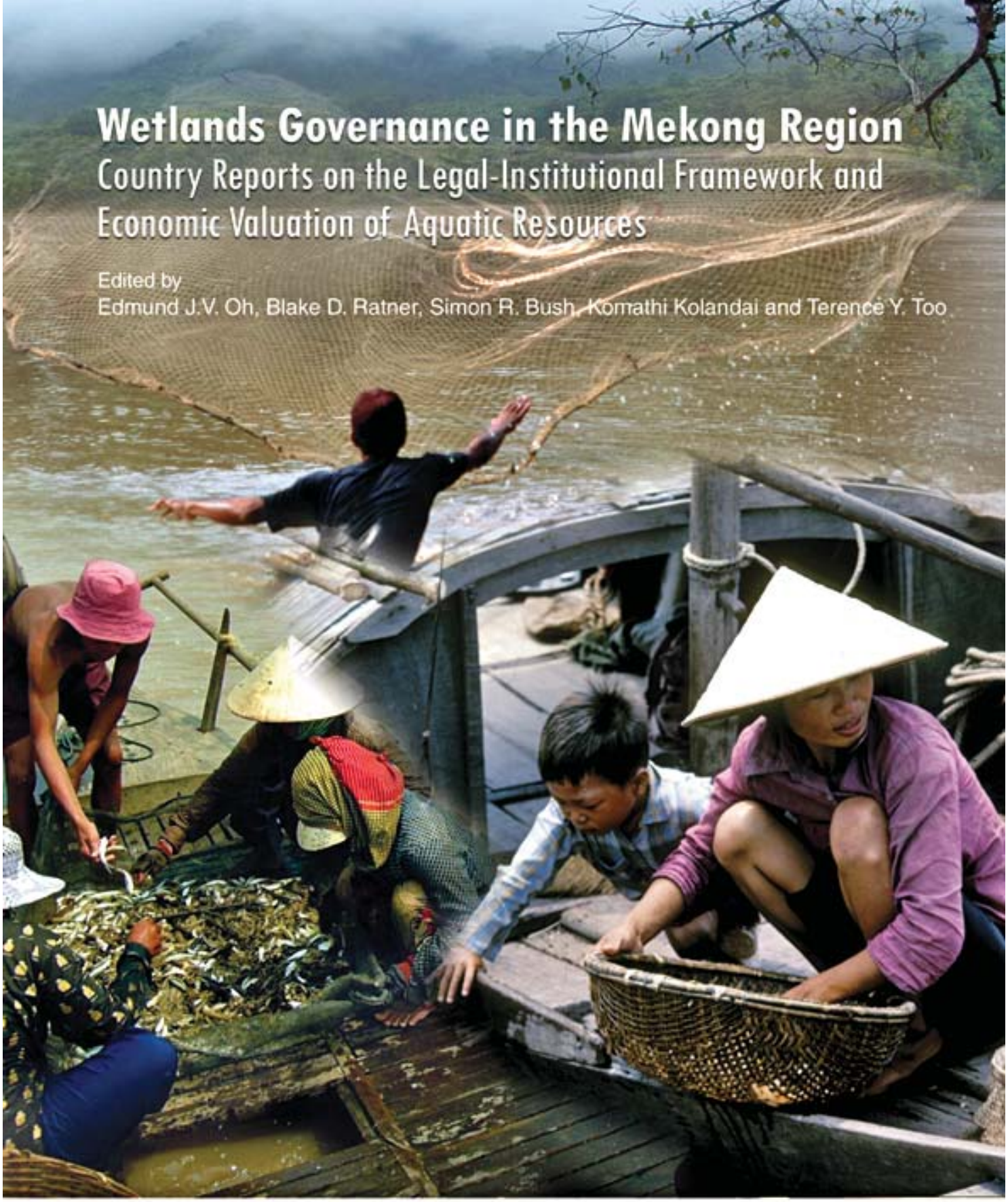
Wetlands Governance in the Mekong Region

Country Reports on the Legal-Institutional Framework and Economic Valuation of Aquatic Resources

Edited by
Edmund J.V. Oh, Blake D. Ratner, Simon R. Bush, Komathi Kolandai and Terence Y. Too



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Wetlands are central to the livelihoods of rural communities throughout the Mekong Region, providing vital functions and services that support the rural economy, ensure food security for the most vulnerable members of society, and underpin the prospects for national development. Proper appreciation of the importance of wetlands has been hampered by inadequate information and awareness of their uses, particularly among development planners, as well as legal and institutional frameworks that are often fragmented and poorly enforced. Wetlands are consistently undervalued and overlooked as a result, and ultimately, it is the rural poor who lose out.

Sustainable development of wetlands demands a systemic, holistic perspective, precisely because wetlands defy boundaries. This collection of country reports presents the findings from a regional research initiative known as the Mekong Wetlands Approach, which is a step in that direction. The challenge for wetlands management is to balance the needs of resource users to ensure a coordinated effort to sustainably manage wetlands and wetland resources. The Wetlands Approach addresses this challenge by providing a platform for the further development of a process oriented, holistic approach to wetlands management and development.

