and water, wetland use is also covered under the Law on Water Resources, particularly by the provisions on the use of water resources. It is proposed that a decree on the use and management of wetlands be formulated. The decree would define the involved agencies and outline their roles and fill in gaps in the existing legal framework in order to make the framework more responsive to current realities (Doan Nang, this volume).

The institutional dynamics in the management of wetlands in the Delta is shown in the case of Ben Tre Province, one of the coastal provinces of the Delta. The province has more than 100 species of mangroves. Following re-unification in 1975, several agencies were assigned the task of developing plans for the exploitation, protection and development of wetlands in the province. These agencies were: the Department of Forestry, Department of Land Administration, Department of Fisheries and Department of Science, Technology and Environment. Steering committees or management boards were also established to implement

these plans. However, there are conflicts over policy interpretation on wetlands use and management, as wetlands are jointly used for forestry and aquaculture. The establishment of protected areas in the Delta is governed by the Law of Forest Protection and the Regulation for Protecting Aquatic Resources in Coastal Areas (Trinh Van Y, this volume).

Nevertheless, additional policies on sustainable use and wetlands management are required at the national level. Le Thanh Binh (this volume) outlines a proposal put forward by the National Environment Agency for a national strategy on the sustainable management of wetlands in Vietnam. She notes that the present strategy on wetlands management is based on a number of laws such as the Law on Environment Protection, the National Action Plan for Biodiversity, the National Action Plan for Environment 2001-2010, the Convention on Biodiversity and the Convention on Wetlands (Ramsar, Iran, 1971) (cf. Doan Nang, this volume). While enshrining coordination among the various sectors involved in wetland use and development as an essential policy mechanism, the strategy is aimed at ensuring the sustainable and effective use of wetlands. Thus, the key themes in the strategy are integration at the levels of policy and management, zoning and proper planning. The other highlight is conversion of mangrove areas into fish or shrimp ponds or ricefields and the possibility for re-converting some of these areas back to mangrove areas.

Currently, a national policy to rehabilitate and develop five million hectares of forests is in place in Vietnam. According to Nguyen Ngoc Binh (this volume), Director of Vietnam's Forestry Development Department, the program will run until 2010 and targets 5 million hectares of forest to be reforested with another 9.3 million hectares to be protected. This is quite an ambitious government program with noble objectives such as ensuring ecological security, conserving genetic resources and biodiversity, creating 2 million permanent jobs and contributing to poverty alleviation. The program budget from the national treasury is being developed and the Vice Prime Minister chairs the committee overseeing this program. Tax incentives are provided to those who plant trees or perennial crops on barren lands or those who invest in wood processing industries. The program also encourages plant breeding to supply materials for reforestation. Foreign investors are encouraged to enter into joint ventures

with national organizations on reforestation and wood processing projects. A challenge to this program is the absence of a clear land use policy that may affect investments in reforestation. In terms of wetlands, this program has a bearing on the use and management of important forest ecosystems in the Delta such as mangrove and *Melalucea* forests.

In the Delta and elsewhere in the country, special use forests (SUFs) are designated. SUFs are one of the three types of forests in Vietnam, which includes protected forests and production forests. SUFs serve a variety of purposes including the maintenance of ecosystem integrity, conservation of biodiversity, scientific research and protection of cultural and historical values. SUFs include three kinds: national parks, natural reserves and cultural-historical forests. The government aims to increase the country's forest coverage and considers SUFs so important that management boards, acting as state-run economic units, manage these forests. For small SUFs, protection and development may be handled by organizations, households or individuals (also referred to as "forest owners"). If the management of SUFs is not assigned, the district people's committees (PC) are expected to assist provincial people's committees at district and commune levels in the management of SUFs (Nguyen Tuan Phu, this volume).

Some components of the legal framework for natural resource management in Vietnam are listed by Hoang Huu Cai (this volume). This includes the Forestry Resource Protection and Development Act, Law on Environmental Protection, Vietnam National Environmental Action Plan and the Vietnam Forestry Action Plan (cf. Doan Nang, this volume). Important stakeholders in the Delta wetlands include the provincial Department of Agriculture and Rural Development (DARD), the provinces' extension centers, provincial Forest Protection Departments, forestry/fishery enterprises, district agricultural extension stations, forest protection stations, people's committees and the communities. These entities need different kinds of support in order to enhance their roles in the natural resource management process. The support activities

can range from enhancing skills and capabilities to financial and information support.

In view of the problems of wetland management in the Delta as reported in various papers in this volume, effort needs to be directed toward analyzing the wetland management "institutions" and deriving the economic value from wetland goods and services in order to influence the policy, plans and decisions toward more sustainable and efficient outcomes. Trinh Truong Giang et al. (this volume) of the University of Agriculture and Forestry in Ho Chi Minh City have outlined the lessons learned from existing and past wetland management arrangements. Since 1995 UAF has been involved in the study of the institutional aspects of natural resource management, especially those relating to the country's wetlands. These authors contend that governments are not the sole stakeholders in natural resource management. To institute proper natural resource management, grassroots organizations should be involved and sectoral management should be discontinued. A transparent and participatory decision-making process increases the effectiveness of the state management of these resources and reduces transaction costs, thereby leading to more sustainable outcomes.

Beyond these formal institutions, there is increasing concern especially among those who are observing trends in global environmental change (for example Adger, Kelly et al. 2001a) that the economic liberalization policies advocated under *doi moi* are increasing the collective vulnerability to hazards (e.g. cyclones and climate change) of populations within precarious environments. This liberalization is thought to erode institutional resilience to these hazards. Adger (2000) argued that the system of local autonomy has, in effect, a potential cost in terms of collective vulnerability to hazards as the reformulation of "the organs of administrative power does not lead to greater local participation and collective empowerment". Instead, these changes decrease opportunities for coherent collective action and often reinforce the uneven distribution of power over resources.

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7 These projects exclude those that are considered general agricultural research, commercially oriented agricultural projects, irrigation and water supply and sanitation.

8 Forty-eight of these projects received multilateral funding while the rest have bilateral funding. The environmental projects in 1999 were at least six times larger than in 1995 (UNDP-Vietnam 1999).

## Responses

We have mentioned some of the pressures on the sustainability of wetlands in the Mekong Delta. There are other factors that can impose pressures on how these resources are managed and used. These include the poverty situation in the Delta and demographic trends of the population within it, as well as those of the whole nation. The donor community, NGOs, private sector and the government have responded in various ways to the challenges. Over the whole of Vietnam, 173 environmental projects<sup>7</sup> were implemented with funding of at least US\$ 1.4 billion<sup>8</sup> in 1999 (UNDP-Vietnam 1999). A sizeable chunk of these projects was implemented in the Delta. Though it is not easy to ascertain their impacts, it is fair to say that the responses are varied and the projects or programs initiated are diverse. Table 11 lists the projects or programs that have been implemented or are in various stages of implementation. The list is not comprehensive and may represent only a small portion of the whole picture. A more complete picture is presented in UNDP-Vietnam (1999).

To cite an example of the kind of intervention initiated in the Delta, it is instructive to look at the Inventory and Management of Wetlands in the Mekong Delta project as this is a pioneering effort to inventory the wetlands in the Delta and serve as a scaffold for succeeding projects. This project, under the auspices of the Mekong River Commission, was carried out from 1991 to 1998 and involved the Lao PDR, Thailand and Vietnam. Between 1991 and 1998, the project achieved the following<sup>9</sup>:

1. Set up a wetland team composed of representatives from different agencies and disciplines;
2. Established a wetland classification based on Ramsar and MRC classifications;
3. Established wetland maps for the Mekong delta at scale 1/250 000 especially for Tram Chim, Thanh Phu (1/25 000) using GIS;

4. Established a database to manage all data related to the project;
5. Established Tram Chim area as a national park;
6. Proposed the establishment of Thanh Phu area as a national conservation area.

In eight years of operation, several insights were gained including<sup>10</sup>:

1. Wetlands are an integrated and sensitive ecosystem. The assessment of natural resources of the wetlands should follow standard methodologies in order for it to be comparable.
2. In Vietnam, there is no agency with the full power to manage the wetlands. As such, resource management in wetlands is according to sector such as fisheries, forestry and agriculture.
3. In Vietnam, there is no single policy on wetland management such that the management policies of the different sectors (fishery, forestry and agriculture) can be coordinated.
4. In the Mekong Delta, the increase in human population and economic development are the main causes for the degradation of the wetland area. There is over-exploitation of natural resources of the (natural) wetland and an imbalance between economic development needs and the potential of natural resources. This is the main reason for the degradation of natural resources in the wetland area. The conservation of the (natural) wetlands areas particularly those with high values of biodiversity, culture and history should be the main priority in the national wetlands management strategy.
5. The development of buffer areas is important in order to conserve and use the resources in (natural) wetlands wisely. There should be a project on this aspect.
6. Knowledge of limnology and of the real value of wetlands are very important for the wetlands researcher.

9 This is largely based on the presentation of Mr Nguyen Chin Thanh, Vice-Director, Institute for Inventory and Planning, Department of Forestry, entitled "Inventory and management of wetlands in the Mekong Delta: Result"

10 Ibid.

**Table 10. Projects/programs implemented in the Delta**

Sector	Project	Donor	Duration	Total Cost (US \$ million)	Source
Conservation and protection of mangroves and wetlands	Mixed Shrimp Farming: Mangrove Forestry Models in the Mekong Delta	Australian Centre for International Agricultural Research (ACIAR)	1998-2000	0.603	(UNDP-Vietnam 1999)
Marine Protection	Evaluation of Brackishwater Farming Systems in the Mekong Delta	Australian Centre for International Agricultural Research (ACIAR)	1997-2000	0.670	(UNDP-Vietnam 1999)
Watershed	Poverty Reduction and Environmental Management in Remote Mekong Sub-Region Watersheds (RETA 5771)	Asian Development Bank (ADB)	1998-1999	0.082	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Social Forestry: Mangrove in Can Gio South Viet Nam	Belgium Administration for Development Co-operation	1995-1999	0.240	(UNDP-Vietnam 1999)
Marine Protection	Marine Aquaculture in the Mekong Delta and Upgrading of Research and Educational Capacity	Belgium Administration for Development Co-operation	1996-1999	0.430	(UNDP-Vietnam 1999)
Sustainable Agricultural Practices	Strengthening of Diversified Farming Systems in the Mekong Delta	Belgium Administration for Development Co-operation	1996-1999	0.170	(UNDP-Vietnam 1999)
Sustainable Use	Impact Analysis and Improvement of Rice-fish Farming System in the Semi-Deep Water Area of the Mekong Delta	Belgium Administration for Development Co-operation	1995-1999	8.700	(UNDP-Vietnam 1999)
Sustainable Use	Land Evaluation for Land Use Planning and Development of Sustainable Agriculture in the South of Vietnam	Belgium Administration for Development Co-operation	1996-2001	0.450	(UNDP-Vietnam 1999)
Sustainable Use	Sustainable Management of Resources in the Lower Mekong Basin	Federal Ministry for Economic Co-operation and Development (BMZ)	1997-1999	5.500	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Rehabilitation of Coastal Mangrove Forest Damaged by Typhoon Linda	Danish Agency for International Development (Danida)	1997-1999	0.450	(UNDP-Vietnam 1999)
Sustainable Use	U Minh Thuong Nature Reserve Conservation and Community Development	Danish Agency for International Development (Danida)	1998-2002	2.800	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Capacity Development in Environment Management in Can Gio Mangrove Forest	European Union	1999-2001	0.210	(UNDP-Vietnam 1999)
Forestry	Afforestation Technology Development Project on Acid Sulfate Soil in the Mekong Delta	Japan International Cooperation Agency (JICA)	1997-2000	3.900	(UNDP-Vietnam 1999)

**Table 10(a). Projects/programs implemented in the Delta (cont.)**

Sector	Project	Donor	Duration	Total Cost (US \$ million)	Source
Forestry	Cat Tien National Park Conservation Project	Netherlands Government	1997-2002	6.300	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Rehabilitation of Mangrove Forests in the Mekong Delta	Netherlands Government	1999-2000	3.160	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Conservation of Key Wetlands Sites in the Mekong Delta	Netherlands Government	1998-1999	0.170	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Vietnam Wetlands Conservation and Management Programme: Towards a National Wetlands Programme	Netherlands Government	1999-2000	0.160	(UNDP-Vietnam 1999)
Sustainable Agricultural Practices	Problem Soils	Swedish International Development Cooperation Agency (Sida)	1999-2000	0.360	(UNDP-Vietnam 1999)
Agriculture, fishing, and forestry	Mekong Delta Water Resources Project	The World Bank	1999-2005	147.600	<a href="http://www.worldbank.org.vn/wbivn/projects/pro023.htm">www.worldbank.org.vn/wbivn/projects/pro023.htm</a>
Transportation	Mekong Transport and Flood Protection Project	The World Bank	2000-2006	N/A	<a href="http://www.worldbank.org/sprojects/project.asp?pid=P042927">www.worldbank.org/sprojects/project.asp?pid=P042927</a>
Environment	Coastal Wetlands Protection and Development Project	The World Bank	1999-2006	65.600	<a href="http://www.worldbank.org/sprojects/project.asp?pid=P042568">www.worldbank.org/sprojects/project.asp?pid=P042568</a>
Transportation	Inland Waterways and Port Rehabilitation Project	The World Bank	1997-2003	73.000	<a href="http://www4.worldbank.org/sprojects/project.asp?pid=P004843">www4.worldbank.org/sprojects/project.asp?pid=P004843</a>
Sustainable Use	Strengthening Capacity Development for Poverty Elimination in Tra Vinh	United Nations Development Programme (UNDP)	1997-2000	1.600	(UNDP-Vietnam 1999)
Conservation and protection of mangroves and wetlands	Mekong River Basin Wetlands Biodiversity Conservation and Sustainable Use Programme. Project Development Phase	United Nations Development Program (UNDP) and Global Environmental Facility (GEF)	1999-1999	0.350	(UNDP-Vietnam 1999)

Recognizing the need to build upon such prior experiences with wetlands management in the Mekong River Region, the WorldFish Center (formerly ICLARM) initiated in mid-2000 a project to (i) review and analyze existing laws, including customary rules and institutions concerning wetlands use and management; (ii) determine the economic, social and cultural values of the goods and services offered by wetlands; and, (iii) develop approaches for building and strengthening a national framework for multi-sectoral management of wetlands based on harmonized institutional and legal regimes and optimal economic, social and environmental benefits. The overall aim of the project is:

“To enhance the quality of life of the people in the Mekong River Region by supporting environmentally sound development and sustaining and improving the values and functions of wetlands in the Mekong River Region”.

The expected outputs of the project are:

- a) Increased understanding of wetlands management issues at local, provincial, national and regional levels;
- b) Improved capacity of riparian countries to promote sustainable wetland and aquatic resources management;
- c) Improved linkages and networks on wetlands management between institutions at national and regional levels;
- d) Improved economic valuation of wetlands and wetlands resources;
- e) Strengthened capacity of relevant agencies to involve communities in sustainable use of wetlands resources;
- f) Improved capacity to integrate local management systems into institutional regulatory and planning processes;
- g) Improved institutional and legal frameworks for wetlands and aquatic resources management.





# Wetlands Protection and Management in Vietnam

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## Introduction

Vietnam is a signatory to the Convention on Wetlands (Ramsar, Iran 1971), which is concerned with the sustainable use of wetlands. This Convention defines wetlands as marsh, swamp, peat or waterbodies. The waterbodies may be natural or artificial, temporarily or permanently flooded with fresh or saltwater, stagnant or flowing water, and include shallow coastal waters of less than six meters in depth at low tide. Vietnam has an estimated wetlands of seven to ten million hectares of which five million are in the Red and Mekong River Deltas.

Owing to their importance, government agencies study and assess wetlands, particularly their use, protection and management. However, systematic research on a legal framework relating to wetland protection and management has yet to be elaborated. Recently, the Legal Division of the Ministry of Science Technology and Environment (MOSTE) (with the assistance of IUCN) conducted a review of current legislation on wetlands to provide the government with a basis for developing effective laws and regulations on wetland use.

## Legal Basis for Wetlands Protection and Management

Wetlands management is addressed in many current laws and regulations. Some matters have been indirectly or separately regulated through policy on agriculture, forestry, aquaculture, aquatic resource exploitation and environmental protection.

The Constitution of the Socialist Republic of Vietnam established public ownership of lands, forests, rivers, lakes, waterheads and underground resources in Article 19, 1980 and in Article 17, 1992. Wetlands are publicly owned. This concept was reinforced in the Land Law (Articles 1 and 18, and 42 to 49, 1993) which uses the term 'lands with waterbodies' (Article 48). The Land Law does not establish a separate framework for wetlands management or specify the precise meaning of 'lands with waterbodies', but includes wetlands as part of other specified lands (agriculture, forest). The Land Law affirms the need for environmental protection and unimpeded transportation on inland waters, the need to implement measures for land protection, enhanced sedimentation, ecological protection and avoidance of any obstacles to national defense and sea traffic safety in coastal waters. In forestry, the emphasis is on the ecological importance of mangroves and *Melaleuca* forests and appropriate measures for their protection, exploitation and development. These measures are reflected in:

- Decision 327-CT of the Chairman of the Council of Ministers (the Prime Minister) dated 15 September 1992 on policies for the development of barren lands and hills, coastal flats and waterbodies (called Program 327);
- Decision 773-TTg of the Prime Minister, dated 21 December 1994 on the program for exploitation and use of riverine, coastal flats and waterbodies in lowland areas;
- Decree 01-CP of the Government, dated 4 January 1995 regulating land allocation to State enterprises for agriculture, forestry and aquaculture purposes;
- Order 12-TTg of the Prime Minister, dated 6 January 1996 on the continuation of Decision 432-TTg dated 7 August 1995 for the protection and

development of mangrove on sediment flats in Ngoc Hien District, Minh Hai Province; and

- Order 286-TTg of the Prime Minister, dated 2 May 1997 on immediate measures for forest protection.

Wetlands management issues are also referred to in sections of the Land Law relating to the protection and exploitation of aquatic resources. As in the case of land management, wetlands are defined as ‘lands with waterbodies for aquaculture and aquatic resource exploitation’. Regulations are focused on encouraging economic exploitation of wetland resources and do not include a clear policy to address the protection, expansion or reduction of wetland areas. The creation of new wetlands resulting from the construction of dams, irrigation works, reservoirs, and aquaculture ponds has not been regulated by a legal framework. However, wetland protection issues have been covered under legislation on the protection and exploitation of aquatic resources and the prevention of damage to aquatic resources and pollution of habitats.

Since 1976, authorities have passed more than 500 regulations on environmental protection. Of these, about ten refer directly to wetlands, while the rest are regulated indirectly through general environmental legislation. Examples are regulations on the prevention of degradation, pollution and disturbances to wildlife, the maintenance of ecological biodiversity, the establishment of reserves and the procedures for land reclamation. The Law on Environment Protection (1993), for example, has contributed substantially to wetland preservation. The following laws relate directly to wetland protection:

- Order 169-CT of the Chairman of the Council of Ministers (the Prime Minister) dated 18 May 1992 on immediate measures for the protection of *Grus antigone sharpii* and the wetland ecosystem in Dong Thap Muoi;
- Decision 47-TTg of the Prime Minister dated 2 February 1994 on the establishment of the Tram Chim Wetlands Natural Reserve in Tam Nong District, Dong Thap Province;
- Vietnam Biodiversity Action Plan promulgated according to Decision 845-TTg of the Prime Minister dated 12 December 1995;

- Circular 2891/TT-KHM of MOSTE dated 19 December 1996 on guidelines for environment protection in Ha Long Bay;
- Decision 1026/1998/QD-TTg of the Prime Minister dated 13 November 1998 for the establishment of the Thanh Phu Wetlands Natural Reserve in Thanh Phu District, Ben Tre Province;
- Decision 253/1998/QD-TTg of the Prime Minister dated 29 December 1998 on upgrading the Tram Chim Wetlands Natural Reserve in Dong Thap Province to the Tram Chim National Park and approval of an investment project for the establishment of the Tram Chim National Park in 1999-2003.

The latter is a detailed action plan for biodiversity conservation. It contains regulations for wetlands with special emphasis on biodiversity, water pollution, and drainage. According to this plan, protected areas for important wetlands will be established in Ca Mau Province (Mekong River Delta) and in Tien Giang Lagoon. Along with the Biodiversity Action Plan other laws relating to biodiversity conservation have been passed, such as:

- Order 359-TTg of the Prime Minister dated 29 May 1996 on immediate measures for wildlife protection;
- Decree 78-CP of the Government dated 29 November 1996 on administrative sanctions on plant quarantine violations; and
- Order 1/1998/CT-TTg of the Prime Minister dated 2 January 1998 on strict prohibition on the use of destructive fishing methods (explosives and toxic compounds).

Regulations of the Government and the Prime Minister on the establishment, zoning, planning and protection of protected areas including national parks, natural reserves, natural landscapes and landscape villages such as Ha Long Bay, Xuan Thuy Natural Reserve (Nam Dinh Province), Tien Giang Lagoon and Tram Chim National Park. The Law on Water Resources has also contributed to wetlands protection but does permit some exploitation of water without authorization, including the use of surface water for agriculture, forestry, aquaculture and micro-hydropower production even though these uses can negatively affect the protection and management of wetlands.

## Legal Framework for Wetlands Protection and Management

An effective legal framework for wetland protection does not yet exist in Vietnam. Such a framework would provide a legal basis for specific regulations on wetland protection, management and use. Most of the current regulations are indirect and regulate wetlands through environmental protection, agriculture, forestry and aquaculture. A comprehensive framework is lacking. This has affected the protection and management of wetlands. Wetlands have been exploited to increase food production without adequate recognition of their other equally important environmental and economic functions. Government agencies are not fully aware of the special features of wetlands and instead, these agencies continue to apply a sectoral style of management, focusing on land use to exploit traditional products.

Following the signing of the Ramsar Convention, the importance of wetlands was more widely recognized by the public as a result of education and awareness programs. International assistance provided for wetland resource conservation has also contributed to a better understanding of the characteristics of wetlands and the consequences of environmental change. Recent laws directly regulating wetland management issues include:

- Decision 773-TTg of the Prime Minister, dated 21 December 1994 on the program of exploitation and use of riverine and coastal flats and waterbodies in lowland areas;
- Vietnam Biodiversity Action Plan (promulgated according to Decision 845-TTg of the Prime Minister) dated 12 December 1995; and
- Order 12-TTg of the Prime Minister, dated 6 January 1996 on the continuation of Decision 432-TTg dated 7 August 1995 for the protection and development of mangrove on sediment flats in Ngoc Hien District, Minh Hai Province.

These laws indicate an increasing awareness of the importance of combining economic objectives with natural resource and environmental protection. The diverse ecological functions of wetlands include flood and erosion control, biomass production and nutrient maintenance, micro-climate stabilization, recharging groundwater, development of ecotourism, provision for

waterway transportation, sediment retention, toxic materials reduction, typhoon and wave damage reduction. To ensure these functions, we propose the inclusion of a section on wetland protection and management in the Strategy for Environmental Protection during the Period of Industrialization and Modernization:

- To exploit wetlands in a sustainable manner;
- To promote international cooperation on wetland use;
- To implement a legal framework for wetland management and protection; and
- To provide a scientific basis for the formulation of laws and regulations by:
  - a) specifying development projects for wetland types
  - b) creating a collaborative mechanism for stakeholder involvement
  - c) conducting surveys and assessments to establish a master plan for wetlands
  - d) combining protection and development, especially protection against erosion in deltas and coastlines
  - e) organizing integrated management systems based on sustainable development, ecological protection, socio-economic development, population redistribution, transportation and tourism
  - f) providing instruction and guidelines for the development of integrated forestry and aquaculture production in wetlands, and
  - g) investing in wetlands development projects according to purpose, with priority given to protection of forests and protected areas such as Xuan Thuy, Tram Chim, Bac Lieu, Ca Mau, and the Tien Giang Lagoon

Along with investment, a strengthened mechanism for supervision, monitoring and control is needed to restore ecological balance and increase economic development. In the short term, the following issues should be prioritized:

- Training management and technical staff in wetland management
- Developing a public education plan on the importance of wetlands
- Forming a new land category (wetlands) with a specific management regime, and

- Assigning agencies and organizations to conduct research, make inventories, and conduct evaluations and monitoring of wetlands

## **Conclusion**

Vietnam is entering a new period of industrialization and modernization. The sustainable development of the country depends on many factors but one of the most important is the conservation of natural assets,

including wetlands. We propose that the government promulgate a decree on the protection and management of wetlands stating which institutions, organizations and authorities have the responsibility to make decisions. In the process of formulating a specific decree for wetlands, the Government needs to clarify sectoral regulations relating to wetlands. We suggest a review of current legislation relating to wetland management as a basis for wetland use and conservation.

# Status of the Mekong Delta: Agricultural Development, Environmental Pollution and Farmer Differentiation<sup>11</sup>

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## Abstract

More than half of the 4 million hectares of the Mekong Delta are covered by acid sulfate soils (ASS). Most ASS areas have been reclaimed for agricultural production during recent decades by means of new canals, new settlements, floodplain drainage, and new rice varieties and cropping systems. In 1996, agriculture occupied 83% of the total area of the Delta. Urban areas account for 10% of the total area. This leaves only 7% for natural or semi-natural wetlands. Rice is the dominant agricultural product and greatly contributes to the food security of the country. Rice exports have increased at an average rate of 4.6% per year (1990-1996), accounting for 15% of the national export earnings. Digging canals and drainage to remove acidity are prerequisites for reclaiming ASS for agriculture, but may create environmental problems such as soil acidification, acid water pollution and loss of functioning wetland ecosystems. The difficulties of farming on ASS and the unpredictable agricultural market often force farmers to sell their land, and many landless people are compelled by poverty to exploit the already diminished natural wetlands. This leads to further environmental degradation, pressure on natural ecosystems, and further poverty. In the future, strategies for sustainable development of the Mekong Delta should be based on balancing agricultural development and natural wetland ecosystem management.

## History of the Mekong Delta

### Geography and Early Development

The Mekong, one of the world's great rivers, flows from the Tibetan Plateau through, or along the borders of Myanmar (Burma), the Lao PDR, Thailand and Cambodia before reaching the sea. Its Delta covers 5 million ha, 80% of which lie in Vietnam. Chiem (1993)

divided the Delta into five land-form units: (1) floodplains, which include natural levees (up to 1m high) along the two main arms of the river; (2) a coastal complex of sand ridges, flats and mangroves; (3) a broad depression covering most of the Ca Mau Peninsula, which does not receive floodwater from the Mekong; (4) an old alluvial terrace in the far northeast; and (5) a small area of mountains.

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Floodplains and the broad depression of Ca Mau cover most of the Delta (Thach 1980, Chiem 1993). These low-lying lands are referred to henceforth as the depression areas. On most of these, sediments rich in pyrite (FeS<sub>2</sub>) were deposited on top of these sediments (Chiem 1993). Mekong floodwaters seasonally overtop the levees. Without artificial drainage, the lower-lying depression areas further from the river were permanently submerged as large areas retained ponded water, the level of which gradually dropped as the dry season progressed (Beilfuss and Barzen 1994). Such areas were very rich in biological resources (Duc 1991), with plant communities dominated by wetland forests and grasslands.

The historical development of the Mekong Delta has been dominated by paddy rice cultivation, with associated creation of canals and new villages. Access to the extensive wetlands of the depression areas was originally very difficult, and these environments remained long undisturbed as the few inhabitants lived on the riverbanks where natural resources were abundant and a thick layer of alluvial sediment was available for agriculture. However, from the mid-nineteenth century, during the French colonial period, canals were dug into the depression areas. Although some main canals were dug during the 1930s and 1940s, it was only after the end of the war in 1975 that the canal network was expanded at an unprecedented rate (Tuong et al. 1998).

The canals served to connect Central Provinces and Districts, but also made the depression areas accessible to settlers, who created more villages and hamlets on raised dikes along canals. Canals are now the major irrigation and drainage systems in the Delta, and also serve as transport routes. Excavation of canals continues today.

### **Changes since the 1970s**

The canals and associated agricultural activities dramatically changed the face of the Delta. Previously inaccessible and uninhabited areas were settled, and surface water drained quickly from the depressions. The average period of flooding in the depressions decreased from 12 months to between four and six months (Hanhart and Ni 1993), and only the lowest areas remained submerged all year round.

Where undrained depression areas were used for cultivation, the traditional method was the *Mua* system, using a transplanted, tall saturated rice variety in the shallowest areas only; rice was planted at the onset of the rainy season and harvested after the recession of the flood (Chiem 1993). Since the introduction of short duration, dwarf rice varieties in the Delta in the late 1960s and with improvement of water management systems, rice-cropping systems have changed completely over most of the Delta.

Farmers began to cultivate an early rainy season (*He-Thu*) crop from May to August, which is harvested before the flood. In the presence of canals supplying water for irrigation, farmers are also able to cultivate a dry season or winter-spring (*Dong-Xuan*) crop, in which rice is planted after the recession of the flood and harvested near the end of the dry season. In areas with intrusion of saline water into the canals, it is impossible to cultivate an irrigated dry season crop. However, where the rainy season is long enough, farmers cultivate an early rainy season crop (*He-Thu*) using early ploughing and dry seeding techniques, followed by a long-stemmed short duration variety (TM, or Middle *Mua*) harvested after the recession of the flood. On the levees, with unrestricted drainage and irrigation, triple rice cropping is possible (Tuong et al. 1989).

These changes from single to multiple rice cropping were made possible by the new canals, and driven by interrelated socio-economic changes, particularly population increases (partly through immigration), the national drive towards increased rice production (helped by tax incentives, available credit from banks and the policy of encouraging landless farmers to “tame the wild lands”), and the increase in rice exports under the new free market system.

### **The Mekong Delta in the late 1990s**

The population of the Mekong Delta in 1996 was 16.9 million (Department of Agriculture, Forestry and Fishery 1996), growing at around 2.2% per annum (data for 1990: NEDECO 1993). Broadly, the Delta consists of three main ecosystems. Towns and cities (defined as areas, including associated owned land, with population density over 600 per km<sup>2</sup>) cover 10% of the land area and support 30% of the population. Agricultural land, including rural villages and hamlets, covers 83% of the land area and supports 70% of the population

(Department of Agriculture, Forestry and Fishery 1996). Rice occupies 57% of the agricultural land, and 78% of the cropped land (Hossain 1998), although upland crops are also important locally. The third ecosystem, natural or semi-natural wetland, now covers less than 7% of the Delta, mainly in the depression areas (Nhan 1997).

## Environmental Problems

Reclamation of the depression areas of the Mekong Delta for agriculture has been critical in allowing a rapid increase in national rice production (4.6% annual growth; 1990-1996: Government of Vietnam 1996). The large socio-economic and environmental changes have led to environmental problems. Saline intrusion and soil acidification have increased (NEDECO 1993), storm or flood damage have been very severe since 1996 (Voice of Vietnam 1998), and natural ecosystem functions including biodiversity have been lost. During the onset of the rainy season, drain-off from the reclaimed ASS areas polluted a large part of the Delta.

These processes had little effect on the early settlements on the levees and in undrained depression areas with ASS in the early 1930s (Tri 1996). This is because: (1) on levees, pyrite-containing sediments were heavily overlaid with alluvium and the soil could be drained without danger of pyrite oxidation (van Breemen and Pons 1978), and (2) in the depressions, year-round flooding of shallower alluvial sediments prevented aerial oxidation of pyrite, and the traditional *Mua* rice-cropping system did not require drainage. Acidification was most severe on drained depression areas with ASS.

Many new settlers using canals to penetrate depression areas were from outside the Mekong Delta, and were unaware of the dangers of acid sulfate soils. They exploited and burned the original *Melaleuca* forests during the dry season and planted rice. These attempts usually failed. Rice seeds were killed by high toxin concentrations in the surface water and topsoil solution. When the seedlings survived, yields were generally very poor, usually below 0.5 ton ha<sup>-1</sup> (Tri 1996). Settlers abandoned their land to settle elsewhere and the original forest and diverse grassland ecosystems did not recover. Instead, the acid-tolerant sedge *Eleocharis dulcis* became dominant over wide areas and this contrasts

with the high species richness often found in some other grassland types in the Delta.

Overall, the changes of natural environmental conditions on agricultural lands in the ASS areas led to a rapid increase in soil acidification. Release of acidity and associated toxins affected ecosystems, and especially water resources, over a wide area. The process started with the arrival of the first settlers, and became more severe when national agricultural development targets took effect. It has become one of the major factors affecting land management in the Mekong Delta.

## Loss of Biological Diversity and Ecosystem Functions

The undrained wetlands of the depression areas were an important habitat for flora and fauna (Duc 1989). A few of the most biologically diverse and productive natural freshwater ecosystems in the Mekong Delta are strict nature reserves, covering a total of around 20 000 ha (Duc 1989; Safford et al. in press). Habitat alteration and intensive exploitation of remaining wetlands have resulted in population decline and extinction of numerous species that cannot exist year-round on paddy fields or are intolerant of intensive exploitation.

Recent surveys (Safford, personal observation 1996-1998) have failed to locate several rare waterbird species, such as Giant Ibis *Pseudibis gigantea*, Milky Stork *Mycteria cinerea* and Greater Adjutant *Leptoptilos dubius*, previously known in the Delta (Duc 1989). At the same time, the decline in habitat areas (Nhan 1997) has caused declines in valuable species such as wild rice *Oryza rufipogon*, so that genotypes that might have proven valuable in selective breeding have almost certainly been lost. Finally, services provided by the wetlands and their biodiversity (Safford and Maltby 1997), such as water purification and floodwater storage, have been reduced.

## Environmental Change, Poverty and Ecosystem Degradation

Despite receiving strong support from the central government for rice production, many new settlers were unable to adapt to the socio-economic and environmental changes that have affected the Mekong Delta in recent decades (Hossain 1998; Yamazaki and Ni 1999). Debts built up and the farmers were forced to sell their land in order to repay them. Landless



**Table 11. Comparison of Farmers' Income and Sources at Hoa An (a study site in Can Tho Province) and the Mekong Delta (Ni and Xuan 1998)**

	Unit	Mekong Delta (*)	Hoa An
<b>Income in VND (1VND = 0.00009083 US \$)</b>			
Income per household	1 000	6 804	4 235
Income per person	1 000	1 265	706
<b>Source of income</b>			
On-farm resources	%	41	40
Off-farm resources	%	56	53
Natural ecosystems	%	3	7

(\*) Source: Tien (1995)

farmers now constitute 15 to 20% of the Delta's population (Ni and Xuan 1998).

They have three main options for survival. The first is to remain and work for those farmers who still have land and have success in land management. Average income from such farm labour in the Mekong Delta is around 30% of the national average so those who select this option typically suffer extreme poverty. The second option is to migrate to towns and cities to look for work, but this is often fruitless, as urban unemployment is as high as 12% (Voice of Vietnam 1998). Finally, many turn to the harvest of natural resources in wetland ecosystems in order to supplement their incomes, or in some cases to provide their entire income. Data from a farming community at Hoa An, a typical acid sulfate soil area in Can Tho province, illustrates the dependence on farming, problems of poverty, the need to sell labour, and exploitation of natural resources (Table 11).

Also at Hoa An, knock-on effects such as competition between labourers for limited available work have damaged social relations within the community (Ni and Xuan 1998). Further damage to natural ecosystems results when migrants to towns and cities return to their villages and find that they can only survive by harvesting natural wetlands resources. This sequence of events results in ever-increasing pressure on natural ecosystems, environmental degradation and poverty (Fig. 3).

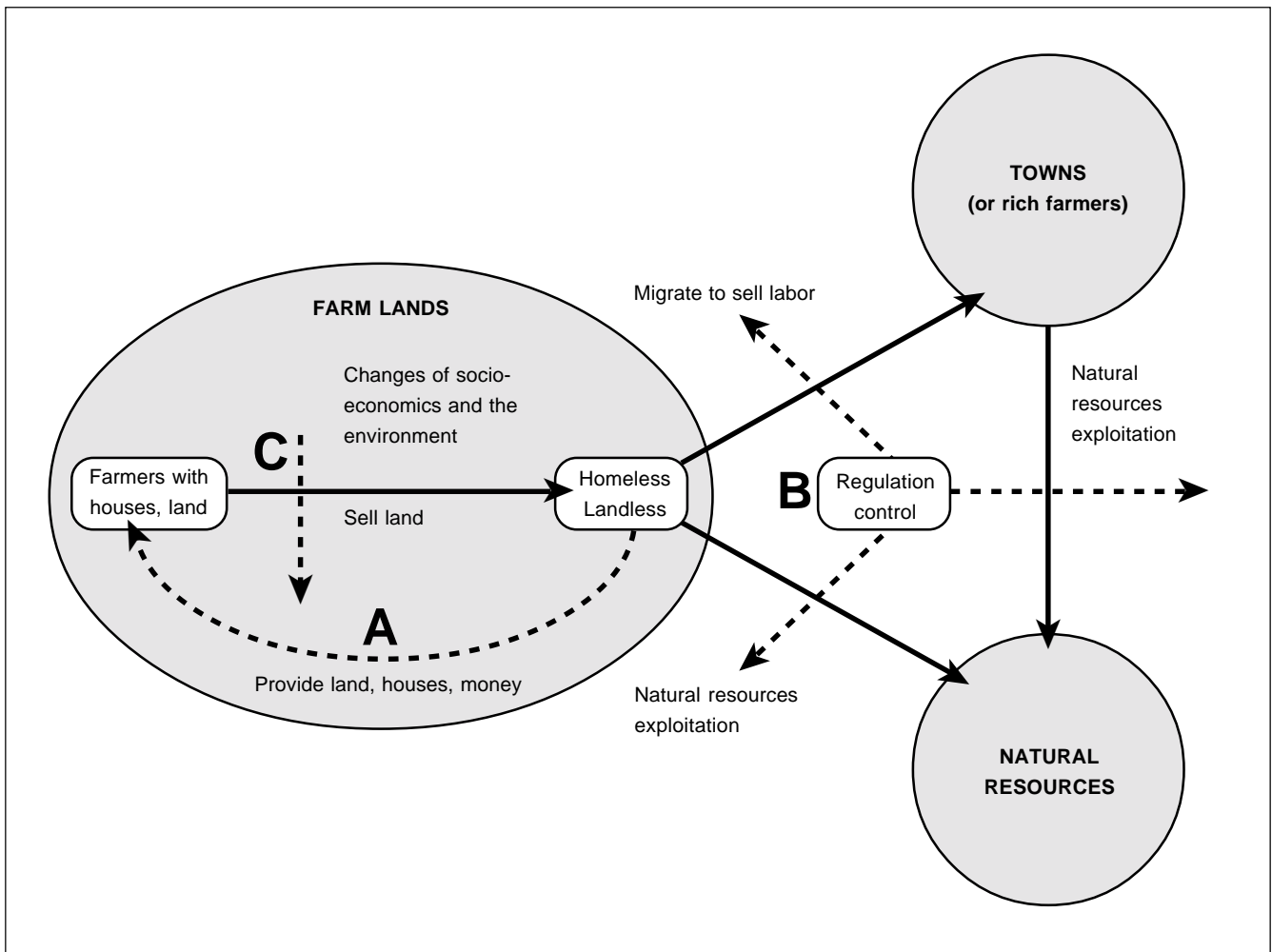
## Strategies for Management

For continued economic development to be achieved with minimal environmental degradation, the trend described above (Fig. 3) must be broken by cutting one or more of the links. Two strategies have commonly been used. The first is the provision of direct assistance (such as lands or loans) to landless people through poverty alleviation projects to avoid the need to move to towns or exploit natural resources (Fig. 3, Break A). Such an approach may fail if the ultimate causes of the changes are not also addressed. Recently landless people may lose their land or money again, and indeed, this often happens more rapidly than in the first instance (Yamazaki and Ni 1999).

The second approach (Fig. 3, Break B) is to use laws or force to protect natural resources, or to prevent migration to towns and cities. This is certain to cause resentment among genuinely needy people, and such laws or force are likely to be overcome or at least challenged.

The third approach (Fig. 3, Break C) is to try to avoid the need for farmers to sell their land by providing education, technical assistance and short-term financial assistance. This provision should be considered in balancing socio-economic development and natural resources management. In the Mekong Delta, sustainable development of agriculture can be achieved through an effective wetland ecosystems management.

Figure 3. Diagram illustrating the relation between poverty and natural resources in the Mekong Delta





# Managing and Classifying Wetlands in the Mekong River Delta

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## Introduction

The Mekong Delta encompasses eleven provinces in the southernmost part of Viet Nam. The total area is about 3.9 million hectares, or 12% of the total area of the country; including areas of marine water, the depth of which at low tide does not exceed six meters. The Delta includes numerous wetlands types such as marine and coastal intertidal mudflats, the estuaries of river mouths, inland floodplains and freshwater lacustrines or palustrines. Wetlands not only provide various types of foodstuff but also play an important role in conserving biodiversity and maintaining environmental balance. They create buffer zones between land and ocean, accumulate fertile silt from the Mekong River, reduce erosion and buffer against harmful effects of typhoons and other forces in the coastal zone, and provide habitats for aquatic organisms and wildlife. For these reasons, the need to find appropriate measures for conservation and wise use of wetlands are priority tasks in establishing a development strategy in the Mekong Delta.

Classification and mapping are the initial steps in the inventory and management of wetlands. There are many wetlands classification systems available. A good system should be suitable for creating wetlands maps at various scales and should also be flexible for application to economic and technological purposes.

In 1993, the Mekong River Commission Secretariat held a meeting to discuss a classification system for the Lower Mekong River Basin. A system was developed from that meeting and applied to inventory and mapping. Some categories were revised after viewing satellite color

prints, agriculture ecology, geomorphology, flooding and land use. Wetland classification maps were established for the Mekong Delta and two study sites.

In order to link the “Inventory and Management of Wetlands in the Mekong Delta” project with national wetlands management, the classification system is being revised and refined. This report discusses how to revise the wetlands classification system in the Mekong Delta.

## Wetlands Definitions in International Literature

There are about 50 definitions of wetlands in the world (Dugan 1990). Wetlands classification requires three attributes:

- (i) the transient land is suitable for most aquatic flora;
- (ii) the soil substratum is not almost dried; and
- (iii) the soil stratum is not clear saturated or inundated sometime during the growing season.

Almost all definitions consider wetlands as transitional ecological zones (ecotones), i.e. transitional areas between aquatic and dry environments. In these areas, inundated lands provide suitable environments for particular flora (Cowardin et al. 1979).

According to the Ramsar Convention (1971), wetlands are “areas of marsh fen, peatland or water, either 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” (UNESCO 1994).

The U.S National Wetlands Inventory defines wetlands as “land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or land covered by shallow water”. Wetlands must have one or more of the following three attributes:

- at least periodically, the land supports predominantly hydrophytes;
- the substrate is predominantly undrained hydric soil; and
- the substrate is non-soil and is saturated with water or covered by shallow water at sometime during the growing season of each year.

The Canadian Wetlands Registry defines wetlands as “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to a wet environment” (National Wetlands Working Group 1988). The New Zealand Department of Conservation defines wetlands as “a collective term for permanently or temporarily wet areas, shallow water and land margins. In Australia, wetlands are defined as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent, seasonal or cyclical, with water that is static or flowing, fresh brackish or salt including mudflats and mangrove areas exposed at low tide” and also as; “an area of permanent, seasonal or intermittent inundation, whether natural or otherwise;

fresh brackish or saline, static or flowing” ; “areas of seasonally, intermittently water-logged soil or inundated land, whether natural or artificial, with water that is static or flowing , fresh brackish or saline, where inundation by water affects the type of biota present”.