TITLES OF RELATED INTEREST

Cambodian Inland Fisheries: Facts, figures and context. E. Baran. 2005. WorldFish Center, Penang, and Inland Fisheries Research and Development Institute, Phnom Penh, Cambodia. 49 p.

Undervalued and Overlooked: Sustaining Rural Livelihoods through Better Governance of Wetlands. B.D. Ratner, Dang Thanh Ha, Mam Kosal, Ayut Nissapa and Somphanh Chanphengxay. 2004. WorldFish Center Studies and Reviews 28, 24 p.

Wetlands Management in Cambodia: Socioeconomic, Ecological, and Policy Perspectives. M. Torell, A.M. Salamanca, B.D. Ratner (eds.). 2004. WorldFish Center Technical Report 64, 55 p.

Wetlands Management in Vietnam: Issues and Perspectives. M. Torell, A.M. Salamanca, B.D. Ratner (eds.). 2003. WorldFish Center Technical Report 61, 89 p.

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Introduction

Wetlands are one of the most important contributors to the livelihoods of people in both rural and urban communities in the countries of the lower Mekong Basin. In the broadest sense, wetlands include rivers, lakes, ponds, swamps, streams, rice fields, mangroves, mudflats, and coral reefs. Wetlands of the region are associated with the tributaries stretching across the plateau in northeast Thailand and the mountains of Lao PDR, the floodplains of Cambodia, the Mekong and Red River Deltas in Vietnam, and coastal zones from the Indian Ocean in southern Thailand to the South China Sea in northern Vietnam. Wetlands collect, store and transport water from the highlands to the coast and, in so doing, provide habitat for plants, fish and other aquatic animals. As well as contributing to ecological integrity, these organisms provide up to 75% of the total protein intake of some of the poorest and most vulnerable people in the region. Wetlands are essential in rice production, and provide a range of economic, social and cultural services important to both local livelihoods and national economies. However, despite the wide range of stakeholders involved in the use of wetland resources, there has been little consultation and open discussion about their responsible and sustainable management from local to regional levels of governance.

Wetlands in the region are being used, managed and developed within the context of rapidly changing national economies and national development agendas that place different priorities on water resources. The trans-boundary nature of the Mekong River has meant that water has increasingly become an internationally politicized resource, with competition increasing between upstream and downstream users involved in national scale development projects, such as electricity generation, navigation development, water diversion and expansion of agriculture. Furthermore, there has been a lack of information coordination between government agencies, and limited institutional support given to resource users in the development process.

The papers in this collection report on the findings of the project, "Legal and Institutional Frameworks and Economic Valuation of Resources in the Mekong River Region: A Wetlands Approach," supported by the Swedish International Development Cooperation Agency (Sida). Building on a number of priority-setting consultations held during 1999 to 2001, the project created country and local-level working groups active during 2002-2004, which helped build a shared understanding of the multiple values of wetlands and highlight the constraints to their governance in Lao PDR, Cambodia, Vietnam and Thailand. Out of this research and dialogue emerged a 'wetlands perspective' on rural development challenges. As summed up in the synthesis report *Undervalued and Overlooked: Sustaining Rural Livelihoods through Better Governance of Wetlands*, a 'wetlands perspective' is one that "gives special attention to the livelihoods of poor people dependent upon wetlands and sets socioeconomic challenges within an ecological context" (Ratner et al. 2004, p.14). To promote not only improved awareness but also long-term institutional change, the project adopted a process-driven approach, placing responsibility for and ownership of research in the hands of decision-makers in each country.

By developing the capacity for networking within and between governments, the process enabled the consideration of a number of local, national and regional perspectives relevant to the sustainable management and use of wetlands and wetland resources. The process encouraged dialogue among a range of sectoral agencies from each of the countries, as well as, in a number of cases, nongovernmental organizations and university research centers. This collection of papers helps make information accessible, which would otherwise be fragmented and dispersed, and provides a reference for further compilation and refinement of information relating to the governance of wetlands. Furthermore, it provides a starting point for further research that will advance a dialogue on how best to manage wetlands and wetland resources.

The country papers included here report the results of two key research themes – (i) the economic valuation of wetland resources, and (ii) reviews and analyses of the legal and institutional frameworks. The latter has focused on the interfaces between national, provincial and customary institutions governing the use and management of wetlands. Taken together, these themes highlight the challenges faced by government and customary resource managers and other local stakeholders in ensuring the sustainable use of wetland resources.

Common themes

The papers demonstrate the need for wetlands management to reflect the multiple needs and values of local users and governments. Each country chapter identifies as key areas to address, the lack of clear definitions, poor interagency coordination, the lack of a coherent national legal framework, and the need to incorporate non-use and indirect-use values in governance and management decisions. In doing so, the collection highlights the importance of a more integrated approach to wetland governance, both within and among the various scales at which decisions are made. Public participation and the effective dissemination of policy information are seen as necessary to ensure that resource management rules and institutions are legitimate.

Each chapter highlights the implications of different definitions of wetlands. The Vietnam chapter notes the management difficulties caused by conflicting official 'development oriented' and 'conservation oriented' definitions. Likewise, the Lao PDR chapter notes the political sensitivities towards the conservationist emphasis in previous definitions of wetlands, which was often interpreted to exclude local livelihood benefits. Revisiting such issues was a necessary foundation for launching a new phase of discussion and debate over wetlands and wetland resources throughout the Mekong region.