## Typical Wetlands Classification Systems

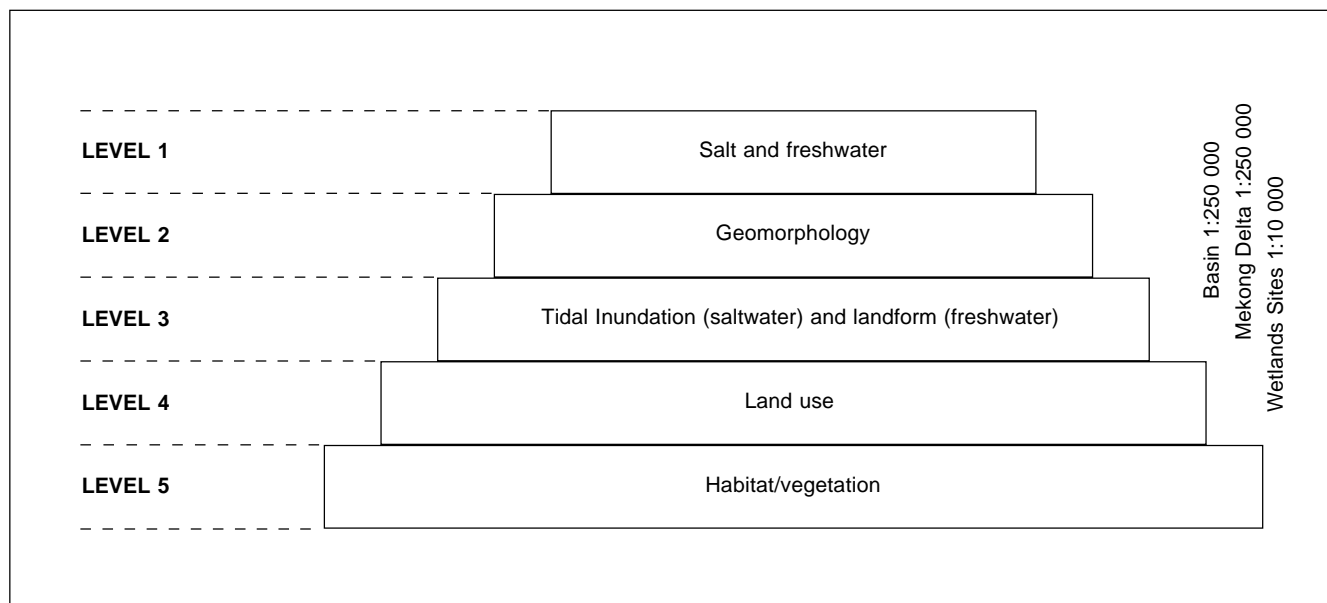
According to Handbook 7 of the Ramsar Handbooks for the Wise Use of Wetlands (Ramsar Convention Bureau 2000), 41 wetlands types can belong to one of three classes: Category 1: Marine/Coastal Wetlands, 11 types; Category 2: Inland Wetlands, 20 types; and Category 3: Artificial Wetlands, 10 types.

Wetlands types are based on water quality (salt, fresh), inundation levels, vegetation and landform. This is a very simple system with two levels (non-hierarchical) but it is not easy to determine wetlands boundaries on maps.

The wetlands classification system of IUCN (Fig. 5) (Dugan 1990) can be summarized as a hierarchical system of four levels as follows:

This system is more comprehensive than the Ramsar system. Information on geology (coastal, estuary) is included in Level 2. Information on hydrology

**Figure 4. Wetlands classification system proposed for mapping in the Mekong Delta**



**Figure 5. IUCN wetlands classification system (Dugan 1990)**

<b>LEVEL 1</b>	Saltwater						Freshwater						Artificial						
<b>LEVEL 2</b>	Marine			Estuary			Lagoon	Salt pans	Rivers		Lacustrine		Palustrine		Aquaculture	Agriculture	Salt Pans	Urban/Industry	Reservoir
<b>LEVEL 3</b>	Tidal	Intertidal	Tidal	Intertidal	Perennial	Temporary			Permanent	Seasonal	Emergence	Forest							
<b>LEVEL 4</b>	Combines 39 wetlands types, identified by geomorphology, soil types, land use, vegetation etc.																		

(inundation and inundated duration) is added in Level 3. However, artificial wetlands are grouped in a single category. Applied to the Mekong River Delta, all wetlands can be brought together in this category; more or less all wetlands are artificial or impacted by human activities.

### Mekong River Basin Wetlands Classification

The system proposed in 1993 by the MRCS (Fig. 6) does not classify artificial wetlands as a separate group. Instead, it is made up of five hierarchical levels.

### Classifying and Mapping Wetlands in the Mekong Delta

#### Fundamental Principle

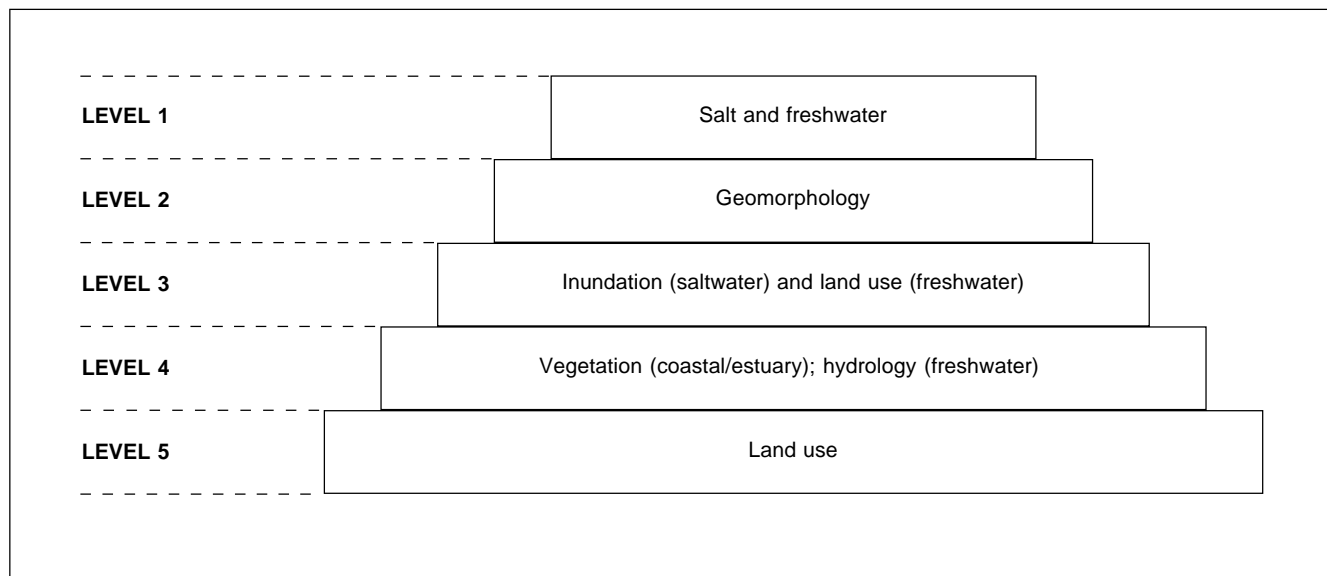
To develop the wetlands classification for the Mekong Delta, the following rules were approved by the wetlands team:

- Wetlands terminology is rooted in the Ramsar Convention. The convention recognizes the

interdependence of people and their environment and the ecological function of wetlands. Article 2.1 of the Convention states that “The boundaries of each wetland shall be precisely described and also delimited on a map and they may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands, especially where these have importance as waterfowl habitat” (UNESCO 1994). In so doing, the classification must be measurable in accordance with the objectives of the Convention.

- As indicated in Article 2.2, the importance of wetlands will be defined in terms of “ecology, botany, zoology, limnology or hydrology” (UNESCO 1994). Two concepts very clearly pointed out in the Ramsar Convention are conservation and wise use. Hence, the classification of wetlands should reflect this point of view. They should not be based on sectoral aspects such as fishery, agriculture or forestry management.
- As agreed by the wetlands team, the classification system in the Mekong Delta has to reflect the Ramsar approach. The wetlands classification should not only fit international classification systems but also the national classification system. The system should be simple and easy to adapt for use in mapping at

**Figure 6. MRCS wetlands classification system (MRCS 1993-1999)**



various scales by satellite photo interpretation and GIS techniques.

### **Wetland Classification**

Based on the above points and in reference to other international wetlands classification systems, the wetland classification system proposed by MRCS in 1993, and after making 3 different wetlands classification maps (scale 1:250,000 – for the whole delta – and at 1:25,000) of the Mekong Delta, the following was agreed:

- For maps using 1:250 000 scale, four hierarchical levels are used.
  - Level 1: Based on water quality (2 groups)
    1. Saltwater wetlands
    2. Freshwater wetlands
  - Level 2: Based on geomorphology (5 classes)
    1. Coastal and marine
    2. Estuarine
    3. Freshwater rivers
    4. Freshwater lacustrine
    5. Freshwater palustrine
  - Level 3: Based on geomorphology (11 sub-classes)
    1. Tidal (coastal/marine)
    2. Intertidal (coastal)
    3. Nontidal (coastal)
    4. Lagoon (coastal)
    5. Tidal (estuarine)
    6. Intertidal (estuarine)
    7. Nontidal (estuarine)

8. Non-regular inundated wetlands
9. Flood plain
10. Fresh lacustrine
11. Fresh palustrine

Level 4: Based on vegetation and land use (40 wetland types)

- For maps using 1:10 000 to 1:25 000 scale, five hierarchical levels are used
- At Level 5, sub-types are distinguished based on habitats (Fig. 4).

### **Mapping Materials and Methods**

#### **MATERIALS**

Wetlands maps of the Mekong Delta were produced using the following information and data:

Maps of physical factors

- geomorphology and sediments of the Mekong Delta at 1:250 000 (1989)
- topographical, USA's UTM at 1:250 000
- soil map of the Mekong Delta at 1:250 000
- surface water resources at 1:250 000 (1986)
- hydrological at 1:250 000 (1984, 1994 and 1996)

Photos and maps of land use and vegetation:

- satellite photos, LANDSAT-5TM (1-3, 1998)
- current land use maps at 1:250 000 (1998) of whole Mekong Delta and 1:100 000 for each province
- vegetation at 1:250 000

## METHODS

The methods involved were:

- Digitising maps of physical factors;
- Overlaying the available maps onto topographical maps to define the mega-classes and macro-classes to make the base map;
- Interpreting satellite photos and field checking land use types and comparing with historical land-use maps;
- Digitising land-use and vegetation information;
- Overlaying and matching the satellite information, land use and vegetation onto base maps and defining wetlands classes to make draft maps;
- Revising;
- Analysing and printing wetlands classification map and data.

## Conclusion

By applying three international classification systems for mapping wetlands in the Mekong Delta, the Vietnamese wetlands team developed a system using four hierarchical levels. Particularly, land use was

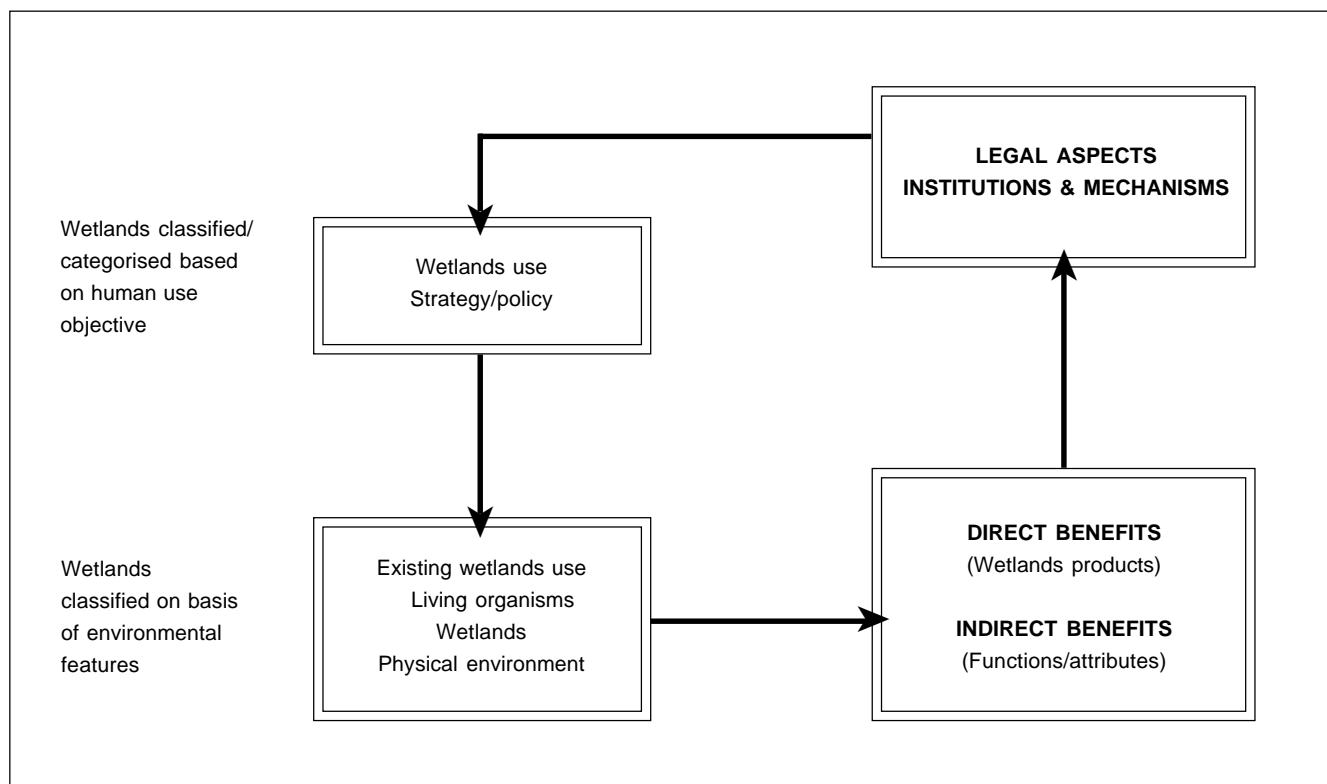
considered a factor in the classification system. The result is a detailed representation of wetland types, as shown in the map that appears on the front cover of this volume. Land use patterns clearly reflect physical characteristics of land and biological resources. This factor is easy to recognize on satellite photos.

It should be recognized that the natural (or original) wetlands have almost disappeared in the Delta. Even though some areas of *Melaleuca* forest in the inland swamps and some plots of mangrove have naturally regenerated in the new land along the coast, they are more or less disturbed by agriculture or aquaculture.

The classification system should be hierarchical and quantifiable. It should be flexible so that it can be linked to regional systems and made more detailed for smaller sites.

Wetlands classifying and mapping provides basic information for inventory and management of wetlands in the Delta. The connection between wetlands classification and other components in the management process is illustrated in Fig. 7.

**Figure 7. Wetlands classification in the Mekong Delta management process**





# ANNEX 1

## Ramsar Classification System for Wetlands Types

### Marine/Coastal Wetlands

- A Permanent shallow marine water
- B. Marine sub-tidal aquaculture beds
- C. Coral reefs
- D. Rocky marine shore
- E. Sand shingle or pebble shores
- F. Estuarine waters
- G. Intertidal mud, sand or salt flats
- H. Intertidal marshes
- I. Intertidal forested wetlands
- J. Coastal brackish/saline lagoons
- K. Coastal freshwater lagoons
- K(a) Karst and other subterranean hydrological systems

### Inland Wetlands

- L Permanent inland deltas
- M Permanent rivers/streams/creeks
- N Seasonal/intermittent/irregular rivers/streams/creeks
- O Permanent freshwater lakes
- P Seasonal/intermittent freshwater lakes
- Q Permanent saline /brackish alkaline lakes
- R Seasonal intermittent saline/brackish/alkaline lakes and flats
- Sp Permanent saline/brackish/alkaline marshes/pools
- Ss Seasonal/intermittent saline/brackish/alkaline marshes/pools
- Tp Permanent freshwater marshes/pools
- Ts Seasonal intermittent freshwater marshes/pools
- U Non-forested peatlands
- Va Alpine wetlands
- Vt Tundra wetlands
- W Shrub-dominated wetlands
- Xf Freshwater, tree dominated wetlands
- Xp Forested peatlands
- Y Freshwater springs, oases
- Zg Geothermal wetlands
- Zk(b) Karst and other subterranean hydrological systems, inland

### Artificial Wetlands

- 1. Aquaculture ponds
- 2. Ponds
- 3. Irrigated lands
- 4. Seasonally flooded agriculture land
- 5. Salt exploitation sites

- 6. Water storage areas
- 7. Excavations
- 8. Wastewater treatment areas
- 9. Canals and drainage channels, ditches
- Zk(c) Karst and other subterranean hydrological systems

## **ANNEX 2**

### **IUCN Wetlands Classification (Dugan 1990)**

#### **1. Saltwater**

##### **1.1 MARINE**

- 1. Sub-tidal
  - i) Permanent unvegetated shallow waters less than 6 metres depth at low tide, including seabay, straits
  - ii) Sub-tidal aquatic vegetation, including kelp beds, sea grasses, tropical marine meadows
  - iii) Coral reefs
- 2. Intertidal
  - i) Rocky marine shores including cliffs and rocky shores
  - ii) Shores of mobile stones and shingle
  - iii) Intertidal mobile unvegetated mud, sand or salt flats
  - iv) Intertidal vegetated sediments, including salt marshes and mangrove, on sheltered coasts

##### **1.2 ESTUARINE**

- 1. Sub-tidal
  - i) Estuarine water; permanent water of estuaries and estuarine systems of deltas
- 2. Intertidal
  - i) Intertidal mud, sand or salt flats, with limited vegetation
  - ii) Intertidal marshes, including salt-marshes, salt meadow, saltings, raised salt marshes, tidal brackish and freshwater marshes
  - iii) Intertidal forested wetlands, including mangrove swamp, nipa swamp, tidal freshwater swamp forest

##### **1.3 LAGOON**

- i) Brackish to saline lagoons with one or more relatively narrow connections with the sea

##### **1.4 SALT LAKE**

- i) Permanent and seasonal, brackish, saline or alkaline lakes, flats and marshes

## 2. Freshwater

### 2.1 RIVERINE

1. Perennial
  - i) Permanent rivers and streams, including waterfalls
  - ii) Inland Delta
2. Temporary
  - i) Seasonal and irregular rivers and streams
  - ii) Riverine floodplains, including river flats, flooded river basins, seasonally flooded grasslands

### 2.2 LACUSTRINE

1. Permanent
  - i) Permanent freshwater lakes (>8 hectares), including shore subject to seasonal or irregular inundation
  - ii) Permanent freshwater ponds (<8 hectares)
2. Seasonal
  - i) Seasonal freshwater lakes (>8 hectares), including floodplain lakes

### 2.3 PALUSTRINE

1. Emergent
  - i) Permanent freshwater marshes and swamps on inorganic soils with emergent vegetation whose bases lie below the water table for at least most of the growing season
  - ii) Permanent peat-forming freshwater swamps including tropical upland valley swamps dominated by *Papyrus* or *Typha*
  - iii) Seasonal freshwater marshes on inorganic soil, including sloughs, potholes, seasonal flooded meadows, sedge marshes, and dambos
  - iv) Peatlands, including acidophilous, ombrogenous, or soligenous mires covered by moss, herb or dwarf shrub vegetation, and fens of all types
  - v) Alpine and polar peatlands, including seasonally flooded meadows, moistened by temporary water from snowmelt
  - vi) Freshwater springs and oases with surrounding vegetation
  - vii) Volcanic fumaroles continually moistened by emerging and condensing water vapour
2. Forested
  - i) Shrub swamps, including shrub-dominated fresh marsh, shrub carr and thickets
  - ii) Freshwater swamp forest including seasonally flooded forest, wooded swamp on inorganic soil
  - iii) Forested peatlands, including swamp forest

## 3. Artificial Wetlands

### 3.1 AQUACULTURE AND MARICULTURE

- i) Aquaculture ponds, including fish ponds and shrimp ponds

### 3.2 AGRICULTURE

- i) Ponds including farm ponds, stock ponds, small tanks
- ii) Irrigated lands and irrigation channels, including rice fields, canals and ditches
- iii) Seasonally flooded arable land

### 3.3 Salt Exploitation

- i) Salt pans and salines

### 3.4 Urban/Industrial

- i) Excavations, including gravel pits, borrow pits and mining pools
- ii) Wastewater treatment areas, including sewage farms, settling ponds and oxidation basins

### 3.5 Water-storage areas

- i) Reservoirs holding water for irrigation and /or human consumption with pattern of gradual, seasonal, draw down of water level
- ii) Hydro-dams with regular fluctuation in water level on weekly or monthly basis

## ANNEX 3

### MRC Wetlands Classification System for the Lower Mekong Basin

Salt Water	Codes
<b>MARINE/COASTAL (M)</b>	
Subtidal	MS
1. Non-vegetated	MSI
Natural Subtidal Bare Marine	MS1
Subtidal Mariculture	MS1m
2. Vegetated/Coral	MS2
3. Subtidal Marine Coral	MS2a
4. Subtidal Marine Seagrass	MS2b
5. Subtidal Marine Seaweed	MS2c
Natural Subtidal Marine Seaweed	MS2c
Subtidal Marine Seaweed Farm	MS2cm
Intertidal	MI
1. Non-vegetated	MI1
Natural	MI1
a) Intertidal Coastal Beach	MIa
b) Intertidal Coastal Mudflat	MIb
c) Intertidal Coastal Cliff	MIc
d) Intertidal Coastal Saltflat	MIId
Artificial	MI1m
a) Intertidal Coastal Salt Works	MI1d
b) Intertidal Coastal Aquaculture	MI1md