The authors of all of the chapters identify inadequate interagency coordination as a major barrier to a coherent management strategy for wetlands. As a step towards assessing opportunities to improve coordination, each chapter identifies the roles of various agencies and coordination bodies for the management of water and wetland resources. The Cambodia chapter, for example, outlines the role and responsibilities of the inter-ministerial Tonle Sap Biosphere Reserve Secretariat, which the authors note, has both advantages and disadvantages stemming from its geographically-defined focus. Similarly, the Lao PDR chapter outlines the roles and responsibilities of the Water Resources Development Committee and the challenges of bringing together organizations responsible for sustainable management of water and those responsible for extractive uses.

Each of the chapters outlines the diversity of national laws that exists in relation to the use and development of water, land, forests and aquatic resources, and identifies why, in each country, the situation falls short of a coherent legal framework to coordinate resource management decisions. The Thailand chapter describes the existing legal framework as fragmented and poorly enforced, with overlapping jurisdictions and centralized structures of power. These characteristics are similarly reflected in the chapters on Lao PDR, Cambodia and Vietnam.

Recognizing the shortcomings of these legal and institutional frameworks, all the authors emphasize the need to incorporate the rights and responsibilities of diverse resource users into decisions over wetlands management from local to regional scales. They advocate governance structures that recognize these rights and responsibilities within formal legislation and that support customary systems of management. The role of the state in recognizing and supporting existing systems of local governance remains a key challenge for authorities in each country. However, that challenge has a very different character depending on such factors as the degree of formal devolution of decision-making authority (highest in Thailand), or the capacity of local-level government (relatively robust in Vietnam, weaker in Laos and Cambodia).

By promoting an integrated approach to wetland management, all of the chapters draw attention to the range of values held by stakeholders. The authors recognize the dominance and influence in wetland management of direct-use values of wetlands, such as irrigation, fisheries and hydropower generation. In contrast, all chapters highlight the lack of attention given to indirect values, such as the ecosystem services of wetlands, or cultural and social non-use values. Attention is also drawn to the importance of capturing these values in location-specific assessments of total economic value. The chapters consistently affirm that a range of qualitative and quantitative measures is needed to integrate the total value into planning and management decisions.

While all recognize the importance of better economic valuation, each chapter places different emphases on the specific values, valuation methods required, and uses of this information in wetland management. The chapters on Lao PDR and Cambodia clearly identify the lack of existing data and the lack of capacity to carry out natural resource valuation. A distinctive feature of the study of Lao PDR is the paucity of information on wetland valuation and water resources planning. In comparison, the Cambodia chapter focuses

on the poor application of this information in strategies designed to help alleviate poverty and promote sustainable livelihoods.

The studies of Thailand and Vietnam include empirical information and analysis related to wetland valuation, and highlight the available technical capacity in both countries. The Thai study concludes that, despite extensive information being available, failure to disseminate this information to local government managers has led to conflict between the state and resource users. In contrast, the Vietnamese study places attention on the lack of available long-term statistics, and emphasizes the need for more systematic data collection and use. The authors also stress the importance of identifying the potential winners and losers of alternative wetlands-related actions and policies.

The collection promotes an integrated approach to wetlands management that incorporates both local and national interests and values in a two-way process, by which the perspectives of local resource users are integrated into the policy process at the national level, and national agendas are grounded in the views and livelihoods of local resource users. Each country chapter advocates public participation as a means of incorporating two-way consultation and local empowerment in an integrated management system. In Lao PDR and Vietnam, local participation is described as a means of communicating interests and concerns to local government. In Cambodia and Thailand, participation is promoted as a means of devolving power to local communities. In all cases, participation is generally promoted as a process that holds potential for greater consultation with communities that will, in turn, lead to increased recognition, understanding, and legitimacy of customary management systems.

Nevertheless, important differences exist in the potential of resource users to control and manage the resources in their country. The Vietnam chapter, while noting that centralized authority is maintained by way of an extensive network of state agencies, describes the important role of the state in communicating the concerns of local resource users to the central governing bodies. In contrast, the Lao PDR chapter reflects on the lack of government capacity to coordinate or enforce centralized management. Instead, the authors describe how decentralized management offers a pragmatic way of incorporating customary systems within a centralized policy framework.

Challenges for the wider research community

This collection contributes to the overall awareness of wetlands and wetland resources in the countries of the Lower Mekong Basin. Each chapter in this collection recognizes that change begins with an awareness of the multiple values of wetlands. The authors discuss the need for institutional innovation that is supported by a strong legal framework, and note that change poses many challenges. Meeting these requires mutual support among research, policy and management personnel and agencies.

Awareness begins with managers addressing the local nature of wetlands and their use. The Ramsar definition of wetlands provides a starting point but, as the chapters in this collection highlight, local discussion and deliberation must stem from a clear understanding of what constitutes wetlands, and why they are important to resource users. Change begins with a better appreciation of the values attributed to wetlands and wetland resources. This collection highlights the need for these values to be better recognized and understood by government and the public.