2.	Vegetated/Coral	MI2
	a) Intertidal Marine Coral	MI2a
	b) Intertidal Marine Seaweed	MI2b
	c) Intertidal Marine Seaweed	MI2c
	Natural Intertidal Marine Seaweed	MI2c
	Intertidal Marine Seaweed Farm	MI2cm
	d) Trees/Shrubs	MI2d
	Coastal Mangrove Swamp	MI2d
	Coastal Mangrove Plantation	MI2
	e) Forbs/Coastal Saltmarsh	MI2e
	Nontidal	MN
	Nonvegetated	
	Nontidal Mariculture	MNm
<b>ESTUARINE</b>		<b>E</b>
	Subtidal	ES
1.	Nonvegetated	ES1
	Natural Subtidal Bare Estuarine	ES1
	Subtidal Estuarine Aquaculture	ES1m
2.	Vegetated /Coral	ES2
	a) Subtidal Estuarine Coral	ES2a
	b) Subtidal Estuarine Seagrass	ES2b
	c) Subtidal Estuarine Seaweed	ES2c
	Natural Subtidal Estuarine Seaweed	ES2
	Intertidal Estuarine Seaweed Farm	ES2cm
	Intertidal	EI
1.	Nonvegetated	EI1
	Natural	EI1
	a) Intertidal Estuarine Beach	EI1a
	b) Intertidal Estuarine Cliff	EI1b
	c) Intertidal Estuarine Saltflat	EI1c
	Artificial	EI1m
	a) Intertidal Estuarine Salt Works	EI1ma
	b) Intertidal Estuarine Aquaculture	EI1mb
2.	Vegetated/Coral	EI2
	a) Intertidal Estuarine Coral	EI2a
	b) Intertidal Estuarine Seagrass	EI2b
	c) Intertidal Estuarine Seaweed	EI2c
	Natural Subtidal Estuarine Seaweed	EI2c
	Intertidal Estuarine Seaweed Farm	EI2cm
	d) Trees/Shrubs	EI2d
	Estuarine Mangrove Swamp	EI2d
	Estuarine Mangrove Plantation	EI2dm
	e) Forbs/Estuarine Saltmarsh	EI2e
	Nontidal	EN
	Nonvegetated	
	Nontidal Estuarine Aquaculture	ENm

Coastal Lagoon	ML
Inland Salt Lake	MSL

## Freshwater

<b>RIVERINE</b>	<b>R</b>
River	
1. Perennial River	RR1
a) Pool in perennial river	RR1a
b) Channel in Perennial River	RR1b
Natural Channel in Perennial River	RR1c
Perennial Canal	RR1bm
c) With Perennial Rapid	RR1c
d) With Perennial Waterfall	RR1d
2. Seasonal River	RR2
a) Pool in Seasonal River	RR2a
b) Channel in Seasonal River	RR2b
Natural Channel in Seasonal River	RR2b
Seasonal Canal	RR2bm
c) With Seasonal Rapid	RR2c
d) With Seasonal Waterfall	RR2d
Riverine Banks/Beaches/Bars	RB
Riverine Floodplain	RF
1. Floodplain Grassland	RF1
Natural Floodplain Grassland	RF1
Man-Made Floodplain Grassland	RF1m
Floodplain Wet Rice	RF1ma
Other Floodplain Crops	RF1mb
2. Floodplain Trees/Shrubs	RF2
Natural Seasonally Flooded Trees/Shrubs	RF2
Man-made Seasonally Flooded Crops/Orchards	RF2m
3. Seasonal Floodplain Lake	RF3
4. Seasonal Floodplain Pond	RF4
5. Seasonal Backswamp/Marsh	RF5
Natural Seasonal Backswamp/Marsh	RF5
Man-made Seasonal Backswamp/Marsh	RF5m
Wet Rice in Seasonal Backswamp/Marsh	RF5ma

**LACUSTRINE**

Lake &gt;8 ha

1. Permanent Lake
  - Natural Permanent Freshwater Lake
  - Man-Made Permanent Reservoir
2. Seasonal Lake
  - Natural Seasonal Freshwater Lake
  - Man-Made Seasonal Reservoir

Pond &lt;8 ha

1. Permanent Pond
  - Natural Permanent Freshwater Pond
  - Man-Made Permanent Freshwater Pond
    - a) Freshwater Aquaculture Pond
    - b) Sewage Treatment Pond
    - c) Farm Pond
    - d) Cooling Pond
    - e) Borrow Pit, Excavated Pond
    - f) Others
2. Seasonal Pond
  - Natural Seasonal Freshwater Pond
  - Man-Made Seasonal Pond

**L**

LL  
 LL1  
 LL1  
 LL1m  
 LL2  
 LL2  
 LL2m  
 LP1  
 LP1  
 LP1m  
 LP1m  
 LP1ma  
 LP1mb  
 LP1md  
 LP1md  
 LP1me  
 LP1mf  
 LP2  
 LP2  
 LP2m

**PALUSTRINE**

Permanent Palustrine

- a) Permanently Flooded Grassland
- b) Permanent Freshwater Marsh, with Trees/Shrubs

Seasonal Palustrine

- a) Seasonally Flooded Palustrine
  - Natural Seasonally Flooded Grassland
  - Man-Made Seasonally Flooded Plantation
- b) Seasonally Freshwater Marsh, with Sedges
- c) Seasonally Freshwater Swamp, with Trees/Shrubs
  - Natural Seasonally Flooded Swamp
  - Man-Made Seasonally Flooded Plantation

**P**

PP  
 Ppa  
 PPb  
 PS  
 PSa  
 PSb  
 PSam  
 PSb  
 PSc  
 PSc  
 PScm

# ANNEX 4

## Wetlands Classification of the Mekong Delta (At 1: 250 000)

Major system	Sub-system	Wetlands Class
MARINE/ COASTAL	Sub-tidal	1. Bare marine sub-tidal
	Intertidal	2. Coastal mudflat
		3. Coastal aquaculture
		4. Coastal mangrove plantation
		5. Coastal salt marsh
	Nontidal	6. Coastal nontidal multiple rained
7. Coastal nontidal single rained wet-rice		
8. Coastal nontidal other crops		
9. Coastal nontidal grassland		
Coastal lagoon	10. Coastal saline/brackish lagoon	
Sub-tidal	11. Coastal saline/brackish lagoon	
ESTUARINE	Intertidal	12. Bare estuarine sub-tidal
		13. Estuarine mudflat
14. Estuarine salt works		
15. Estuarine aquaculture		
16. Estuarine mangrove plantation		
RIVERINE	Nontidal	17. Estuarine salt marsh
		18. Estuarine sandy ridge
	River	19. Estuarine nontidal multiple rained crops
		20. Estuarine nontidal single rained wet-rice
		21. Estuarine nontidal other crops
		22. Estuarine nontidal grassland
		23. Estuarine nontidal aquaculture
River banks/bars	24. Perennial river and canal	
Riverine Floodplain	25. Riverine banks and bars	
LACUSTRINE	Lake	26. Floodplain grassland
		27. Floodplain multiple irrigated wet-rice
PALUSTRINE	Seasonal palustrine	28. Floodplain single rained wet-rice
		29. Floodplain wet-rice rotated with upland crops
		30. Floodplain other crops
		31. Seasonally flooded <i>Melaleuca</i> plantation
		32. Seasonally flooded orchards/plantation
		33. Permanent <i>Melaleuca</i> forest reservoir
		34. Seasonal reservoir
		35. Seasonal flooded grassland
36. Seasonal flooded <i>Melaleuca</i> plantation		
37. Seasonal flooded single wet-rice		
38. Seasonal flooded multiple irrigated wet-rice		
39. Seasonal floodplain wet-rice rotated with upland crops		
40. Seasonal flooded other crops		





# Institutional and Policy Issues of Wetlands Management in Ben Tre Province, Vietnam

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Ben Tre Province

## Introduction

Ben Tre is a coastal province in the Mekong Delta. It borders Tien Giang Province in the North, Tra Vinh and Vinh Long Provinces in the West. Ben Tre covers 2 287 km<sup>2</sup> with a population of 1.4 million and a density of 613 per square kilometer. With 65 km of coastline and a dense network of rivers and canals, the province has diverse wetlands and rich aquatic resources (Fig. 8).

## Distribution and Characteristics of Wetlands in Ben Tre

Wetlands are found in three coastal districts with a total area of 32 000 ha. The distribution is as follows:

Mangrove forest land	14 032 ha
Aquaculture	13 885 ha
Aquaculture and salt works	1 185 ha
Mud flats, riverine and coastal waterbodies	3 000 ha

The topography is laced with a network of natural rivers and canals. The coastline is dynamic, reflecting both erosion and sedimentation. Sedimentation has led to land expansion in the area toward the sea. The province can be divided into sub-regions according to three levels of saltwater invasion. In low elevation zones, saltwater can reach about 60-100 cm; in medium elevations about 20-60 cm and higher zones can be partly submerged only at high tide. Flooding is the main factor affecting

vegetation distribution. Mangroves are considered the most important wetlands ecosystem of the province. Research from different institutions and universities presented during the "Project to Establish the Thanh Phu Natural Reserve" provided a list of species found in the province's wetlands.

The mangroves flora consists of 119 species, belonging to 45 families of which 10 species have been planted by local people and about 100 species occur naturally. The most numerous species are *Avicenia* spp., *Sonneratia* spp., *Rhizophora* spp., *Nipa fructicans*, *Exoecaria agallocha* and *Acanthus illicifolius*. The Fauna includes 27 species of reptiles, 8 species of amphibians, 16 species of mammals and 60 species of birds. Aquatic resources include 185 species of phytoplankton, 93 species of zooplankton, and 90 benthos species. Twenty species of shrimp and prawn have been identified (12 saltwater, 8 freshwater). Ninety-six species of fish have been identified (63 saltwater, 30 brackishwater and 3 freshwater).

## Institutions and Policies for Wetlands Management in Ben Tre Province

### Institutions

Following re-unification in 1975, the People's Committee of Ben Tre Province assigned provincial agencies to implement wetland management measures. Relevant departments included the Department of Agriculture, Department of Forestry, Department of Land Administration, Department of Fisheries and Department of Science, Technology and Environment.

These agencies were to develop plans for the exploitation, protection, and development of wetlands and submit them to the Provincial People's Committee to decide land allocation for projects and to establish Steering Committees or Management Boards to implement the plans. The Vice Chairman of the Provincial People's Committee is the head of the Board and has responsibility for problem resolution during implementation. The Management Board includes members from relevant departments.

### **Policies**

During implementation, conflicts develop between central and local governments and among the sectors over policy interpretation. To resolve these conflicts, the Provincial Party Committee and the People's Committee developed guidelines and directives confirming the roles and responsibilities of the departments. The wetlands has, by and large, been used for forestry and aquaculture, but to attain sustainable development objectives and to prevent conflicts, master plans for agriculture, forestry and the fishery were established and implemented.

A Forestry, Fishery and Coastal Protection Project for the province was implemented under the National Program 327-CT of the Central Government for barren land development. The project created a forest protection belt along 65 km of the coastline of Binh Dai, Ba Tri and Thanh Phu Districts. It is now a forest resource protecting the area from waves, shifting sand, erosion, and provides other positive environmental and socio-economic influences for local people.

To reduce illegal cutting and ensure the forest remains cared for, each section of the forest (about 2 850 ha) is allocated by contract to households and collectives. About 1 000 ha of forest is managed by the Ben Tre Forestry and Fishery Enterprise to continue reforestation and protection and for forestry and aquaculture development. This is an attractive area to visit, to study, and for the development of demonstration models.

The Provincial People's Committee enforces the Law of Forest Protection and Development to protect the forests, to prevent deforestation for shrimp farming and to prosecute violations. At the same time, it attempts to stabilize the livelihoods of forest dwellers and reduce

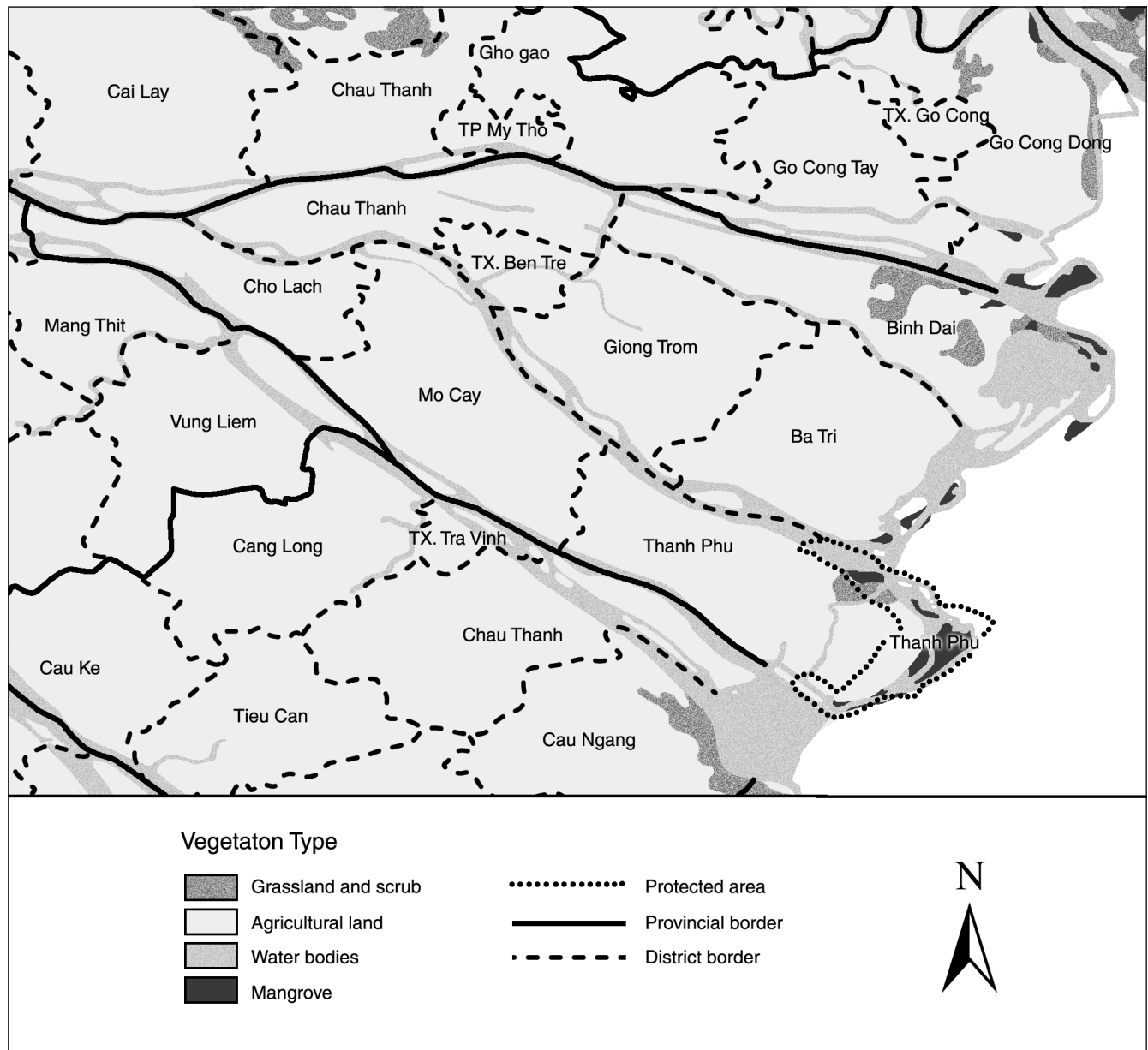
economic pressures on forest resources.

In implementing decisions 327-CT and 773-TTg, policies have been applied that avoid conflicts and the overlapping of projects which can lead to wetlands being lost. The province is hoping for sustainable development and with the assistance of universities and research institutions, a plan to mix mangroves development with aquaculture planning has been developed. In this blend of forestry and aquaculture systems, an area (75-85% of the total area) of mangroves is maintained. The remaining waterbodies are for aquaculture. This combination ensures that economic, social and environmental objectives are met.

The Law of Forest Protection and Development and the Regulation for Protecting Aquatic Resources in Coastal Areas have been implemented successfully. In 1987, the Government promulgated policies on the use of wetlands. Since then, protected areas have been established in some provinces in the Mekong River Delta, such as the Tram Chim National Park in Dong Thap Province and bird sanctuaries in Minh Hai Bac Lieu, and Dam Doi. In this context, the Provincial People's Committee and the Provincial Forestry Department have collaborated with national institutions and international organizations to conduct a study in Thanh Phu District. Since 1991, with the support of the Ministry of Forestry (now the Forest Department of MARD), an integrated study on wetlands has been conducted. The province decided that 1 18 ha of swampy forest land in Sector 16 of the Thanh Phu Forestry Enterprise would be used for the study area although the area had a high potential for forestry and aquaculture development. The results provided a basis for the establishment of the Thanh Phu Wetlands Natural Reserve. In 1998, the Government approved the Thanh Phu Wetlands Natural Reserve by decision 1026/QD-TTg dated 11 November 1998 with an area of 8 825 ha including 4 510 ha of protected area and 4 315 ha for the buffer zone. The province allocated land to the Project Management Board by decision 2929/QD-UB dated 29 April 1999, along with decisions relating to organization and personnel matters.

The Vam Ho Bird Sanctuary in Batri District is also a reserve with high biodiversity and attractive ecotourism potential. This area is seasonally flooded. The vegetation is dominated by *Nipa fruticans*, *Rhizophora*

Figure 8. Existing and proposed protected areas in Ben Tre Province<sup>13</sup>



*apiculata*, *Phoenix paludosa*, *Avicenia alba*, *Acanthus illicifolius* and ferns, and provides a habitat for animals, especially two bird species: *Ardeola speciosa* and *Nycticorax nycticorax* in Thanh Phu District.

13 This map is provided courtesy of Sub-FIPI.



# Proposals for a National Strategy on Sustainable Management of Wetlands in Vietnam

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National strategies need to be established in order to develop measures for the sustainable exploitation of natural resources. Wetlands are particularly important.

## Legal Foundations

The present strategy is based on:

- The Law on Environment Protection, approved by the National Assembly on 27 December 1993;
- The National Action Plan for Biodiversity, approved by the Prime Minister in December 1995;
- The National Action Plan for Environment 2001-2010;
- The Biodiversity Convention; and
- The Ramsar Convention.

## Long-Term Objectives

- To promote sustainable use of wetlands; and
- To conserve the biodiversity of wetland ecosystems.

## Immediate Objectives

- To stop unsustainable uses of wetlands; and
- To stop the conversion of wetlands without a scientific basis.

## Basic Principles

The conservation of biodiversity in general and of wetland ecosystems in particular should be an important element of all master plans and policies for the sustainable development of Vietnam. The strategy for protection and sustainable development of wetlands needs to be consistent with the national strategy for environment and resource protection and with international conventions to which Vietnam is a signatory.

Strategies for the protection of wetlands are based on preventing the reduction of wetland areas and by maintaining their ability to moderate the surrounding environment. The strategy also promotes the participation of local people, government officials, and other stakeholders.

## Policies and Laws

The government needs to develop and issue a clear law on wetland management that will identify who has responsibility for its conservation and exploitation. Wetlands development needs to be in accordance with objectives, and measures for control and supervision and monitoring need to be implemented. The law should identify a mechanism for collaboration among sectors and develop common objectives for the sustainable use of wetlands. A public awareness campaign should be conducted to highlight the

importance of wetlands. Use tax should also be imposed on those using the waterbodies for aquaculture and this tax should be different from the tax for using the agricultural lands. Finally, there should also be policies to encourage the local people to invest in sustainable production and to prevent calamities.

## Zoning and Planning

Vietnam currently has a food surplus. It is therefore unnecessary to exploit all potential agricultural land for food production. Consideration should be given to an integrated land use plan. Wetlands have both environmental and economic uses. To establish appropriate management measures for each wetland type, a wetlands classification system needs to be developed. In addition to wetland rice areas, watersheds along rivers, estuaries, lagoons, coastlines and lakes need to be zoned and planned for sustainable use while maintaining their natural features. Building dikes to expand land area needs to be studied carefully. In selecting options for wetland use, priority should be given to the conservation of land, aquatic resources and other environmental conditions. Hydrological plans to reclaim and convert wetlands to agricultural production need to be based on an integrated assessment. Economic growth has contributed to increased river pollution which can lead to shortages of water and aquatic resources for daily use by the residents. Economic development in watersheds needs to ensure clean water is available for domestic use. The use of lagoons and estuaries for aquaculture development needs to consider natural currents.

## Managing Organizations

Currently, the following organizations have a mandate affecting wetlands.

- MARD is responsible for overall state management of wetland rice areas and protected forest areas.
- MOF, Ministry of Industry and MARD manage large waterbodies for irrigation and hydropower.
- MOF collaborates with other ministries in planning wetland resource development.
- MOSTE collaborates with other Ministries and Provincial authorities to:
  - ~ Propose rules and regulations;

- ~ Zone wetlands of national and international importance;
- ~ Provide professional and technical guidelines on matters of conservation; and
- ~ Produce submissions for the Government on issues relating to wetland protection and use.

## Sustainable Use and Rehabilitation of Wetlands

The objective of sustainable use of wetlands is to ensure that the biodiversity of these ecosystems is maintained.

### Shallow Gulfs and Seas

Shallow gulfs and seas are habitats of high economic value. Controlled exploitation must ensure that resources are not depleted. Coral reefs, submerged rocks and seagrasses protect the coastline, provide important habitats and can be developed for ecotourism. These areas should be zoned to prevent damage to coral reefs and seagrasses. The exploitation of dead coral for construction materials should not disturb the coastline. The exploitation of offshore minerals should be strictly controlled and prohibited in coral reef areas. Measures to prevent land-based pollutants from reaching the sea should also be implemented.