The collection demonstrates that institutional reform and innovation for wetland management is needed in each of the countries examined. Acknowledging the importance of customary management systems and the views of resource users, national governments, with the support of civil society, must find ways of facilitating institutional change. Furthermore, change must be supported by way of better coordination and strengthening of the legal frameworks that outline the rules, rights and responsibilities of governments and local users alike. Finally, strategies for change have to operate under increasing environmental uncertainty and increasing demand on wetland resources.

The wetlands perspective that emerges from this collection provides a starting point for the development of a process-oriented, holistic approach to the management and development of wetland resources. Initiatives need to be sensitive to national and regional needs, while being locally grounded. Research needs to focus on developing effective governance structures that balance action and understanding of policy initiatives within all levels of government and among resource users. Research into improved policies and management decisions needs to be

jointly undertaken by researchers and decision-making authorities. This collection is a step in that direction. There is clearly a need for more collaboration and the Wetlands Approach project helped address this need by providing a platform for a range of useful partnerships. Detailing the results of this process, the chapters in this volume present information on what is known, and make clear how much still remains to be done.

References

Ratner, B.D., Dang Thanh Ha, Mam Kosal, Ayut Nissapa and Somphanh Chanphengxay. 2004. Undervalued and overlooked: Sustaining rural livelihoods through better governance of wetlands. WorldFish Center Studies and Reviews 28, 24 p.

Rules, institutions and values: Towards an integrated approach to wetlands governance in Lao PDR

Somphanh Chanphengxay, Pingkham Latsasima, and Bounthong Xaphakdy

The Mekong Wetland Approach project provided the first opportunity for representatives of different local agencies to undertake an analysis of the legal and institutional framework and to attempt an economic valuation of wetland resources in Lao PDR. The chapter presents the findings of these two research activities. In particular it highlights the link between the perceptions of different stakeholders regarding the value of wetlands and the investment made by governments in their management.

The current situation and the research approach

For some time, wetlands have been a contentious issue in Lao PDR because of their association with conservation. The Mekong Wetlands Approach reopened discussions on wetlands, creating a forum for different government ministries to consider the broad range of views on wetlands.

Lao PDR has a diverse topography, extending from the floodplains of the Mekong River to highland areas in the north and east. Wetlands extend across the full range of these environments. Much of the water flowing into the Mekong Basin – 35% of the total flow in the dry season – originates in Lao PDR.

Despite recognition of the diversity of wetlands, agreement on a national classification for wetlands has proved difficult to find. Local terms for wetland habitats are often not compatible with the classifications offered by the World Conservation Union (IUCN) and the Mekong River Commission. Furthermore, local terms for wetlands vary around the country and also among government agencies. Nevertheless, during a Mekong Wetlands Approach meeting, the Department of Livestock and Fisheries developed a preliminary classification of wetlands. This represents an important step towards the implementation of an integrated system of wetlands governance.

There is little literature on the status of wetlands in Lao PDR. What few studies there are highlight the importance of wetlands to Lao culture, food security, rural livelihoods, and living aquatic resources management. The chapter reviews relevant studies and the main lessons arising from them. The lessons learned need to be applied to policy formulation, and used to improve the coordination of governmental and non-governmental organizations in an integrated approach to wetlands management.

The lack of appreciation of the importance and integrated nature of wetlands resources was a primary focus of the study. Through the Mekong Wetlands Approach and its tools the study aimed to improve wetlands management and policy decision-making by improving the valuation of wetlands resources, by integrating and coordinating organizations with responsibility for wetlands, and by reducing institutional constraints and coordinating wetlands management.

The legal and institutional framework governing the management and use of wetlands

The research into the legal and institutional framework was designed to provide baseline information from which future laws and regulations, better suited to contemporary wetland use by rural Lao communities, could be developed. The study was divided into four parts: (i) a review of national policies relevant to wetlands and wetland resources, (ii) an analysis of the current legal and institutional framework for wetland governance, (iii) a review of international agreements related to wetland use and management, and (iv) an outline of the roles and duties of government agencies involved in wetland governance.

In Lao PDR there is no one policy that relates to wetlands. Instead, there are numerous policies that refer to various aspects of the use and management of wetlands and related resources. Such policies generally exhibit two central features. The first is the explicit links between development, conservation, and poverty alleviation. The second is the constitutional right of access to natural resources by the Lao people and state, and their obligation to protect and use these resources sustainably.

As is the case with policy, Lao PDR has no one law relating to wetland use, management and development. Instead, there are several laws applicable to wetlands ensconced within the laws dealing with forestry, water and water resources, and agriculture.

The chapter reviews the relevant features of natural resources policy in the areas of social and economic development, environmental protection, and conservation. During the research undertaken for this project, it became apparent that there is some confusion over the jurisdiction of laws, particularly with respect to those concerning fish and other aquatic animals and their capture in forested and non-forested areas. It also became apparent that the extent to which centrally planned laws are actively enforced is limited by public awareness of the laws and by the capability of government officials. It is suggested that a possible alternative to such centrally planned laws would be village rules and regulations that are specific to local conditions and better understood and enforced by resources users; there are examples of local rules being ratified into district and provincial law and regulations.

The Lao PDR government recognizes the importance of international cooperation in environmental protection and is a signatory to a number of environmental agreements, including the 1992 Convention on Biological Diversity and the 1995 Mekong Agreement. The government is currently deliberating whether or not to become a signatory to the Ramsar Convention. The main difficulty in ratifying that Convention stems from the perception that Ramsar is primarily focused on the preservation of wetland resources through the exclusion of resource users, which comes into conflict with the Lao PDR constitutional right of access to natural resources.

A number of government organizations are involved in the management of wetland resources, and there is no formal framework for the coordinated management of wetlands in Lao PDR. The Ministry of Agriculture and Forestry has overall responsibility for the management of wetland resources, including agriculture and conservation, while other ministries have interests in wetlands as they relate to transport, construction, or electricity production. This distribution of responsibilities and interests highlights the division between agencies responsible for sustainable management of wetlands and those responsible for extractive uses.

Recent discussions within the Ministry of Agriculture and Forestry have taken the important step of starting to designate areas of responsibility among departments; the features of this process are outlined in the chapter. The government's decentralization policy, in which the legal and institutional framework is more inclusive of existing local management systems, will allow national and provincial departments to take into consideration local variations in wetlands and, as a result, develop appropriate management systems. Further development of practical guidelines would decrease the overlap of responsibilities at the ministerial and departmental levels, as well as improve the coordination of local resource management systems.

Economic valuation of wetland resources

The responsibility for the use and management of wetland resources is shared among different ministries, which are largely uncoordinated in the matter of wetlands governance. This lack of coordination is directly linked to a lack of appreciation of the different economic values placed on wetland resources by different government offices. The Mekong Wetlands Approach provided a first opportunity for multiple stakeholders to share their perspectives on the importance and value of wetlands. This was an important step in raising the profile of wetland use by communities; it will improve the community's understanding of the agendas of different government sectors, and facilitate the integration of local interests into management and development of wetlands at the provincial, national and regional levels.

The survey undertaken as part of the project was based on the total economic valuation (TEV) framework, which breaks values down into categories that can be assessed separately using differing methods. These categories include both use and non-use values, with use values being further divided into direct-use values, indirect-use values and option values, and non-use values being divided into bequest and existence values. The TEV is calculated as the sum of all these values. Direct-use values are more commonly recognized by government agencies, but indirect-use values and non-use values are not as well understood, or as easily identified.

The emphasis in Lao PDR has been on the direct-use values of wetlands, and this is reflected

in much of the legislation and policy related to natural resource use. However, studies of wetland-related activities have identified a range of indirect-use values and non-use values. While extensive information related to wetlands has been collected at the provincial level, the information is often qualitative and not suitable for economic valuation. However, it does provide a base on which to develop future studies. The case studies undertaken for this project show that, if the full range of wetland values is to be captured, a variety of qualitative and quantitative methods – including market prices, replacement costs, consumption surveys and participatory-based tools – need to be employed.

The Mekong Wetlands Approach has demonstrated the importance of incorporating provincial and local level stakeholders in discussions about natural resource governance. This is a new concept in Lao PDR, and, as yet, there remains no coherent understanding of the variety of values that exist, or how these values can be assessed.

Policy conclusions: Challenges and strategies for improved governance of wetlands

The dialogue resulting from the Mekong Wetlands Approach has enabled related resources to be integrated under a common management framework. Several positive outcomes have emerged from this process. First, a new term for wetlands, *'din boliven nam'*, which literally means 'land where there is water', has been adopted to replace *'din tham'*, which refers mainly to floodplain areas. The new, broader term is an important milestone in the development of open discussion and shared understanding of wetlands and does not carry the negative connotations of protection-based conservation. Second, the Ministry of Agriculture and Forestry has begun the process of classifying and creating a national inventory of wetlands. These are both important precursors for the better governance and valuation of wetlands and wetland resources.

Based on this study, several recommendations in three areas have been developed.

1. To improve inter-agency coordination in the management of wetlands

    - Further define specific roles and responsibilities of the various departments within the Ministry of Agriculture and Forestry, and clarify overlapping areas of work.

    - Improve cooperation between ministries, and create a national steering committee to coordinate and facilitate work between ministries and provincial offices.

    - Increase awareness of the importance of wetlands in all ministries, and expand links between national and regional stakeholders in wetland management.

    - Encourage the Ministry of Agriculture and Forestry to continue its work on developing a national wetlands inventory, which should culminate in a comprehensive wetlands classification system.

2. To increase the effectiveness of wetlands legislation

    - Identify overlapping laws, roles and responsibilities and modify legislation accordingly. Develop the capacity of district and provincial officers to identify, record and recognize customary rules and regulations at the community level.

    - Focus effort on the enforcement of management systems by communities, assisted and supported by district officers.

    - Raise public awareness of existing laws and regulations through appropriate information education activities.

3. To develop the capacity to undertake economic valuation

    - Develop both the research capacity for economic valuation within government institutions and the capacity of ministries to incorporate values into impact assessments, planning and policy.

    - Develop methods for economic valuation that reflect the broad use of wetlands in Lao PDR by involving a wide range of stakeholders at national, provincial and local levels, and incorporating a range of qualitative and quantitative tools that measure what is important to resource users, planners and policy-makers.

    - With support from provincial and district governments, carry out economic valuations in key wetlands across the country.