### Estuaries and Tidal Flats

Estuaries and tidal flats, especially in the Red and Mekong Rivers, are areas of high biological productivity. The livelihoods of millions of people in the coastal areas depend on the quantity and quality of these resources. Intervention is needed to stabilize estuarine ecosystems. Consideration should be given to stop the expansion of agricultural land by building dikes in mangrove areas, stop exploitation that leads to a reduction of wetlands, limit the creation of industrial zones or resettlement areas, increase productivity and quality of salt marshes, and to reduce their area in low tidal areas. Programs to ensure the free flow of currents in tidal flats to minimize sedimentation should be undertaken. The removal of dams in some river zones and limits on canal construction should also be considered, as well as the removal of dikes surrounding low efficiency reclaimed lands with the view to reforesting them with suitable species. Prevention of water pollution should also be prioritized.

### **Wetlands Surrounding Small Islands**

Coral reefs and seagrasses surrounding islands provide feeding grounds and habitats for organisms and maintain biodiversity. These areas are usually attractive for ecotourism. Exploitation of coral reefs for handicrafts should be strictly prohibited. Tourist activities on islands and the surrounding sea should be strictly managed to prevent degradation. Maps showing the distribution of coral reefs need to be designed and distributed to inform and involve local people in coral reef protection. The exploitation of minerals, infrastructure construction and digging canals leading to coral reef degradation should be prohibited.

### **Sand Dunes and Beaches**

Information on the dynamics and ecology of sand dunes and beaches in Vietnam is very limited, despite the fact that materials from these are being used in building construction. These areas are also important for tourism. Some of their management issues concern overexploitation and water pollution. Afforestation of protective forests on moving sand dunes needs to be developed. In areas where there is heavy sand mining, environmental restoration needs to be implemented. There is also a need to protect the breeding sites of marine animals on wet sandy beaches.

### **Saltwater Swamps and Mangrove Forests**

The mangroves cover in Vietnam has been seriously reduced. Measures to stop mangrove exploitation (at least for the next 10-15 years) must be undertaken to give the forests time to recover. There should be strict prohibitions on the conversion of mangroves to shrimp farms. The mangroves cover should be 70-75% of the total area. Mangroves protect coastlines and rivers from erosion and the impacts of typhoons. Restoration of seriously degraded wetland ecosystems and the gradual reduction of large-scale shrimp farms should be undertaken.

### **Coastal Lagoons of Salt or Brackishwater**

Lagoons are generally environments high in natural resources and require appropriate management to ensure sustainability. Measures to prevent pollution and unregulated changes in lagoon use should be implemented.

### **Salt Marsh (artificial wetlands)**

All coastal provinces have salt marshes. It is projected

that salt production will be three to four times the current value by 2010. The southern part of the central coastal area should receive priority for expansion of this industry. Expansion should be restricted in other areas.

### **Fish and Shrimp Ponds**

Fish and shrimp farming in freshwater and brackish-water environments are increasing, especially shrimp farming in the tidal flats along estuaries and lagoons. But deforestation due to mangroves conversion into ponds impedes sustainable development. Hence, it should be prohibited.

There should be a re-conversion of coastal rice fields which were flooded for fish and shrimp farming into mangrove areas. Areas not favorable for rice production (i.e. high acid sulfate soils) should be used for saltwater or brackishwater fisheries.

### **Rivers and Springs**

The maintenance of water flows is necessary to provide for flood control and transportation. Measures for such maintenance include the protection and restoration of watersheds, the regulation and control of shipping, and regulations on fishing and aquaculture.

### **Natural Lakes and Ponds of Salt or Freshwater (greater than 2 ha)**

There are six important natural lakes in Viet Nam:

- West Lake, Hanoi
- Chu, Phu Tho Province
- Ba Be, Bac Kan Province
- Bien Ho, Gia Lai Province
- Lak, Dak Lak Province, and
- Bien Lac, Bing Thuan Province

The formation of these lakes reflects the geological and hydrological processes in different regions. They are specific aquatic ecosystems with rare species and provide habitats for migratory and local birds. In these lakes, the maintenance of natural conditions and prevention of human interference is required.

Conversion of these lakes for short-term benefit without careful consideration of the environmental impact should be prohibited. Freshwater swamps are habitats for migratory birds and as such, these aquatic resources must be maintained to ensure an adequate food supply.



### **Artificial Reservoirs**

Artificial reservoirs regulate water for irrigation, hydroelectric power, flood control, transportation, tourism, domestic water supply and aquaculture. The most important issue in the management of these multi-purpose reservoirs is to protect the water quality by controlling the use of pesticides on agricultural lands surrounding the reservoirs. Other issues include the prohibition of mineral exploitation in the reservoirs, the protection of the watershed, controlling the use of manufactured feed material for aquaculture and regulations on shipping to prevent pollution from ship waste disposal and oil leakage.

### **Inland Drainage Systems**

Vietnam has a dense distribution network of springs, rivers and canals that support a diverse wetlands ecosystem. This network is also the drainage system and water supply for irrigation and domestic use in rural areas. Measures to protect this system include a reduction in the direct disposal of domestic waste and the controlled use of pesticides in agriculture. Other measures include the control and treatment of wastewater from industry and limiting the speed of boat traffic in canals suffering from bank erosion to prevent erosion and flow obstruction.

### **Seasonally Flooded Forests**

Seasonally flooded forests include *Melaleuca* forests, swamps and grasslands. This type of wetlands is found mainly in the Plain of Reeds. Their most important value is in recharging the groundwater and preventing the upward movement of acid sulfate to the topsoil. They also help regulate flooding. The biodiversity of these forests is also high. Objectives in managing these wetlands include the maintenance of the total area, preventing clearcutting of *Melaleuca* forests, and preventing the drying-out of swamps for agriculture.

### **Agricultural Wetlands and Irrigated Lands**

These areas are important artificial wetlands in Viet Nam. After a long process of reclamation, they become rice agro-ecosystems with a network of irrigation and drainage. The management of these wetlands includes the maintenance of existing areas of wetlands rice, prohibition of the conversion of wetlands rice areas to other uses, and avoiding rapid conversion of unstable tidal flats to wetlands rice.

### **Peat Deposits**

Peat deposits are formed under *Melaleuca* forests and seasonally flooded swamps. Peat is a high calorie fuel and a raw material in the production of fertilizer. Peat deposits play an important role in retaining and filtering freshwater. Ecological values of peat deposits need to be assessed before exploiting them for fuel or fertilizer production. Following exploitation, vegetation cover on the site needs to be restored.

### **Land and Water Management**

Stable wetlands already zoned are allocated to households to encourage them to invest in sustainable resource use. Unstable wetlands (tidal flats in estuaries and coastlines) are managed directly by the commune PCs and are not allocated to households.

### **Conservation of Biodiversity**

Conservation of wetlands biodiversity is an important component of the protected area system in Vietnam. There is a need to establish a network of protected areas of appropriate size and representing important ecosystems. Inventoried in 1999, seventy-nine wetlands areas showed high biodiversity values. Various ministries and provinces will suggest areas for protection and collaborate with MOSTE to have them listed as protected areas in the system.

## **Environmental Impact Assessment**

According to the Law on Environmental Protection and Decree No. 175/CP, all development projects in or affecting wetlands need to have an environmental impact assessment (EIA).

## **Pollution Control**

Wetlands identified for pollution control will be designated as “strictly protected areas”.

## **Research and Survey**

Biophysical and economic research should be undertaken on the sustainable use of wetlands. The use of modern technologies in the cultivation, exploitation, and processing of natural resources and for pollution

control should be accelerated, and the practices of exploitation of natural resources improved. Forecasting and warning procedures to alert authorities when degradation of wetlands becomes apparent need to be developed and surveys conducted including periodic inventory of wetlands and assessments of their economic value.

## **Awareness**

Appropriate educational programs aimed at specific target groups need to be developed and the media must be involved in order to increase their understanding on the importance of wetlands. Industries receiving direct benefits from wetlands must be encouraged to contribute financial support to awareness programs.

## **International Cooperation**

Vietnam needs international assistance to protect and conserve its wetlands. Up to now, the country has faced difficulties in understanding the diversity and complexity of its wetlands and developing management options and allocating capital for their management. Priority should be given to wetlands of high national or international value, containing important ecosystems and rare species, and to wetlands in sensitive areas, especially those having important positive influences in environmental regulation.



# The National Policy to Rehabilitate and Develop 5 Million Hectares of Forests and Other Issues on Wetlands

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## Background

The National Program to Rehabilitate and Develop 5 Million Hectares of Forests was approved by the National Assembly during its Second Session. Objectives, targets, policies and organizational structure for the implementation of the program were then determined by Decision No. 661/QD/TTg dated 29 July 1998.

## Objectives

The program will end in 2010 with five million hectares reforested and 9.3 million hectares protected; an increase in forest cover from 28% to 43%. This increase will ensure ecological security, increase freshwater generation, and conserve genetic resources and biodiversity of the tropical forests. The program will create two million permanent jobs, contribute to hunger eradication and poverty alleviation, promote agriculture, and enhance political and social stability. The program will provide an annual supply of 15 million m<sup>3</sup> of timber and 20 million steres (m<sup>3</sup>) of firewood, provide raw material for the production of 1 million t of paper, and 1 million m<sup>3</sup> of board to meet domestic and international demands. The program was mandated to rehabilitate 2 million hectares of special use and protected forests including natural regeneration, and to plant one million hectares of forests in watersheds creating wind breaks, fixing sand dunes and protecting coastal dikes. Three million hectares will be planted in production forests of which

2 million hectares will produce raw materials for pulp and paper, poles and posts for mining, timber and non-timber forest products and 1 million hectares will be planted to fruit trees and other perennial crops. Fifty million seedlings per year will be planted around offices, schools, along roads and canals to create additional sources of timber and firewood. The schedule for new planting is 700 000 ha (1998-2000), 1 300 000 ha (2001-2005) and 2 000 000 ha (2006-2010). Natural regeneration is scheduled at 350 000 ha (1998-2000) and 650 000 ha (2001-2005). The program is a continuation of previous reforestation efforts and combines natural regeneration with reforestation and the establishment of new forests.

## Organization

At the national level, a Steering Committee was established to assist the Government in the implementation of the program. The Committee is chaired by the Vice Prime Minister and assisted by the Minister of MARD. The committee includes representatives from the Ministry of Planning and Investment, the Ministry of Finance, the Committee of Ethnic and Mountainous Regions, the Farmers' Association and the Young Communist League. The National Project Management Board was established to support the Steering Committee in implementing the program. It is chaired by the Vice Minister of MARD and includes representatives from several departments of MARD as well as other ministries. The Permanent Project Office was established as a specialized body and

located at the Department of Forestry Development. At the provincial level, a provincial Steering Committee was established to support the provincial People's Committee (PC) and chaired by the Deputy Chairman of the PC. The provincial Project Management Boards are located at the MARD or the provincial Sub-Department of Forestry Development.

At the local level, governments are organizing projects according to forest use and implementing regulations to facilitate planning. The program has been implemented in 57 of 61 provinces. Planning contributes to communication between levels of government and local communities.

### **Selection of Project Managers**

All organizations and individuals in Vietnam having an approved project and an area of allocated, contracted or hired land can be selected as project managers for production forests. Special use and protection forests are managed by the state. A project manager at local level has the responsibility for managing and supervising the project. Households participating in the project have planting costs reimbursed and they share benefits according to regulations. Households may benefit in a number of ways; develop fixed agriculture programs in protection and special use forests, earn wages in protection forests, and harvest firewood, thinning, and non-timber forest products in protection forests.

### **Species Composition**

The selection of species and composition to be planted are based on the functional objectives of the forests. In special use forests, the objective is ecosystem restoration, therefore, native species are selected. In protected forests, the objective is to realize multiple use potentials, therefore, fruit trees, species providing special products and industrial use trees are selected. In production forests, the selection of species is based on soil, climate, accessibility, processing requirements and market demand for products.

## **Policies**

### **Land Use Policy**

An inventory of agriculture and forest land was conducted to establish a land use plan for the three

forest types. This forms the basis for the establishment of new projects and the evaluation of on-going projects. This facilitates the issuance of land use right certificates to organizations, households and individuals.

### **Investment and Credit Policy**

The following types of investments come from the national budget:

- 2 million VND (US \$140)/ha for planting precious and rare species in production forests;
- 2.5 million VND (US \$175)/ha for planting and maintenance for three years in protection forests;
- 50 000 VND (US \$4)/ha/yr for a maximum of five years for silvicultural measures in protection forests; and
- 1 million VND (US \$ 70)/ha over six years (maximum) for enhancement of natural regeneration.

Infrastructure investments are limited to creating facilities for silviculture such as fire control, pest eradication and nurseries at a rate not more than 5% of the total annual investment for the program. Project management costs are estimated at 8% of the total investment. Credit is available for investment in production forests and less critical protected forests. Loans with favorable conditions are available up to a maximum of 70% of the total investment in the project. Investors may also benefit through a reduction of land use tax of 50% to 100% depending on the areas' accessibility. Investors use the land use certificates as a guarantee for loans.

### **Tax Policy**

Organizations and individuals who plant trees or perennial crops on barren land or invest in processing industries can benefit from a favored tax policy under the laws on domestic investment. Products harvested from production forests are exempt from the resource tax. Products legally collected from planted forests and non-timber products from natural forests are exempt from the batch trading tax.

### **Science and Technology Policy**

Institutions are encouraged to develop plant breeding and seed certification protocols. Additionally, they are to undertake research on intensive reforestation and advanced techniques for protection against pests and fire.

## Foreign Investment

Foreign investors are encouraged to establish reforestation and wood processing joint ventures with national organizations. Favorable conditions for foreign investments are available under the Law on Foreign Investment, Decree No. 10/ND-CP.

## Challenges

The program faces a number of investment and institutional challenges. A clear land use plan is not yet established and this may be affecting investments in reforestation. Wood processing facilities are small, dispersed, and their needs to be a better understanding about market conditions and project profitability. Staff capacities and infrastructure (fire control, pest eradication) for local projects, especially in remote areas, need to be upgraded, as do offices and equipment. There is a need for continued efforts to attract foreign and domestic investments through tax and interest rate adjustments. Public awareness appears low. Some of these challenges can be overcome through technical and financial support as well as assistance in land use planning.

## Issues Relating to Wetlands

### Introduction

Mangroves play an important role in livelihood stabilization and have strong environmental benefits, including the reduction of toxic compounds in soil and groundwater, the prevention of salt intrusion and the protection of the coastal dike system. In 1950, the total mangrove forests in Vietnam was estimated at 400 000 hectares. By 1983, the estimate was down to 252 000 hectares.

### Forest Types in the Mekong River Delta

According to a recent inventory, forest occupies 270 500 hectares in the Mekong Delta, covering 7% of the region's area and 2.5% of the country's total forested area. Its distribution based on three functional types is as follows: 55 400 hectares of protection forest (21% of the delta's forested area), 57 200 hectares of special

use forest (21% of the delta's forested area), and 157 900 hectares of production forest (58% of the delta's forested area). On the other hand, its distribution based on natural or planted forest is 63 100 hectares of natural forest (23% of the delta's forested area) and 207 400 hectares of planted forest (77% of the delta's forested area).

Important species in both natural and planted forests include *Melaleuca leucadendron*, *Rhizophora apiculata*, *Eucalyptus spp.*, *Avicenia spp.* Official figures of barren land to be reforested are not currently available. The government has promulgated Ordinance No. 24/1999/CT-TTg asking the Land Administration Department to collaborate with other departments to conduct a land inventory.

## The Government's Strategy

The Government established a strategy for natural resource management through the National Environment Action Plan of August 1985. This document outlined a strategic framework for the conservation of ecosystems in both inland forests and wetlands. The development of wetlands in the Mekong Delta must:

- Protect and rehabilitate mangrove;
- Protect core and buffer zones from degradation;
- Ensure sustainable development to stabilize local livelihoods;
- Seek international assistance for reforestation and biodiversity conservation;
- Increase production through the use of improved plant varieties and advanced plant breeding practices.

Forests and wetlands have an important role to play in the economic development of Vietnam, especially in the Mekong River Delta. With national efforts and international assistance, existing resources will be conserved, managed and developed to address the increasing economic, social and environmental demands of the country.



# Special Use Forest Management in Vietnam with Emphasis on Wetlands

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## **The Need for Forest Management**

In recent years, the forestry sector in Vietnam has faced two challenges: to ensure the supply of forest products for industrial and domestic use and to conserve and develop the remaining forests while restoring ecological equilibrium.

Forests have always suffered from socio-economic pressures, particularly demographic pressure in the rural upland area where 26 million inhabitants belonging to 54 different ethnic groups live. The need to create jobs for a growing labour force and to produce food has led the local people to exploit the forests heavily. Deforestation has occurred in a number of ways, including overexploiting forest products and clearing the forest for agriculture and aquaculture expansion.

The consequences are the reduction of forest area and damage to the environment. Protection and development of the forest is a seemingly contradictory responsibility. The National Assembly and the Government have developed a national program for rehabilitation aiming to increase the forest cover from 28% (1999-2000) to 43% by the year 2010. To manage the forests while meeting the objectives set by the National Assembly, the Government has classified the forest into special use forest (SUF), protected forest, and production forest. SUFs have been established to maintain ecosystems, conserve biodiversity, provide opportunities for scientific research, protect cultural and historical sites and for outdoor recreation and

ecotourism. Protected forests have been established to regulate water, reduce soil erosion, regulate the climate and ensure ecological balance and environmental security. Production forests have been established to provide forest products, both timber and special non-timber products consistent with sustainable use.

## **Organization of Wetlands SUFs**

Due to the crucial importance of SUFs, the Government has assumed overall management of the SUF system. Each SUF has been established, organized and managed according to a specific objective with an assigned owner, (a management board which directly manages the forest). Their responsibility includes protecting and using the forest according to the laws and regulations. For national parks and protected areas within wetlands, they include ecosystems and aquatic resources. SUFs can be classified into three groups:

### **National Parks**

A national park is a natural land area established for long term conservation of one or several ecosystems which are still intact or have suffered limited human intrusion, to maintain typical features of plant and animal habitats, or to preserve forests of high scientific, educational or landscape values. The Tram Chim National Park in Dong Thap Province, for example, was established by decision No. 253/1998/QD-TTg dated 29 December 1998.



### **Natural Reserves**

Natural reserves are established to ensure natural forest regeneration. They are still intact or have suffered limited human disturbance but remain natural ecosystems with a high biodiversity. Human settlement in these areas may be sparse or limited. They are managed for conservation and scientific purposes. This is usually a large area (not less than 70% of the total area) to ensure the integrity of ecosystems. The Thanh Phu wetland natural reserve in Ben Tre Province is one such area established by decision No. 1026/QĐ-TTg dated 13 November 1998.

### **Cultural-Historical and Environmental Forests**

These are areas with high aesthetic, cultural, or historical values to serve culture, tourism and science. They include historical sites or special natural features such as waterfalls, caves, cliffs, and beaches.

### **Decentralization of SUF Management**

The Government assigned MARD to supervise, manage, and control the SUF system. Responsibilities include the formulation and submission of plans to the Central Government for approval, protection and development, and providing technical guidelines. The Ministry of Fisheries (MOF) is to develop a system for marine protected areas and submit plans to the Central Government for approval. It is also tasked to manage the system of marine protected areas as well as being enjoined to collaborate with other ministries to develop policies that will ensure the management, protection and conservation of wetlands. The Ministry of Cultural and Information Affairs (MCIA) is to manage the system of cultural, historical and environmental forests and to collaborate with MARD and MOF to organize, manage and protect these forests.

Each SUF has a development program based on the land use master plan. Development projects (including buffer zone projects) are submitted for approval. In the case of large projects, time schedules need to be divided into periods of five years. Funding comes from the national budget, donor countries and international agencies.

### **SUF Management Mechanism**

A management board is established for each SUF. These management boards act as state run economic units and are responsible to manage, protect and develop the forests. Forest inspection stations can be established in SUFs based on the size. These stations report to the management boards and receive professional guidance from the provincial forest inspectorate having jurisdiction over the SUF. Small SUFs can be managed, protected and developed by organizations, households or individuals. They are called “forest owners”. In cases where the SUF has not yet been defined, the district PCs are responsible to assist commune PCs to manage the forest and submit land allocation proposals.

### **Management, Protection and Development of Wetlands SUF Resources**

Surveys of wetland resources need to be conducted and a resource inventory done every five years. Rare and endangered species need to be recorded and monitored. In strictly protected areas, all activities (hunting and catching) affecting wildlife and vegetation are prohibited, including grazing and introducing exotic plant species to the SUF. In restoration areas, exploiting natural resources is prohibited. Hunting and catching these resources are therefore prohibited, although certain cases may be allowed. Restoration in SUFs is by natural regeneration only. The management boards can provide additional food and water for wildlife when needed. Healthy and disease free animals can be introduced depending on the habitat and the availability of food. MARD is assigned to promulgate regulations on monitoring and management of SUFs.

### **Harvesting and Using Wetlands SUF Resources**

Over-mature and fallen trees in SUFs may be salvaged. In wetland reserves with seasonal flooding, migratory fish may be trapped in canals and swamps which dry up in the dry season. These aquatic resources can be collected to avoid water pollution from the accumulation of dead aquatic animals as long as over-harvesting is prevented in order to leave food for migratory animals and amphibians.

## **Ecotourism and Scientific Research**

One of the objectives of SUFs is to provide areas for research, education and ecotourism. These activities can be conducted by organizations, individual scientists, and students (Vietnamese and foreign) with permission from the management board. Users pay a fee to the board and research results must be submitted to the board. Research and ecotourism ventures conducted by foreigners or in collaboration with foreigners must have permission from MARD.