Towards a holistic approach to wetlands governance: The legal and institutional framework and economic valuation of wetland resources in Cambodia

Neou Bonheur, Mam Kosal, Mao Kosal, Kim Sour, and Srun Lim Song

The chapter aims to contribute towards wetlands management in Cambodia by providing a clear understanding of the legal and institutional systems involved in the country. It provides a review of the current national legal and institutional framework, an overview of the economic value of Cambodian wetlands and their resources, and an analysis of data related to the valuation of wetlands at the national level and in three provinces (Stung Treng, Takeo, and Siem Reap).

Wetlands in Cambodia

Wetlands dominate the Cambodian landscape, with large expanses of land inundated during the wet season. Despite their ubiquity, however, the concept of wetlands remained unfamiliar to most Cambodians until the 1990s. It was during this time that Cambodia became a signatory to the Ramsar Convention, and an official Cambodian term for wetlands – 'dambon dey saeum' – was formalized in a government decree, greatly facilitating communication and increasing awareness of the concept. Nevertheless, wetlands in Cambodia remain threatened, primarily by the overexploitation of wetland resources and by conversion to land for agricultural expansion and human settlement.

The institutional and legal framework

The institutional arrangements governing the management of wetlands in Cambodia are highly complex and involve a large number of agencies operating under various ministries. In part, this institutional complexity reflects the diversity of wetland uses and functions across a broad range of sectors, which includes agriculture, fisheries, forestry, water resources, environmental management, transport, and tourism.

As a result of this institutional complexity, coordination and cooperation between the various agencies responsible for different aspects of wetlands management is difficult and slow. There is currently no inter-ministerial coordinating mechanism for wetlands planning and management at the national level. The overlapping and poorly defined jurisdictions of managing agencies lead to ineffective enforcement and, consequently, resource use goes largely unregulated. This in turn gives rise to conflict among resource users, between managing agencies, and even between countries.

Much decision-making authority concerning wetlands management still resides with the central government. This top-down approach to resource governance causes delays, and means that the flexibility required to respond to problems at the local level is lacking. Although there have been some attempts to devolve power to local authorities and to increase the involvement of local communities in wetlands management, progress has been slow. There are still no clear regulations on community participation and on the rights of local people to voice their concerns.

The legal framework governing wetlands management rests upon legislation vested in government agencies responsible for resource use (Fishery Law 1987), land use planning (Land Law 2001), and environmental conservation (Environmental Law 1996; Royal Decree on the Designation and Creation of National Protected Areas System 1993). However, none of these laws deal directly with the issue of wetland management and conservation in a holistic and integrated manner. This lack of a clear legal basis for wetlands management has led to conflicts about inequitable resource use, and to a decline in the resource base itself. Currently, the only law explicitly concerned with wetlands is that which prescribes Cambodia's obligations under the Ramsar Convention, but even this does not provide specific legal tools regulating the use and protection of wetland resources. Moreover, the lack of an agreed-upon wetlands classification system has hindered the drafting of management and conservation plans.

In response to these shortcomings, a Draft Wetland Action Plan has been developed that addresses the institutional coordination and legal reform necessary for the sustainable management of wetlands in Cambodia. Currently still under review, the plan also outlines the necessary steps to be taken in order to raise awareness, build capacity, and increase public participation in wetlands management. If adopted, the plan would provide a coherent national strategy for wetlands management.

Economic valuation of wetlands

Wetlands provide a wide range of values to human communities, some of which are more apparent than others. Wetlands are particularly difficult to value because of the different ways they are perceived by stakeholders who have different interests. Notwithstanding this, wetlands are typically undervalued because of a poor understanding of how wetland systems work. Furthermore, the way that access to wetland resources is regulated influences attitudes towards wetlands and how they are valued.

The most economically important uses of wetlands in Cambodia are agriculture, fisheries, aquaculture, water supply, extraction of timber and non-timber forest products, tourism, water transport and habitation, and conservation. Other uses and functions of wetlands include livestock farming, waste dilution and treatment, flow and flood regulation, protection from storms, energy production, and socio-cultural uses. Summarizing the results of provincial consultations and existing national-level data, the chapter demonstrates the economic value of wetlands through their contribution to each of the uses listed above.

Any attempt to assess the economic value of wetlands should take into particular account the value of wetlands to the poor, especially those values that relate to their livelihoods, income generation, and welfare. This is because many poor people live in or around wetlands and depend on wetland resources for their livelihoods. In Cambodia, these include farmers who fish seasonally, after harvesting their crop, and those who live permanently on the waters and depend primarily on fishing for their subsistence.

However, while the wetland values that relate to the livelihoods of the poor are important, they are also often the most difficult to capture in economic terms and are, therefore, often overlooked in policy. For example, many wetland products harvested by local users are either for own-consumption or are shared among the community. Since these products do not enter the market, it is often difficult to ascribe to them an economic value. Certain functions provided by wetlands – like water transport and habitation – are so intimately a part of the daily lives of the poor that they are taken for granted, making them difficult to quantify. Valuation is also hindered by a lack of understanding of how certain wetland functions work. Functions such as the provision of spawning grounds for aquatic animals, sustenance of soil fertility, and protection from storms, are often overlooked or poorly accounted for.