## **Buffer Zones**

Buffer zones are established to prevent negative impacts by human intrusion in wetland SUFs. Activities in the buffer zones support protection, conservation and management of the SUFs including limiting immigration, the prohibition of hunting and catching, and the harvesting of protected plant species. The buffer zones are not included in the area of the related SUF, however, projects in the buffer zones need to be considered in terms of impact to the SUF. The objectives of buffer zone development are to stabilize and to improve the livelihoods of local people.



# Situation Analysis and Training Needs Assessment of Natural Resource Management Stakeholders in the Mekong Delta

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## Introduction

Vietnam is situated along the southeastern margin of the Indochinese Peninsula and has a coastline of about 3 200 km. Three quarters of the country is hilly or mountainous, with the highest peak rising to 3 134 m (Fan Si Pan) in northwestern Vietnam where the mountains form an extension of the Himalayan range. The ten million hectares of low-lying, potentially arable land are situated in the large plains of the Mekong Delta (6 million hectares) and Red River Delta (1.5 million hectares). Although the country is situated in the tropics, the climate is diverse, due to the variation in topographic conditions and the influence of the sea. The original vegetation of Vietnam was almost entirely comprised of tropical forest, two thirds of which was dry evergreen and semi-evergreen forest (Maurand 1943). By 1943, forest cover was estimated at 43% of total land area, with extensive areas cleared in coastal regions and on the floodplains of the Mekong and Red Rivers.

## Natural Resources

Vietnam's natural resources have long been under stress. From about 1965 to the early 1990's, the total area of national forests declined at an estimated rate of 350 000 ha per year from about 40% to 26% of total land area. Deforestation has occurred in both upland and wetland forests. Of the nearly 19 million ha of forest land controlled by the former Ministry of Forestry, only 8.8 million ha had natural forest cover by 1993. A category of land designated as "barren lands" (denuded forests) covered about 13 million ha, nearly twice the total area cultivated.

Although precise estimates of mangrove forest cover in Vietnam in general and the Mekong Delta in particular are hard to make, mangrove forests in the Mekong Delta are reported to have been drastically reduced in area and quality. In 1983, it was estimated that only around 190 000 ha of the 1943 mangrove cover was left (Phan Nguyen Hong and Hoang Thi San 1993). Since 1983, the integrity of wetland ecosystems has been severely compromised by uncontrolled wood extraction, paddy expansion in *Melaleuca* forests and extensive shrimp farming in the mangrove areas of the Delta.

## Demographic Pressures

The population of Vietnam is currently estimated at 75 million with a density of 210 persons per km<sup>2</sup> and is growing by 2.3% annually. While people constitute a valuable resource, they also pose the greatest threat to the environment. Being a densely populated country largely dependent on natural resources and primary products for its economic well-being, relocation, resettlement and migration are the main concerns of government agencies at provincial and district levels. Per capita income is estimated at less than \$200 a year, making it one of the world's poorest countries. The incidence of rural poverty is estimated at 57%, more than double the 27% rate in urban areas. With about 78% of its population living in rural areas, Vietnam is very dependent on its agriculture and natural resources. Agriculture and forestry account for approximately 30% of GDP and about 73% of the total labor force. Processing of primary products accounts for about 65% of industrial production and almost 20% of GDP (MARD 1998).

### **The *doi moi* Policy**

After years of economic isolation, Vietnam has undergone rapid and extensive political, economic and social change. Emerging from the Soviet influence of the 1980's, Vietnam is evolving from a centralized socialist economy to one that is primarily market driven. The Government of Vietnam, through its *doi moi* or renovation policies (1989), has provided economic stabilization, market liberalization and institutional and legal reforms that have had a significant impact on economic performance (see Torell and Salamanca, this volume). From 1989 to 1994, GDP growth averaged 7.3% annually with exports increasing by nearly 30% annually. The annual inflation rate has been reduced from 400% in 1989 to single digit levels since 1993. However, analysis of the growth of agriculture (including the natural resource sectors of forestry and fisheries sectors) reveals a number of disquieting trends and issues which have to be tackled (UNDP-Vietnam, 1997).

As in many developing countries, the dilemma for natural resource management in Vietnam stems from the increasing trade-off between the need for economic growth and protecting the environment. This issue is particularly important for Vietnam because, unlike most fast growing economies, there is still time (although barely) to minimize the trade-off and thus achieve a more sustainable path in economic development. To ensure sustainable economic development and protect the environment, resource-users, policy-makers and researchers need further information. In the policy domain, ultimately the responsibility of State agencies, natural resource management needs investment as well as institutional support that is appropriate and effective. In this context, enabling policies must be complemented by the active participation of local communities. The role of the research and training component is to provide not only technologies and access to technical information but also appropriate institutional arrangements to ensure access. It is hoped that this component can help develop tools to link research, development, policy and extension.

### **Institutional Framework of Natural Resource Management**

The Government of Vietnam's strategy for natural resource management is embodied in a number of documents, legislation and programs. The most important are:

- (1) The Forestry Resource Protection and Development Act (The Forestry Act, 1991) covering the following categories of forests: (a) Protection Forest (critical watersheds and wetlands); (b) Special Use Forests (wildlife sanctuaries and national parks; and (c) Production Forests.
- (2) The Law on Environmental Protection enacted in December 1993 and the Vietnam National Environmental Action Plan (VNNEAP), issued in August 1995. VNNEAP reviewed all aspects of the environmental situation in Vietnam and proposed a number of priority areas for environmental investment, policy change and technical assistance. Permanent working groups (one of which was on natural resource management) were established. They comprised representatives from national planning and management agencies, line ministries, provincial government departments, academic institutions, and Vietnamese non-governmental organizations working together to review and revise the priorities and develop a strategic plan for implementation.
- (3) The Ministry of Forestry is responsible for the management of forest lands and stipulates management principles through its implementing decree of 1994. Among them is item (c), principles for land allocation to private users, the role of international cooperation, monitoring and enforcement. Long-term tenure rights or Certificates of Land Tenure (usually 50 years) will be given together with extension services for land use. Limited resources have, however, prevented large-scale implementation of the policy.
- (4) The Vietnam Forestry Action Plan (1991) is responsible for: (a) the separation of forest protection at the departmental level; (b) the drafting of special legislation covering (i) the management of protected areas including coastal protected belts and (ii) the disengagement of the role of forest enterprise; and (c) programs to develop barren lands (Decree 327).

## Stakeholder Analysis

The perception of natural resource management issues in the wetlands varies among stakeholders. The following are some observations in two sites in Ca Mau (mangroves area) and Kien Giang (*Melaleuca* forest or peat swamp).

### Provincial Level

#### *The Provincial Departments of Agriculture and Rural Development*

The establishment in each province of a provincial Department of Agriculture and Rural Development (DARD) for state administration of all agriculture, forestry and rural development activities began only two years after the reorganization of the former Ministry of Forestry. However, the expected outcomes have been uncertain. Administration is still sectoral but takes an interdisciplinary approach to natural resource management policy.

In all the DARDs contacted, the main concern was to maintain the provincial forests. In both Ca Mau and Kien Giang Provinces, important areas of the mangrove forests were cleared for prawn farming. To meet management objectives, some DARDs intervened by demarcating forest and agricultural lands, strengthening the roles of forest enterprises, enforcing laws and regulations and supporting villagers in developing commercially oriented farming. However, rural development was perceived as ambiguous, complicated and involving too many departments. Giving the forest management system a people-orientation was clearly perceived among department staff as a new way to deal with sustainability. Some initiatives were undertaken during the change from state-owned business enterprises to public enterprises. Difficulties encountered were:

- No clear concept of social forestry. There needs to be a good theoretical basis for social forestry to set criteria for project assessment and evaluation.
- No clear enabling policy for social forestry according to national criteria including land and forest tenure decision-making in forest management activities.
- A need to revise land use planning at the central and provincial levels to involve local villagers in forestry activities and a need for long term forest

land planning and collaboration with other institutions.

Initiatives toward social forestry such as the 327 Projects, buffer zone development in national parks, target group identification, land allocation and rights to use non-timber forest products have not yet been agreed to among the sectors or provinces.

Rural development was perceived by DARD as a new and complicated task. It was complicated because the concept covers diverse investments and interventions from infrastructure development to community health and education, from a subsidiary offering of some necessities to the elaboration of a rural credit system and small-scale industries. These investments and interventions have been in the hands of different institutions and a collaborative system has not yet been elaborated. Authorities in DARD said the main issues of forest management in the new context are:

- Lack of a clear concept of social forestry;
- Conflicts between local people and state owned forestry enterprises in resource management;
- Encroachment into forest lands; demarcation of forest and agricultural land have not been fully implemented;
- Limited capacity and motivation of the personnel in the forestry sector to implement new approaches to forest management;
- Limited funds to implement forest management activities.

#### *The Provinces' Extension Centers*

For a long time, agricultural production was managed by state-owned enterprises or cooperatives. Technical interventions had largely been in the form of regulations that lower levels in the administration had unconditionally followed and therefore an extension system was not implemented until 1993. In 1993, by Degree 13/CP, a national system for agriculture extension (including forestry) was set up. This explains the dominance of traditional approaches to extension, which is largely top-down.

Under the administration of DARD, there is in each province an Extension Center, mandated to provide extension services to farmers. With limited funds from government, these centers offer informal training and

workshops to farmers to improve production, create demonstration models, publish articles, and participate in radio and TV programs in local mass media. The new approach to extension based on the participation of local communities is not yet fully implemented. Difficulties were found in planning: extension topics were centrally decided by the government extension programs and the budget was reduced without explanation.

Skills of local extension workers need to be improved, not only in the way they conduct activities, but also in the way they plan extension programs, and more importantly, in the way they monitor and evaluate extension activities. The outcomes and impacts of the extension programs have not reached the expected target, and a participatory monitoring and evaluation system is not yet fully elaborated to see the effectiveness and potential impacts of programs. An example can be seen in a national extension program set up at the ministry level, which emphasized cash crop production development in the forestry sector without any consideration of different target groups' specific conditions.

### ***The Provincial Forest Protection Departments***

Each province has a Forest Protection Department managed by the Provincial People's Committee. The main task is to enforce forestry laws and regulations. The main issue of concern is preventing trespass of forest laws. Trespass, in traditional foresters' terminology, is loss due to theft and encroachment on forest land. Trespass problems are due to violations by both local communities and state enterprises, which have increased in recent years. Reasons for trespass were summarized as:

- The livelihood dependence of poor local villagers on the collection of forest products and conversion of forestlands for agriculture.
- Absence of clear policies to address local needs for timber and non-timber forest products.
- Illegal forest products harvesting is risky but profitable, and this has led to violations of forestry laws and regulations by both state-owned enterprises and villagers.

Along with enforcing forestry laws, forest inspection agencies have conducted some technical activities for

biodiversity conservation and forest fire control. At present, forest inspection agencies directly manage strictly protected areas. However, this function will be transferred to separate management boards.

Foresters in the forest inspection agencies contacted have long argued that trespassing would be reduced if enforcement could be intensified. Some investments were made in this direction, such as establishing semi-military brigades of forest guards. Field-based staff in these organizations were mostly untrained veterans and performed few technical interventions. Based on interviews with some staff of the forest protection agencies, poor law enforcement is associated with lack of staff, lack of skills and knowledge in implementing forestry laws and regulations, and inappropriate approaches in working with communities.

### **District Level**

State administration of agricultural and forestry activities at the district level is in the hands of the district People's Committee, usually the Bureau of Economic Affairs. However, forest enterprises or forest management boards are the most influential stakeholders. The name differs depending on the class of forest they manage: "forestry enterprises" for production forest and "forest management boards" for protection or special use forests. The transition from state-owned enterprise to public enterprise status was observed in Don Duong. In this transition, some areas of the forestland have been allocated to villagers. However, the process of land allocation has been slow.

### ***The Forestry (or Forestry/Fishery) Enterprises***

In July 1998, proposals to change these enterprises into public enterprises were submitted to DARD for approval. Should they become a public enterprise, the mandate will be reduced to forest protection and management tasks and to provide services to the local communities. Some of the issues they would address are:

- Forest protection and management;
- Reforestation;
- Forestland demarcation and allocation.

Those responsible said the main concern was to ensure the remaining forests are kept intact. This objective was not met, as the demarcation of forestland was not clear. Villagers live in the forest and practice different forms

of cultivation. To deal with that issue, Don Duong Forest Enterprise (DDFE) need a land-use map that clearly delimits agriculture and forestlands as well as staff trained to work with local villagers.

Opinions relating to the establishment of Communal Forestry Committees at the commune level were quite diverse. In some places, interviewees agreed with the policy but in others, people were uncertain.

### ***District Agricultural Extension Stations***

Each district has an Extension Station. However, forestry extension activities are limited compared with agricultural extension. Influenced by a centrally planned system, extension activities deal mainly with cash crops rather than having an integrated approach towards sustainability. It was observed that a system of local extension work reached commune level. Extension workers received some assistance from the Extension Station at the district level. However, mainly top-down planning in extension activities was observed. The role of extension workers at the commune level was to implement activities according to the plan set at the station and local needs were rarely taken into account. Activities in a more participative approach to extension were not well recognized among extension stations.

### ***The Forest Protection Stations***

The Forest Inspection Station is mandated to perform state management in forestry activities and to enforce forest protection laws and regulations. The situation at the stations is similar to that in the department at the provincial level.

### ***Other Government Agencies***

At the district level, there is an Office for Economic Affairs and an Office for Fixed Agriculture and Sedentarisation. The project for promoting coffee planting in Kado Commune was implemented by the latter.

### **Community Level**

The People's Committee at commune level is the lowest rank of state administration in Vietnam. At the grassroots level, communes have a number of social organizations including a farmers' association, women's union and a veterans' association. Field workers from different sectoral agencies who work directly with villagers are sometimes observed.

At the community level, the general impression was that there are different stakeholders in the natural resource management system in the communities. They make decisions in pursuing different livelihood activities according to their particular situations and relationships with outsiders. However, villagers' capacity to voice their needs is usually very weak compared to stronger stakeholders in the management system. It seems that the current system of extension and project management has been commandeered by powerful stakeholders in the commune, while low-income forest dependent families have been left behind.

A SWOT analysis was performed to help understand the impact of these interventions on rural communities (Table 12). The outcomes were cross-referenced with information generated from the interviews. It was clear that although large state investments have been made, development targets have not been reached. Human resources were listed as the main constraint. A clear example is the 327 Projects implemented at the district level, where persons who were not trained to work with the communities hastily wrote project documents. The mechanism of monitoring and evaluating activities was uncertain.

The need for integrated land use planning at the commune level was perceived as a premise of recent national programs of forest land allocation and contractual forest management. However, how to reach this integrated approach is not clear among stakeholders. Provincial DARDs in some provinces even argued that agroforestry could lead to deforestation. It was observed that forest areas in all studied sites have suffered as a result of pressure to convert them to agricultural uses, mainly due to migrants from more densely populated areas. Foresters maintained the need for having a clear spatial delimitation of forest and agricultural land, which would mean a resettlement of local people.

At the commune level, pressures on forest resources were seen to be due to over-logging and conversion for agricultural purposes. One of the important state interventions at the community level is the system of contractual forest protection and management. Local villagers can receive 20 000 to 50 000 VND (US \$1.5-3.5) per hectare from forestry enterprises for forest protection (the rate varies according to the degree of



**Table 12. Responsibilities, problems and issues of forest management agencies in Vietnam**

Organization	Mandate	Problems
Provincial Level		
DARD	<ul style="list-style-type: none"> <li>• State administration for agriculture and forestry in the provinces</li> <li>• Rural development</li> <li>• Manage 327 Projects</li> <li>• Combine agriculture with forestry development</li> <li>• Change management system</li> <li>• Land use planning</li> </ul>	<ul style="list-style-type: none"> <li>• Few well motivated foresters to work with local people</li> <li>• Lack of appropriate approaches to deal with local communities</li> <li>• Lack of team leaders</li> <li>• Hard to provide an integrated training program- Rural development is a big issue, not yet clear in responsibility</li> <li>• Complicated collaborative structure among agencies</li> <li>• Few stable policies</li> <li>• Staff with narrow specializations</li> <li>• No clear concept of social forestry</li> </ul>
Forest Protection Department	<ul style="list-style-type: none"> <li>• Manage Special Use Forests</li> <li>• Control forest fires</li> <li>• Biodiversity conservation</li> <li>• Combine agriculture with forestry</li> <li>• Forest land demarcation</li> <li>• Forest land allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Livelihoods of poor local villagers depend largely on the collection of forest products and agriculture</li> <li>• No clear policies to address local needs for timber and non-timber forest products</li> <li>• Illegal harvesting of forest products is risky but profitable, which leads to violations.</li> </ul>
Extension Center	<ul style="list-style-type: none"> <li>• Design and carry out extension activities</li> </ul>	<ul style="list-style-type: none"> <li>• Limited personnel capacity</li> <li>• Lack of funds</li> <li>• Limited communication skills</li> <li>• Few forestry extension activities</li> <li>• Poor coordination</li> <li>• Top-down planning</li> </ul>

difficulty in forest protection). They can be hired by the forestry enterprises for reforestation activities and can receive a sum of money according to a fixed rate. The effectiveness of such a program of forest protection and management is doubtful. A proposal to establish a Forest Stewardship Committee at the community level was drafted and will soon come into effect.

### Training and Research Needs

Changes in state policy towards recognizing the role of households in resource management were observed. These trends indicate that options for land users and forest users will be enlarged as barren lands and some production forests have been handed over to households and private enterprises for development,

conservation and use. However, privatization of forestlands seems to restrict the potential for community resource management. Traditional systems for common property management at community level such as grazing lands and water springs have not been considered in the new land administration systems.

Some of the emerging issues in wetland management in the country are wetland forest conservation and management for biodiversity conservation; improving livelihoods and income generating potential in wetland areas in conjunction with the development of buffer zones surrounding protected areas; and protection, rehabilitation and management of inland marshes conflicting with expansion of wetland rice areas.

**Table 13. Re-orientation training of wetlands management staff**

Aims	Objectives	Activities
Participatory and objective oriented approaches to project management accepted at provincial levels	To train provincial DARD staff in project management	<ul style="list-style-type: none"> <li>• Identify staff in each DARD to participate in the training program and assess their training needs</li> <li>• Develop curricula for training</li> <li>• Conduct project management training</li> <li>• Follow-up</li> </ul>
Improved protected area management	To train protected area staff in protected area management (PAM)	<ul style="list-style-type: none"> <li>• Design and develop curricula and training materials in PAM</li> <li>• Conduct training</li> </ul>
To promote participatory approaches to extension	To train Extension Center staff in participatory extension methodology (PEM)	<ul style="list-style-type: none"> <li>• Identify two staff members in each participating provincial extension center to participate in the training program</li> <li>• Develop curricula for training</li> <li>• Conduct PEM training</li> <li>• Follow-up</li> </ul>
Integrated community development principles accepted at the community level	To have a group of trainers at the provincial level to conduct training in community development in the buffer zones of the protected areas	<ul style="list-style-type: none"> <li>• Identify staff from DARD, forest protection department and extension centers to participate in the training program and to form a group of trainers</li> <li>• Develop curricula for buffer zone development</li> <li>• Conduct training</li> <li>• Follow-up</li> </ul>

Based on the above analysis, an action oriented research and training program was elaborated (Table 13). The main purpose is to enhance the management capability of stakeholders in natural resource management. The College of Agriculture and Forestry in Ho Chi Minh City could be a partner in this component of the project.



# Wetlands Study: Lessons Learned and Future Challenges

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## Introduction

While Vietnam has many types of wetlands, the largest is the Mekong Delta. Based on the Ramsar definition, wetlands include areas that are seasonally or permanently covered with water. Thus, wetlands may exist from the uplands to the lowlands and may include the shallow coastal waters. The need to manage and sustainably develop wetlands is recognized as a national priority as they are ecozones with high biological productivity supporting vibrant agriculture and aquaculture industries. They also suffer from increasing population, overexploitation and unsustainable management practices. Because of this situation, the management of wetlands needs to be based on a systematic and an interdisciplinary approach with an understanding of the hydrological cycle and relationships among various ecosystems. The depletion of wetland resources and the degradation of the wetland environment negatively affect the livelihoods of local communities. At present, providing systematic information to policy makers and local communities to achieve better wetland management is a goal; especially as information on policy, and institutional and legal aspects of wetland management is either inadequate or unavailable.

Following the Viet Nam National Mekong Committee's (VNMC) workshop on wetland classification where agreement was reached on a system to classify the diverse wetlands in the region, groups from the University of Agriculture and Forestry organized a workshop to explore additional ways to understand the various classifications and to discuss challenges confronting research on institutional aspects of integrated wetlands management. The aim was to develop practical and appropriate measures of wetland

management. It was agreed that there could be at least two classes of wetlands: saltwater and freshwater wetlands. The boundary of freshwater wetlands can be determined during the rainy season while those of saltwater wetlands are based on the amount of salt invasion as affected by the tidal and hydrological regimes of rivers. Stagnant or flowing water and the drying-out of soil during the dry season due to evaporation/transpiration and percolation are some of the hydrological events affecting wetlands. Thus, hydrological conditions vary seasonally and waterbody size is a useful criterion for classification. This report presents some of the lessons learned.

## Natural Resources Management Studies at UAF

The University of Agriculture and Forestry in Ho Chi Minh City introduced a course on institutional aspects of natural resources management in 1995. The course began as a research project on upland watersheds jointly funded by the International Development Research Center (IDRC) and the Ford Foundation. Support for the project was also received from the AIT-Aqua Outreach Program. IDRC has continued to support a group at the Faculty of Fisheries conducting community-based mangroves management in Can Gio District under the Sustainable Economic Development in Vietnam project (VEEM). The Swiss Agency for Development and Cooperation (SDC)-Helvetas is supporting participatory technology development in Ca Mau Province. In collaboration with World Resources Institute-Resources Policy Support Initiative (WRI-REPSI), a study of the institutional aspects of water resource management in a Srepok watersheds was undertaken. UAF's research on institutional aspects of

natural resource management is directed toward gaining a better understanding of the mechanisms for achieving effective conservation and development of wetlands.

## Lessons and Challenges

### Management Institutions

Since the first workshop in March 1999, new policies have been implemented emphasizing local institutions. Therefore, the main direction for policy research on resource management should be on institutions. Young and Underdal (1997) defined institutions as "...a set of rights, regulations and relationships defining social behaviors and guiding interactions among stakeholders participating in a management system". This includes arrangements governing land use, resource tenure and exploitation, environmental protection, market dynamics including globalization, participation in Asian Free Trade Agreement (AFTA) and influences of financial institutions such as the International Monetary Fund, the World Bank, and the Asian Development Bank.

### A Multi-Stakeholder Management System

It would be simplistic to think that all natural resource management issues, especially wetlands issues, can be resolved by governments alone. A study of government organizations indicates a bias towards sectoral management at the central and provincial levels. Implementation of policies is inadequate while enforcement is poor, despite the fact that the government has invested substantially in natural resources management. At the grassroots level, conflict is increasing between conservation and development. Hence, the study of institutional arrangements in natural resources management should proceed from macro to micro levels and include both formal and informal institutions. The role of people's organizations at these levels was expanded after *doi moi*. For example, the Farmers' Association in Ca Mau Province has been active in ensuring farmers participation in mangrove rehabilitation and the local Women's Union is acting to improve women's livelihoods. Changes in the policy environment in Vietnam have led to a sharing of responsibilities with local communities. Examples are the establishment of Commune Forest Management Committees (Decision 245 of the Prime Minister) and local participation in irrigation management.

### Management Effectiveness and Transaction Cost

Policy formulation is not a top down or bottom up choice. The issue is one of making the process more open and involving more stakeholders. This can have two expected outcomes. It can increase the effectiveness of state management and reduce agency transaction costs.

Recognition of the actual transaction costs of resource policy implementation is an emerging trend in resource management. For example, in some localities there are two overlapping resource control agencies: a forest inspectorate dealing with forest protection and an aquatic resource management agency dealing with fish and shrimps. The costs of enforcing resource-use regulations increase while the holistic approach to wetlands management is not ensured.

Changes to natural resource management policy in recent years have led to the sharing of responsibilities with more stakeholders. In this context, a community-based approach to natural resource management can become a promising option contributing to increased management effectiveness leading to sustainable development.

### Wetlands as Common Property

Wetlands management is complicated by the issue of resource tenure, affecting access to and control of wetlands. Except for stable artificial wetlands converted to agriculture or aquaculture by private individuals, most wetlands are common property and communities have some form of regulations for their management. In many cases, a land allocation program has been implemented; but in other cases, enterprises have signed contracts with local households to exploit resources subject to conditions. Case studies from communities reveal a trend that some common property has been privatized, reflecting influences of the market economy. This creates challenges for local institutions which are used to a common property regime. The process has affected poor communities' access and control of resources, leading to social problems. With the weakening of a common-property management regime, resources become open-access resources, threatening the sustainability of the system. The "tragedy of the commons" described by Hardin has emerged and conflicts among resource users have increased. This suggests that developing a framework

for wetland resource management begins with an analysis of the problems confronted by user groups.

### **Economic Evaluation of Wetlands Resources**

The non-market worth of goods and services produced by wetlands should be properly valued so that informed decisions on the conservation and sustainable use of wetlands are made. This can be undertaken by employing direct-use values and cost-benefit analysis models. The importance of non-market values has been underestimated in policy formulation and there is a lack of incentives for conservation and thus a lack of motivation among stakeholders to pursue sustainable development. The case of shrimp farming in mangrove areas is a good example. An incomplete and biased cost-benefit analysis suggested that intensive shrimp farming

is more profitable than other uses. This has proven to be wrong as more external inputs are needed for shrimp farming and the long-term sustainability of the ecosystem is sacrificed.

### **Conclusion**

Institutional issues of wetland management need to be analyzed in different ways and include all stakeholders. Local communities consider wetlands a source of livelihood while government agencies consider wetlands management in terms of a legal framework for protection and sustainable development. The challenge for researchers working in this field is to ensure that these views are brought together.



# Socio-Economic Situation, Management, Rational Utilization and Development Potentials of Tram Chim, a Wetlands Ecosystems Conservation National Park

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## Abstract

The Tram Chim Protected Area was recently recognized by the Government as a national park for the conservation of typical wetland ecosystems in the Dong Thap Muoi area of the Mekong Delta. However, the protection of this national park has been a challenging task. Population in the area has rapidly increased in recent years, a result of the State policies encouraging land reclamation and natural resources exploitation in this area. Many of the local people are poor farmers whose livelihoods are based on rice cultivation and natural resource gathering. The establishment of the national park has allowed vegetation restoration in Tram Chim, and rich and diversified wetland ecosystems have gradually been rehabilitated. In the period 1994-1996, infrastructure for the protected area was improved and since then violations of the protection regulations have been reduced. The National Park Development Plan focuses on biodiversity conservation, eco-tourism development and local farmers' livelihood improvement. To cope with management difficulties in Tram Chim, the report proposes more investment from the Central Government as well as international organizations.

## Introduction

The Wetlands Protected Area of Tram Chim, located in the district of Tam Nong of Dong Thap province, was established according to a decision of the Prime Minister, and was recently reclassified by the Government as a national park, mandated to environment protection and wetland ecosystems conservation in the Dong Thap Muoi area. The establishment and development process of this protected area has been implemented through different phases with various difficulties and challenges. This report describes the process and proposes some of the development directions for the near future. The report consists of three parts:

1. Current socio-economic situation in the Tram Chim area of Tam Nong district
2. Establishment process, roles and biodiversity of ecosystems in Tram Chim
3. Development potential of the Tram Chim wetlands ecosystem protected area



## Current Socio-economic Situation in the Tram Chim Area

Dong Thap Muoi is a vast wetlands area on acid sulfate soil, located in three provinces of the Mekong Delta, i.e. Long An, Tien Giang and Dong Thap. It has a total natural area of 629 000 ha, in which 259 700 ha or 42.3% of the total area belongs to Dong Thap province, which amounts to 76.6% of the area of this province.

Tam Nong district of Dong Thap province has a natural area of 46 000 ha with a population of 76 206 persons; the population density is thus 117 persons per km<sup>2</sup>. Agriculture absorbs 83.2% of the total population. The



natural population increment is 2.18% per year, higher than the average for the whole province (which is 1.93% per year). The district consists of 10 communes and a district town.

The Tram Chim protected area has a total area of 7 612 ha, located between 10°37' to 10°45' latitudes North and between 105°28' to 105°36' longitudes East. It is about 25 km from the Mekong River border and near the national boundary with Cambodia. For administration purposes, the area belongs to 6 communes: Tan Cong Sinh, Phu Tho, Phu Duc, Phu Hiep, Phu Thanh B and the district town of Tram Chim.

The history of natural resource exploitation in the Tram Chim area has been linked with the overall Dong Thap Muoi development. Years ago, the population was sparsely distributed on relatively high banks along the Mekong river. Since the initiative of reclamation, the canals known as Dong Tien, Xang Cut, and Ca Dam were dug to drain acid sulfate water and to bring fresh water to the area, winter-spring and summer-autumn rice crops were developed, a network of canal-based transportation was established and a district town named Tram Chim was established. The area has become more attractive for landless migrants from different provinces of the country and the population has rapidly increased.

Immigrants can be classified into three categories:

- The first group consists of farmers who immigrated collectively according to New Economic Zone (NEZ) development (Decision 95/QD/UB) and population redistribution (Decision 254/QD/CP) policies. During the period 1984-93, a total of 1 998 households with 8 915 persons were resettled in newly developed areas after the canals were dug; 500 households (including 300 households of local residences) were resettled in the NEZs of Phu Thanh (Ca No junction) and Cao Doi (Tan Cong Sinh commune). In the period 1989-94, a total of 5 606 ha of wetland were reclaimed and this reclamation has continued over a further 3 500 ha of wetland.
- The second group consists of temporary immigrants. There are thousands of agricultural workers, landless farmers from Ben Tre and Tien Giang provinces, who seasonally migrate to work as hired labour for rice cultivation, weeding and harvesting.
- The third group comprises fishermen from other areas in the province or from neighboring provinces who migrate for fishing during the flooding period.

The main livelihoods of the population are rice cultivation, fishing, firewood gathering and hunting.

The traditional production system, which was highly dependent on natural resources, has been changed into a new market-based economic structure only recently. Rice yield is rather low, about 3.5-4 t/ha/year, partly due to very acid sulfate soil and water conditions, and partly due to low investment. Although the government at all levels has supported the communities, especially through a formal credit system for production, house construction and infrastructure, the living conditions are still hard. About 38.2% of households are classified as poor, about 27.2% as intermediate and about 34.6% as better-off. The level of education is low, the literacy level is 12.2%, only 5.6% of the population reach the level of secondary education and only about 85% of children of school age attend school. Educational, health and cultural infrastructure have been annually improved but remain poor, especially in remote communes. There are 25 primary and secondary schools, 2 high schools, one district 30-bed hospital, a 10-bed community clinic, and 11 community mothers' health-care centers with a total of 50 beds. About 18.75% of the labour force permanently or seasonally lack job opportunities. The road from the provincial township of Cao Lanh to Tram Chim has been partially asphalted. The rural road network has been improved although rivers and canals are the principal means of transportation in Tram Chim.

## **National Park Establishment Process, Roles and Biodiversity Values of Wetlands Ecosystems in Tram Chim**

After the reunion of the country in 1975 the provincial PC decided to select Tram Chim for the restoration of the Dong Thap Muoi habitat. In 1985, the district PC of Tam Nong demarcated 5 000 ha in Tram Chim, dug a boundary canal, and reforested the barren land with *Melaleuca*. The natural vegetation then recovered, with a flora of 130 species, creating habitats for a fauna of 140 species of invertebrate, 55 species of fish, 198 species of bird (of which 16 are rare species). The Dong Thap Muoi area has thus gradually recovered.

Since then, the site has attracted the attention of national and international scientists; IUCN, WWF and ICF have all invested in research and conservation activities. Its

value as a typical wetland ecosystem of the Mekong delta of international importance is recognized.

On 18 May 1992, the Prime Minister promulgated an order requesting relevant agencies to take immediate measures to protect *Grus antigone sharpii*, a wetland bird species, as well as the overall wetlands ecosystem in Tram Chim. Implementing this order, the Southern Sub-FIPI in collaboration with national and international institutions, drafted and submitted a "Project proposal to establish the Tram Chim Wetlands Protected Area". Based on this proposal, the Prime Minister issued a decision (No. 47/TTg dated 2 February 1994) which established Tram Chim wetland area as "a national protected area". The protected area was then upgraded into the Tram Chim National Park by a decision of the Prime Minister (No. 253/1998/QD-TTg. dated 29 December 1998).

The establishment of the Tram Chim National Park has great significance, not only for scientific research, but also for economic and social development in the area. The objectives, functions and mandates of the Tram Chim National Park were decided as follows:

Objectives:

- Conserve a typical wetlands ecosystem in the Mekong Delta and the region
- Protect this dynamic wetlands and related habitats of wetlands fauna especially rare migratory birds
- Conserve indigenous flora and fauna
- Maintain suitable conditions for the study of the natural environment and natural resource conservation.

Functions:

- Rehabilitate wildlife habitats, especially those for rare wetlands and migratory birds conserve genetic resources of both land and water flora and fauna.
- Study the land, flora and fauna resources and the natural land forms of the wetlands ecosystem; protect the environment, maintain ecological balance and provide services for research, eco-tourism and outdoor recreation.
- Enhance positive effects of the wetlands ecosystem by means of environment and water regulations and flood control.

## Activities Performed

In the three years after establishment (1994-96), the Tram Chim Protected Area implemented four programs: infrastructure development, water level regulation (through gates and boundary canals), buffer zone socio-economic development and research.

### Infrastructure Development

Ten construction items were built with finance from the Central Government totaling 1 166 million VND (US \$105,606) (200 million VND in 1994, 703 million VND in 1995 and 263 million VND in 1996).

Two gates for water level regulation (C5 and C6) were built, a water pump and pipes and a patrol car were procured for forest fire control, with the financial assistance of ICF (totaling 34 500 US \$).

### Water Level Regulation

A system of six gates and boundary canals were built and carefully operated to maintain hydrological conditions in compartments A1 and A2. This is an important program as it affects the whole ecosystem. The main objective of the program is to protect 16 rare bird species, especially *Grus antigone sharpii*.

### Forest Management and Protection

The total area of the Tram Chim National Park is 7 612 ha, occupying 17% of the district area (44 615 ha). The buffer zone of the national park consists of five communes and a district town, with a population of 31 229 or 39% of the district population (76 206 persons). The perimeter of the park is 53 km. The population density in the buffer zone is about 600 persons per km<sup>2</sup>, while the area covered by each forest protection staff member is 1.4 km<sup>2</sup>.

The project proposal of the national park included a total staff of 25 persons, eight office persons and 17 forest protection staff. Presently there are 44 persons on the staff, including 30 on a contractual basis. The average salary is 278 000 VND (US \$ 25.18)/month and the salary for contractual forest protection staff is 200 000 VND (US \$ 18)/month. The pay is thus very low and does not provide incentive for adequate forest protection activities. With the complexity of the national park, the number of contractual forest protection staff needs to be increased to 50 and the average salary to be 300 000 VND (US \$ 27/month).

Illegal wetland resource exploitation is the main threat to the national park. About 100-150 persons (up to 500-600 persons in peak period) penetrate the park daily for illegal fishing, hunting small animals, collecting firewood and harvesting lotus flowers and seeds etc. In the four months from January to April 1995, 207 cases of violation of the protected area were recorded involving 513 persons. Illegal activities listed below included fishing and catching eel, snakes and rats, and animal grazing:

- Using electric shock for fishing: 11 groups (301 persons),
- Fishing using electric shock devices: 12 boats,
- Firewood gathering: 20 households collecting for sale, 50 households for domestic use,
- Buffalo grazing in the protected area: 289 buffaloes of 16 households.

In the two months from the beginning of April to the end of May 1995, 31 cases of grassland and *Melaleuca* forest burning were reported, an area of 305.17 ha of *Melaleuca* forest were affected, of which 76 ha were badly damaged.

As a result of lessons learnt in 1995, forest management and protection in 1996 were improved, and mechanisms of coordination with local government, the forest inspectorate and the aquatic resource protection agency were established. Equipment for monitoring and control was acquired. The number of violations was thereby reduced.

In the first 6 months of 1996, 54 violators were arrested, 31 of them were dealt with on the spot, 18 were transferred to the commune police and five were transferred to the district police station. Seized materials included 1 800 m of fishing line, 39 firewood boats, 21 electric shock generators, 33 batteries, and 171 hand nets. Other violations included 34 cases of illegal grazing in the protected area (buffaloes, cattle and ducks), one case of use of toxic compounds harmful to birds, and three cases of cultivation in the ecological rehabilitation section of the park.

Water level regulation and fire control:

- Water level has been regulated according to plan; dikes, water gates, protection stations, boundary poles and fire control boards have been maintained.

- A forest fire control plan has been implemented and forest fires have not occurred.
- At present, 173 households have built houses temporarily for rice cultivation or permanently for settlement, on dikes near the 30 km border of the park disturbing water birds and other animal and plant species.

### Socio-economic Program

The park has elaborated a “Project for buffer zone protection and establishment, flood prevention and control and acid sulfate soil protection in Tan Cong Sinh and Phu Cuong communes of Tam Nong district, Dong Thap province”.

With the assistance of Prof. Tran Phuoc Duong and Prof. Vo Tong Xuan (Can Tho University), proposals were made and submitted to OXFAM and to the British Embassy to request assistance for poor communities in Tan Cong Sinh (25 000-50 000 US \$2.3-4.5). The Danish Embassy has given 50 000 (US \$4.5) for Phu Duc and Phu Tho communes.

### Basic and Applied Research

The park has collaborated with ICF and other international institutions to conduct a monitoring of *Grus antigone sharpii* and some other water birds. The number of *Grus antigone sharpii* were recorded as follows:

YEAR	NUMBER	YEAR	NUMBER
1994	271	1997	511
1995	302	1998	503
1996	631	1999	337

Water quality and hydrobiological sampling has been done for environmental impact assessment and resource monitoring with the assistance of the MRC wetlands project.

A proposal for integrated buffer zone development based on a combination of *Melaleuca - Rice - Animal husbandry - Cottage industries* has been drafted with the assistance of the Royal Holloway Environment Research Institute, the Darwin program of London University and the Farming System Research and Development Institute of Can Tho University.

The Department of Science, Technology and Environment of Ho Chi Minh City has provided solar

panels for 10 forest protection stations. A proposal for a production model of a combination of *Melaleuca* - Rice - Aquatic Resources was approved.

## Development Potential and Direction of the Tram Chim National Park

The question of how to protect, conserve and develop the Tram Chim National Park is the main concern of the authorities in Dong Thap province. Scientists, through their researches have significantly contributed to the formulation of development directions and alternatives. However, the development path is still challenging and studies need to be continued to develop feasible measures and to solve practical difficulties.

### Combining Conservation and Development

Conservation and development objectives are usually in conflict. A rational resolution for this conflict to attain both objectives is required.

- A strategy of biodiversity conservation for the national park is not yet in operation. There are conflicting ideas on how to conserve natural resources. For instance, the park has sometimes focused on the protection of a plant or an animal species without enough consideration of the existence of other species.
- The integration of conservation with eco-tourism needs organizational and operational arrangements so that tourism development opportunities can be realized without negative impacts on conservation objectives.
- The willingness of the State authorities to protect the area for a long term objective is clear. However, without adequate support to improve the livelihood of villagers in the buffer zone, conflicts between local communities and the park are emerging and leading to management difficulties. The solution is to improve villagers' livelihoods and at the same time, to increase their awareness of shared responsibility in protecting the park's resources.

### Increasing Investment

Capital invested for the development of the Tram Chim National Park has been very limited as compared with the extensive mandate of wetlands ecosystem conservation and development. Because of this limitation, the park's potential has not been fully realized. It was estimated that with an area of 7 612 ha, the investment capital

should be not lower than 20 billion VND (US \$ 1 811 430 ). However, the national investment has only been 1.116 billion VND (US \$ 101 078) – (200 million VND (US \$ 18,114) in 1994, 703 million VND (US \$ 63 671) in 1995 and 263 million VND (US \$ 25 000 ) in 1996), and the international support from ICF was 34 500 US \$ in 1995. Without adequate investment, large areas of the park are still in an idle state. The current rice price makes these areas attractive for conversion into rice fields. This leads to conflicts between local farmers and the park.

Results of a survey reveal that in the current poor socio-economic conditions and due to the low commune development budget in Tam Nong district in general and especially in the Tram Chim area, pressure to convert natural vegetation to wetland rice is very high. In areas near the park's border, good rice fields can give 5-6 t/ha/crop. If a farmer has a piece of land, even if labour is scarce, a land rent of 2 000 kg/ha/year (about 3 to 4 million VND (US \$ 271-362.29)/ha/year) can be earned. This option is also attractive to the commune PC as it would then receive agricultural tax, while large areas of the national park stand idle and undeveloped.

### Potential of the Tram Chim National Park

Tram Chim has the potential to become a smaller version of Dong Thap Muoi, to develop eco-tourism and to provide income. Three reasons can be cited for this potential: Firstly, its location is favorable, especially once the national road No. 1B is built; secondly, it is a rare and authentic ecosystem; and thirdly, it is rich in biodiversity. However, if it is kept untouched as in past years, the high flammability of *Melaleuca* poses a threat of forest fires. The destruction of Tram Chim would have important ecological consequences to the population of *Grus antigone sharpii* as well as other animals and plants.

The recorded number of *Grus antigone sharpii* in Tram Chim has declined in recent years. The reasons are:

- *Grus antigone sharpii* is a migratory bird, (nests and eggs have not been found)
- Although the area of Tram Chim is large, the range of *Grus antigone sharpii* is larger.
- The main feeding material for *Grus antigone sharpii* is the *Eleocharis* tuber. Unfortunately, with agricultural land expansion and irrigation development, the area suitable for *Eleocharis* has been drastically reduced.

- *Grus antigone sharpii* needs a quiet environment. The environment has been increasingly disturbed due to the process of urbanisation, population pressure and human activities.

In analysing the ecological management in Tram Chim, two conflicting pressures were found:

- The management objectives of keeping *Melaleuca* from fire and enhancing *Eleocharis* tuber production for *Grus antigone sharpii* are in conflict: To protect *Melaleuca* forests from fire, the park has to maintain a high water level under the forest. This in turn reduces *Eleocharis* tuber yield and water birds' accessibility to feeding materials.
- The population has been rapidly increasing, creating demographic pressures. Good management strategies for immigration are needed to avoid the conflict between ecosystem conservation and expansion of agricultural areas.

### **Future Development of the Tram Chim National Park**

To cope with the above difficulties, the master plan for the Tram Chim National Park needs to be revised to fit the current situation. The revision will be submitted to Central Government for approval. Along with this revision, a detailed land-use plan of different functional sections needs to be made to form a basis for the formulation of projects and to call for investment of all economic sectors to exploit the park's potential. Resource use should be based on combining protection, rehabilitation and development of the typical bio-resources of the Dong Thap Muoi area, especially plant species such as *Melaleuca*, floating rice, lotus, bamboo, *Canarium*, *Adina*, *Combretum*; bird species such as *Ardea spp.*, *Egretta spp.*, *Phalacrocorax spp.* etc., fish species such as *Ophiocephalus triatus*, *Clarias spp.*, *Anabas estudineus* etc., and reptiles such as *Python molurus* and various turtles. Natural gathering and eco-tourism development are possible.