There is a need for a more comprehensive valuation method that captures and assigns values to all wetland uses and functions, particularly those that benefit the poor, those that are difficult to capture in economic terms, and those that are poorly appreciated by users. One promising direction is to devise valuation methods that require values to be expressed not in monetary terms, but in terms of their percentage contribution to the livelihoods, survival, or welfare of a particular local group of users or a larger group of society. A good valuation method would capture the values of all individual elements in a wetland system, including mobile resources, at various spatial scales.

Policy recommendations

Based on its findings, the chapter recommends the following measures as ways to improve the governance of wetlands in Cambodia.

1. **Adopt a coherent national strategy for wetlands management**
   The adoption and implementation of the Draft Wetland Action Plan would provide a clear strategy for wetlands to be managed in a more coordinated manner, as it recognizes that government agencies, non-governmental organizations (NGOs), communities, and the private sector all have an important role to play.

2. **Improve the legal framework to support integrated wetland resources management**
   Public awareness of, and compliance with, newly promulgated laws could be improved by issuing guidelines on the implementation of these laws at the provincial, district, and

local levels. Apart from this, greater decentralization would promote better wetlands management at the local level. This would encourage public participation and also empower local institutions, like the District and Village Development Committees, to better regulate access to wetland resources, especially through the establishment of community fisheries. The implementation of fisheries policy could be improved by better assessing the impacts of recent policy reform. Recognizing and protecting the customary access rights of local communities to wetland resources would ensure more equitable and sustainable use of these resources. Finally, incorporation of knowledge gained from economic valuation research would assist the development of wetlands-related policy.

3. **Improve the distribution of responsibilities among government institutions**
   There is a need for a better inter-ministerial coordination mechanism to resolve areas of overlap, and to clarify the conflicting roles of the various government agencies concerned with wetlands management. A high-level commission – like the Council of Ministers – would best be positioned to open an inter-ministerial debate on draft laws and sub-decrees in those areas where the problem of overlapping roles and responsibilities still exists. Management plans for important wetland sites in the country that clearly specify the division of responsibilities and points of collaboration between agencies, would be useful.

4. **Improve mechanisms to better manage competition and coordinate wetland use among stakeholders**
   At the regional level, the Mekong River Commission (MRC) can foster dialogue between regional stakeholders, especially in relation to development projects that have transboundary implications. At the community level, better legal and institutional support is needed for community-based management, especially of fisheries. Lessons learnt from the experiences of NGOs in the introduction of community fisheries could be used in government efforts to expand community fisheries. The successful development of community fisheries will require greater capacity-building, increased community participation in decision-making, and extension services that raise awareness of the importance of wetlands in supporting livelihoods. Development projects involving wetlands need to be subject to full environmental impact assessments, and involve stakeholders to a greater degree in the planning process.

5. **Support the collection and dissemination of better information on the multiple values of wetlands**
   A database of wetlands-related information would greatly facilitate knowledge-building and sharing among planners, decision-makers, resource users and managers. The two highest priority information needs are an inventory of wetlands in Cambodia and a standardized wetlands classification system. The quality and frequency of data collection by government agencies could be improved by building research capacity and by addressing various institutional and methodological constraints. The collective knowledge of wetlands management could be greatly increased if more information were shared among institutions at the various levels, including the regional level, as well as among stakeholders. The National Administrative Authority of the Ramsar Convention within the Ministry of Environment could play the role of a central information source, and be a clearing-house for national and international data on wetlands management.

The legal and institutional framework and the economic values of wetlands in the Mekong River Delta of Vietnam: A wetlands approach

Hoang Huu Cai, Dang Thanh Ha, Ngo An, and Trinh Truong Giang

Current status and challenges of the Mekong River Delta

Vietnam is a densely populated and poor country, its national income largely dependent on natural resources and primary products. Agriculture is one of the major sectors in the country, employing about 67% of the labor force. The Doi Moi policy of 1986 has seen Vietnam enter a transition phase, moving from a centrally planned economy to a state-regulated, market-oriented one. Institutional and policy changes saw Vietnam become the world's second largest rice-exporting country by 1996 (it now ranks third). Together with rice, production of rubber, coffee, tea, and aquaculture products is also expanding rapidly.

While considering issues affecting wetlands throughout Vietnam, the report focuses on wetlands in the Mekong Delta region. These wetlands support the livelihoods of local people and contribute substantially to the country's economy; major uses include agriculture, fisheries, aquaculture and forestry. Perceived as the great 'rice bowl' of Vietnam, the delta has attracted development investment from both the government and the private sectors; there has been heavy investment in the development of an intensive canal network, in expansion of the agricultural area for wet-rice production, and, more recently, in aquaculture.

A significant challenge for Vietnam during this period of transition is that of balancing economic development and poverty alleviation with environmental protection. Despite recent gains in agricultural production, approximately 30 million Vietnamese, or 37% of the population, continue to live in poverty; at the same time, the country faces a number of serious environmental problems. Natural resources have long been under stress from in-situ and off-site pressures, and wetlands remain undervalued by users, due in no small part to highly sectoral approaches to wetland management. This has resulted in two 'extreme' responses – on the one hand, short-term exploitation of wetland resources regardless of the long-term consequences, and on the other hand, strict conservation in the form of national parks and other protected areas regardless of the cost to local people. Reclamation of wetlands for the expansion of rice production and other forms of environmental degradation are expected to increase in many areas, especially as agricultural and industrial activities intensify and expand. Simultaneously, many protected areas have become isolated 'islands', subject to large impacts and pressures from surrounding development.