The redistribution of the population should be done in a way that allows eco-tourism. There are propositions for the development of the resettlement areas along the dike in the eastern part of A1 section to become a tourism village, while aquaculture will be developed in the western and southern parts of this section. Habitats for *Python*,

turtles and snakes will be developed in some higher places along with places for water birds. Bamboo and *Adina* trees will be planted to create niches for water birds. The population of water birds can be regulated by rational hunting, along with the development of bird-raising businesses for the tourist market. In general, interventions should be done harmoniously, with a combination of protection and exploitation measures.

Section C will be developed for cultural purposes, including hotels and restaurants to attract visitors.

### **Collaboration Mechanisms Between the Local Government and the People**

Collaboration mechanisms between the park and local government at district and commune levels as well as with local villagers will be developed, based on a harmonious sharing of benefits. A clarification of government investment with the investment from other sectors, including a contractual mechanism to provide economic opportunities for local villagers according to government guidelines is needed in order to make the idea of converting Tram Chim to "a reduced picture of Dong Thap Muoi" realizable.

One of the critical issues of the local population surrounding the national park is the stabilization of the livelihood of people along the Phu Hiep canal. These people have long been living there and their presence is justified. The area from the dug canal in A1 section to Phu Hiep canal would be allocated for settlement as is the current status, and the barren land area would be allocated by contract for cultivation according to the land use plan of the national park.

### **Conclusion**

Given good direction, the Tram Chim National Park could become a precious asset. It has a significant role not only for the area but also for the whole country and for the international community. With this potential, it needs larger investment from the Government and international organizations to become a real national park for the protection of genetic resources of the Dong Thap Muoi wetlands.

# References

- Adger, W.N. 2000. Institutional adaptation to environmental risk under the transition in Vietnam. *Annals of the Association of American Geographers* 90(4): 738-758.
- Adger, W.N., P.M. Kelly and Nguyen Huu Ninh. 2001a. Environment, society and precipitous change, p. 1-18. *In* W. N. Adger, P. M. Kelly and Nguyen Huu Ninh (eds.) *Living with Environmental Change: Social Vulnerability, Adaptation and Resilience in Vietnam*. Routledge, London.
- Adger, W.N., P.M. Kelly and Nguyen Huu Ninh. 2001b. Prospects for sustainable development, p. 263-270. *In* W. N. Adger, P. M. Kelly and Nguyen Huu Ninh (eds.) *Living with Environmental Change: Social Vulnerability, Adaptation and Resilience in Vietnam*. Routledge, London.
- Adger, W.N., P.M. Kelly, Nguyen Huu Ninh and Ngo Cam Thanh. 2001. Property rights, institutions and resource management: coastal resources under *doi moi*, p. 79-92. *In* W. N. Adger, P. M. Kelly and Nguyen Huu Ninh (eds.) *Living with Environmental Change: Social Vulnerability, Adaptation and Resilience in Vietnam*. Routledge, London.
- Bailey, C. 1997. Aquaculture and basic human needs. *World Aquaculture* 28(3): 28-31.
- Bailey, C. and M. Skladany. 1991. Aquacultural development in tropical Asia - a reevaluation. *Natural Resources Forum* 15(1): 66-73.
- Baltzer, M., Nguyen Thi Dao, Robert Shore, J. Handcastle, B. Long, K. Clay and J. Springer. 2001. The Forests of the Lower Mekong Ecoregion Complex: The Greater Annamites, Central Indochina Dry Forests, Lower Mekong Floodlands, and Cardamom Mountains. World Wildlife Fund, Hanoi. 42 p.
- Beilfuss, R.D. and J.A. Barzen. 1994. Hydrological restoration in the Mekong Delta, p. 453-468. *In* W. J. Mitsch (ed.) *Global wetlands: old world and new*. Elsevier, New York.
- Boyd, C.E. and H.R. Schmittou. 1999. Achievement of sustainable aquaculture through environmental management. *Aquaculture Economics and Management* 3(1): 59-70.
- Boyd, C.E. and J.W. Clay. 1998. Shrimp aquaculture and the environment. *Scientific American* 278(6): 59-65.
- Boyd, C.E., L. Massaut and L.J. Weddig. 1998. Towards reducing environmental impacts of pond aquaculture. *INFOFISH International*(2): 27-33.
- Buckton, S.T., Nguyen Cu, Ha Quy Quynh and Nguyen Duc Tu. 1999. Conservation of Key Wetland Sites in the Mekong Delta. Birdlife International Vietnam Programme Conservation Report No. 12. Birdlife International Vietnam Programme, Hanoi. 101 p.
- Bui Chi Buu, Nguyen Thi Lang, Phung Ba Tao and Nguyen Duy Bay. 1995. Rice breeding research strategy in the Mekong Delta, p. 739-755. *In* IRRI-International Rice Research Institute (ed.) *Fragile Lives in Fragile Ecosystems*. Proceedings of the International Rice Research Conference, 13-17 Feb. 1995. IRRI-International Rice Research Institute, Manila.
- Cantho University. 1997. Eco-Technological and Socio-Economic Analysis of Fish Farming Systems in the Freshwater Area of the Mekong Delta. West-East Programme and College of Agriculture, Cantho University, Cantho. 124 p.
- Cao Thang Binh and C. Kwei Lin. 1995. Shrimp culture in Vietnam. *World Aquaculture* 26(4): 27-33. Ho Chi Minh City (unpublished).
- Chiem, N.H. 1993. Geo-pedological study of the Mekong Delta. *Southeast Asian Studies* 31(2).
- Chu Thai Hoanh and Thai Dinh Khang. 1993. Water management for sustainable development in the Mekong Delta, Viet Nam, p. 232-253. *In* M. W. Rosegrant, J. Witcover, R. V. Gerpacio and C. Ringler (eds.) *Agricultural Sustainability, Growth, and Poverty Alleviation in East and Southeast Asia: Issues and Policies*. Proceedings of an International Conference. German Foundation for International Development, International Food Policy Research Institute and Institute of Strategic and International Studies, Washington, D.C.
- Clay, J.W. 1997. Toward sustainable shrimp aquaculture. *World Aquaculture* 28(3): 32-37.
- Cockburn Sound Management Council. 2001. The State of Cockburn Sound: A Pressure-State-Response Report. Cockburn Sound Management Council, Freemantle. 134 p.
- Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Fish and Wildlife Service, US Department of Interior, Washington DC.
- de Graaf, G.J. and T.T. Xuan. 1998. Extensive shrimp farming, mangrove clearance and marine fisheries in the southern provinces of Vietnam. *Mangroves and Salt Marshes* 2(3): 159-166.
- de Silva, S.S. 1998. Tropical mariculture: current status and prospects, p. 1-16. *In* S. S. De Silva (ed.) *Tropical Mariculture*. Academic Press, London.
- Department of Environment, MOSTE of Vietnam. Strategy for Management, Protection, and Sustainable Development of Wetlands. Draft Programme in Vietnamese.
- Dubois, M. 2000. Study on the MRC Wetlands Classification System Including Recommendations for its Further Development. Mekong River Commission, Vientiane.
- Duc, L.D. 1991. Proceedings of the Workshop on *Melaleuca* Rehabilitation and Management, Long Xuyen, An Giang. 14-18 May 1991. Agricultural Publishing House, Hanoi, Vietnam.
- Dugan, P.J. (ed.) 1990. Wetlands Conservation: A Review of Current Issues and Required Action (Translated into Vietnamese by Nguyen Khac Kinh). IUCN-The World Conservation Union, Gland.
- Dumanski, J. and C. Pieri. 1997. Application of the pressure-state-response framework for the land quality indicators (LQI) programme. *In* The World Bank, UNEP, UNDP and FAO (eds.) *Land Quality Indicators and Their Use in Sustainable Agriculture and Rural Development*. Proceedings of the workshop organized by the Land and Water Development Division, FAO Agriculture Department and Extension and Training Division, FAO Sustainable Development Department, 25-26 January 1996. The World Bank, United Nations Environment Programme, United Nations Development Programme, and Food and Agriculture Organization of the United Nations, Rome.

- Flaherty, M., P. Vandergeest and P. Miller. 1999. Rice paddy or shrimp pond: tough decisions in rural Thailand. *World Development* 27(12): 2045-2060.
- Fox, J. and J. Ledgerwood. 1999. Dry-season flood-recession rice in the Mekong Delta: two thousand years of sustainable agriculture? *Asian Perspectives* 38(1): 37-50.
- Government of the Socialist Republic of Vietnam and Global Environmental Facility. 1994. Biodiversity Action Plan for Viet Nam. Government of the Socialist Republic of Vietnam and Global Environmental Facility, Hanoi.
- Government of the Socialist Republic of Vietnam. 1995. Incorporating Environmental Considerations into Investment Decision-Making In Viet Nam. Government of the Socialist Republic of Vietnam, Hanoi.
- Hanhart, K. and D.V. Ni. 1993. Water management on ricefields at Hoa An, Mekong Delta, Vietnam. *In* D. L. Dent and M. E. F. Van Mensvoort (eds.) *Selected Papers of the Ho Chi Minh City Symposium on Acid Sulfate Soils*. International Institute for Land Reclamation and Improvement, Wageningen.
- Hashimoto, T.R. 2001. Environmental Issues and Recent Infrastructure Development in the Mekong Delta: Review, Analysis and Recommendations with Particular Reference to Large-scale Water Control Projects and the Development of Coastal Areas. Working Paper No 4. Australia Mekong Resource Center, Sydney. 70 p.
- Hein, L. 2002. Toward improved environmental and social management of Indian shrimp farming. *Environmental Management* 29(3): 349-359.
- Hossain, M. 1998. Recent developments in the world rice market and Vietnam rice economy: implications for prioritization of rice research. Paper presented at the IRRI-Vietnam meeting, 11-13 November 1998, Hanoi, Vietnam.
- Institute for Fisheries Economics and Planning. 1997. Operational Policies and Strategies to Realize Fisheries Development Objectives. Danida-Ministry of Foreign Affairs and Ministry of Fisheries, Vietnam, Hanoi. 27 p.
- Kammerbauer, J., B. Cordoba, R. Escolan, S. Flores, V. Ramirez and J. Zeledon. 2001. Identification of development indicators in tropical mountainous regions and some implications for natural resource policy designs: an integrated community case study. *Ecological Economics* 36(1): 45-60.
- Koji, T. 2001. Agricultural development in the Broad Depression and the Plain of Reeds in the Mekong Delta: conserving forests or developing rice culture? *Southeast Asian Studies* 39(1): 137-150.
- Le Dien Duc (1989) "Socialist Republic of Vietnam". *In*: D A Scott (Ed.), *A Directory of Asian Wetlands*. IUCN, Gland, Switzerland, pp. 749-793.
- Le Dien Duc. 2001. The Socialist Republic of Vietnam. World Conservation Monitoring Centre. [Online]. Available: <http://www.wcmc.org.uk/infoserv/countrysp/vietnam/app8new.html> [2001, 24 July].
- Lovatelli, A. 1997. Status of aquaculture in Vietnam. *Aquaculture Asia* 2(3): 18-24.
- Luttrell, C. 2002. Embracing and resisting the global shrimp boom: shifting access to resources in the Vietnamese renovation. Paper Presented during the 9th Conference of the International Association for the Study of Common Property, 17-21 June 2002. 33 p.
- Macintosh, D.J. 1996. Mangroves and coastal aquaculture: doing something positive for the environment. *Aquaculture Asia* 1(2): 3-8.
- Maurand, P. 1943. L'Indochine Forestière. Imprimerie d'Extrême-Orient, Hanoi, Vietnam.
- Mekong River Commission. 1998. Inventory and Management of Wetlands in the Lower Mekong Basin, Phase II, Project Document. Mekong River Commission, Phnom Penh.
- Menasveta, P. and A.W. Fast. 1998. The evolution of shrimp culture and its impact on mangroves. *INFOFISH Int*(1): 24-26.
- Minh, L.Q., T.P. Tuong, M.E.F. van Mensvoort and J. Bouma. 1997. Contamination of surface water as affected by land use in acid sulfate soils in the Mekong River Delta, Vietnam. *Agriculture Ecosystems & Environment* 61(1): 19-27.
- Ministry of Agriculture and Rural Development. (MARD) 1998. Report on Five Years for Development of Technology on Rice Production. Ministry of Agriculture and Rural Development, Hanoi, Vietnam.
- Minot, N. 2000. Generating disaggregated poverty maps: an application to Vietnam. *World Development* 28(2): 319-331.
- Minot, N. and F. Goletti. 1998. Export liberalization and household welfare: the case of rice in Vietnam. *American Journal of Agricultural Economics* 80(4): 738-749.
- NACA. 2000. State of Asian aquaculture. *Aquaculture Asia* 5(1): 4-24.
- NEDECO. 1993. Masterplan for the Mekong Delta in Vietnam. Prepared for the Government of Vietnam, State Planning Committee, The World Bank, Mekong Secretariat and UNDP. NEDECO, Arnhem & Nijmegen, Netherlands.
- Nguyen Van Nhan. 1997. Wetland mapping in the Mekong Delta and Tram Chim area using Geographical Information Systems (GIS), p. 87-93. *In* R. J. Safford, D. V. Ni, E. Maltby and V. T. Xuan (eds.) *Towards Sustainable Management of Tram Chim National Reserve, Vietnam*. Proceedings of a Workshop on Balancing Economic Development with Environmental Conservation. Royal Holloway Institute for Environmental Research, London.
- Nhan, N.V. 1997. Wetland mapping in the Mekong Delta and Tram Chim National Reserve area using Geographical Information Systems, p. 87-94. *In* R. J. Safford, D. V. Ni, E. Maltby and V.-T. Xuan (eds.) *Towards Sustainable Management of Tram Chim National Reserve, Viet Nam*. Proceedings of a Workshop on Balancing Economic Development with Environmental Conservation. Royal Holloway Institute for Environmental Research, London.
- Ni, D.V. and V.-T. Xuan. 1998. Rural development in a remote area: a case study of Hoa An, Phung Hiep, Can Tho, Vietnam. *In* V.-T. Xuan and S. Mitsui (eds.) *Development of Farming Systems in the Mekong Delta of Vietnam*. H.M.C. Publishing House, Japan International Research Center for Agricultural Sciences (JIRCAS), Farming Systems Research and Development Institute and Cuu Long Delta Rice Research Institute (CLRRI), Ho Chi Minh City, Vietnam.
- NIAPP. 1993. The agroecological systems in the Mekong Delta. *Journal of Agricultural Food Stuff Industries* 370(4): 128-131 (English Summary).

- Paez-Osuna, F. 2001. The environmental impact of shrimp aquaculture: causes, effects, and mitigating alternatives. *Environmental Management* 28(1): 131-140.
- Paez-Osuna, F., S.R. Guerrero-Galvan and A.C. Ruiz-Fernandez. 1998. The environmental impact of shrimp aquaculture and the coastal pollution in Mexico. *Marine Pollution Bulletin* 36(1): 65-75.
- Phan Nguyen Hong and Hoang Thi San. 1993. Mangroves of Vietnam. IUCN, Bangkok, Thailand.
- Phan Nguyen Hong and Hoang Thi San. 1993. Mangroves of Vietnam. IUCN, Bangkok, Thailand. 173 p.
- Phillips, M.J. 1998. Tropical mariculture and coastal environmental integrity, p. 17-110. *In* S. S. De Silva (ed.) *Tropical Mariculture*. Academic Press, London.
- Pingali, P.L. and Vo-Tong Xuan. 1992. Vietnam: decollectivization and rice productivity growth. *Economic Development and Cultural Change* 40: 697-718.
- Primavera, J.H. 1991. Intensive prawn farming in the Philippines: ecological, social, and economic implications. *Ambio* 20(1): 28-33.
- Primavera, J.H. 1997. Socio-economic impacts of shrimp culture. *Aquaculture Research* 28(10): 815-827.
- Primavera, J.H. 1998. Tropical shrimp farming and its sustainability, p. 257-290. *In* S. S. de Silva (ed.) *Tropical Mariculture*. Academic Press, London.
- Ramsar Convention Bureau. 2000. Ramsar Handbooks for the Wise Use of Wetlands. Ramsar Convention Bureau, Gland, Switzerland.
- Rothuis, A. 1998. Rice-Fish Culture in the Mekong Delta, Vietnam: Constraint Analysis and Adaptive Research. Dissertation, Katholieke Universiteit Leuven, Belgium.
- Ryan, J. 2002. Assessing the impact of food policy research: rice trade policies in Vietnam. *Food Policy* 27(1): 1-29.
- Safford, R. J., Tran Triet, Maltby, E., and Duong Van Ni (1998) "Status, biodiversity and management of U Minh wetlands, Vietnam", *Tropical Biodiversity* 5(3):217-244. Thach,
- Safford, R.J. and E. Maltby. 1997. The overlooked values of *Melaluccea* wetlands, p. 109-112. *In* R. J. Safford, D. V. Ni, E. Maltby and V.-T. Xuan (eds.) *Towards Sustainable Management of Tram Chim National Reserve, Vietnam*. Proceedings of a Workshop on Balancing Economic Development with Environmental Conservation. Royal Holloway Institute for Environmental Research, London.
- Safford, R.J., Tran Triet, E. Maltby and Duong Van Ni. 1998. Status, biodiversity and management of U Minh wetlands, Vietnam. *Tropical Biodiversity* 5(3): 217-244.
- SCP Fisheries Consultants Australia. 1996. Vietnam Coastal Aquaculture Review. ADB TA No. 2382-VIE: Coastal Aquaculture Development Study. Asian Development Bank and Ministry of Fisheries, Hanoi.
- Senarath, U. and C. Visvanathan. 2001. Environmental issues in brackish water shrimp aquaculture in Sri Lanka. *Environmental Management* 27(3): 335-348.
- Shintani, M. 2001. Underemployment in the Agricultural Sector of Vietnam: a production function approach. *The Japanese Journal of Rural Economies* 3(72): 26-35.
- State Planning Committee and General Statistical Office. 1994. Vietnam Living Standards Survey 1992-1993. Statistical Publishing House, Hanoi.
- Stonich, S.C. 1995. The environmental quality and social justice implications of shrimp mariculture development in Honduras. *Human Ecology* 2.
- Stonich, S.C. and C. Bailey. 2000. Resisting the blue revolution: Contending coalitions surrounding industrial shrimp farming. *Human Organization* 59(1): 23-36.
- Stonich, S.C., J.R. Bort and L.L. Ovaes. 1997. Globalization of shrimp mariculture: The impact on social justice and environmental quality in Central America. *Society & Natural Resources* 10(2): 161-179.
- T.K. 1980. Sedimental Geology of the Mekong Delta. General University of Ho Chi Minh City.
- Tien, D.C. 1995. Survey on the socio-economic status of farmers in the Mekong Delta.
- Tran Thanh Be, Le Canh Dung and D. Brennan. 1999. Environmental costs of shrimp culture in the rice—growing regions of the Mekong Delta. *Aquaculture Economics and Management* 3(1): 31-42.
- Tran Triet, R.J. Safford, Tran Duy Phat, Duong Van Ni and E. Maltby. 2000. Wetland biodiversity overlooked and threatened in the Mekong Delta, Vietnam: grassland ecosystems in the Ha Tien Plain. *Tropical Biodiversity* 7(1): 1-24.
- TranTruong Luu. 2000. Vietnam: mangrove-friendly aquaculture, p. 67-80. *In* J. H. Primavera, L. M. B. Garcia, M. T. Castanos and M. B. Surtida (eds.) *Mangrove-Friendly Aquaculture*. Southeast Asian Fisheries Development Center, Tigbauan, Iloilo.
- Tri, L.Q. 1996. Developing management packages for acid sulfate soils based on farmer and expert knowledge. Field study in the Mekong Delta, Vietnam, Wageningen University, The Netherlands.
- Tuong, T.P., C.T. Hoanh, N.T. Khiem. 1989. Agro-hydrological factors as land qualities
- Tuong, T.P., L.Q. Minh, D.V. Ni and M.E.F. van Mensvoort. 1998. Acid Water Pollution from Reclaimed Acid Sulfate soils. Paper presented at IRRI-Vietnam meeting. 12-13 November 1998. Hanoi, Vietnam.
- UNDP-Vietnam. 1997. Some Lessons Learned in Supporting the Transition from Poverty to Prosperity. United Nations Development Program - Vietnam. [Online]. Available: <http://www.undp.org.vn/undp/docs/1997/lessons/eng/index.htm> [2002, 27 August].
- UNDP-Vietnam. 1999. Compendium of Environmental Projects in Vietnam - 1999. 1. United Nations Development Programme, Hanoi. 80 p.
- UNESCO. 1994. Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, Iran 2.2.1971), as amended by the Protocol of 3 December 1982 and the Amendments of 28 May 1987, as of July 1994. Office of International Standards and Legal Affairs, UNESCO. [Online]. Available: [http://www.iucn.org/themes/ramsar/key\\_conv\\_e.html](http://www.iucn.org/themes/ramsar/key_conv_e.html) [2001, July 19].
- van Breemen, N. and L.J. Pons. 1978. Acid Sulfate Soils and Rice, p. 739-761. *In* International Rice Research Institute (ed.) *Soil and Rice*. International Rice Research Institute, Los Baños, Laguna.



- Van Lap Nguyen, Thi Kim Oanh Ta and M. Tateishi. 2000. Late Holocene depositional environments and coastal evolution of the Mekong River Delta, Southern Vietnam. *Journal of Asian Earth Sciences* 18(4): 427-439.
- Voice of Viet Nam. 1998. *VTV# news*, Wednesday, 4 November 1998.
- Yamazaki, R. and D.V. Ni. 1999. Modification of farmers' differentiation process and role of farmers' organizations: a case study in Hoa An village, Mekong Delta of Vietnam. *JIRCAS Journal* 7: 117-132.
- Young, O. and A. Underdal. 1997. *Institutional Dimensions of Global Change*. IHDP Scoping Report. International Human Dimensions Programme on Global Environmental Change, Bonn, Germany.

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