The institutional and legal framework

Those involved in wetland management and use in Vietnam include district governments and local communities at the local level, ministerial bodies at the national level, and large organizations which span local and national levels. In general, there are no specific laws and regulations for wetland management in Vietnam, although different aspects of wetland regulation are captured in various legal constructs. In recent years, changes in international perceptions about the management of natural resources have filtered through to Vietnam by way of that country's commitments to international or regional conventions and by way of the international support it receives for development projects, and have influenced its wetland management.

Perhaps the most important policy change in rural Vietnam since Doi Moi has been the implementation of the Land Law (1992), which allows for land-use rights. Such rights provide incentives for farmers to make long-term investments and to allocate capital and other factors of production to the most efficient uses. Indeed, the introduction of land-use rights has contributed more than any other policy to the acceleration of agricultural production and income in the Mekong Delta.

An analysis of existing documents and field consultations identifies the factors motivating sustainable resource management. Factors discussed in this chapter are summarized below.

Overlap of functions

With no integrated wetland management system, functional, operational and regulatory overlaps occur. For example, separate water monitoring systems are operated by different ministries; each ministry has its own research and planning body that often works independently of other such bodies; and different sub-departments manage and control similar areas at the local level.

Lack of cooperation and long-term view

Wetlands are open systems and their management requires strong collaboration among the various users, including shrimp farmers, rice farmers and landless people who depend on wetlands to make a living by capturing aquatic products. Furthermore, privatization of land-use often leads to managerial shortsightedness, and individual users are often unable to bear the cost of investing for long-term sustainability.

The erosion of traditional tenure laws

The replacement of traditional tenure laws with new, either more relaxed or more restrictive, land laws has increased conflicts among wetland stakeholders; the loss of traditional tenure associated with land-use privatization has disproportionately affected the poor.

Economic valuation

To date, only a few studies have attempted to evaluate specific wetland types in Vietnam because there is no suitable information available for such valuation. Official economic data usually provide only partial valuation of direct uses of wetlands, such as rice production and aquaculture. There is no economic value provided for the whole wetlands system.

In an effort to demonstrate how local wetlands valuation could contribute to better management decisions, as part of the Mekong Wetlands Approach, a study was undertaken in Thanh Phu District, Ben Tre Province, a coastal area of the Mekong Delta. The total economic value (TEV) of the mangrove forest in Thanh Phu was estimated at between VND26.8 million and 35.1 million/ha (USD1793-2343/ha). The TEV was made up of the value associated with aquaculture production; production from the near-shore fishery; protection from storms, flooding and erosion, maintenance of water quality; the protection of biodiversity and traditional culture; sedimentation; tourism and recreation; and provision of food, fuel and transport. Despite there being several ways of evaluating natural resources, selection of an appropriate method was a challenge. The main constraint to analysis was the lack of reliable detailed data. Because of this, the economic valuation was largely unable to take into account the values of different wetland types and varying stakeholder perceptions of the importance of wetlands products and services, particularly those of poorer farmers. Nevertheless, some key issues were brought to the fore by this exercise.

Lack of reliable statistics

In many cases, data on wetland resources, production and uses are only available at the aggregated level. Consequently, the data do not cover the resources harvested by subsistence farmers, nor do they differentiate between wetland type or use. Data on the availability of natural resources and other goods and services need to be enriched.

Insufficient awareness of the multiple uses of wetlands

Economic valuation can help highlight the importance of wetlands and wetland resources. It can also help identify cases where under-valuation leads to inappropriate decision-making in wetlands use and management, and help identify measures to ensure that appropriate wetland values are incorporated in the decision-making process. Importantly, the study demonstrated that decision-makers at various levels were generally insufficiently aware of the multiple uses of wetlands.

Lack of recognition of inter-linkages within the wetland ecosystem

Sustainable use and management of wetlands depends partly on recognition of the linkages within wetland ecosystems, and of the benefits that can be obtained from sustainable management. Such management requires coordination at many levels and among many management institutions, and must begin with the involvement of stakeholders.

Importance of identifying winners and losers

Effective implementation of wetland policies is partly dependent on identifying incentives and disincentives for compliance. This requires identifying winners and losers, and ensuring that costs and benefits reflect these patterns of winners and losers. When local people are expected to bear the costs of conservation projects that have broadly enjoyed benefits, they are generally unwilling to support them.

Importance of continuous, long-term knowledge management

The economic evaluation of wetlands, and the analysis of information for decision-making is not a one-off process. It is important to improve the valuation approach and link it to the policy process. For sustainable management of wetlands, there is a continuous need for the collection and analysis of environmental and economic information, and the communication of such information to decision-makers. It is therefore important to train local staff to collect, process, store, analyze, and report data to policy-makers.

Conclusions and recommendations

Conclusions

- Current language used in wetland classification is not well suited to management. The most recent classification, although comprehensive and based strongly on ecology, has not been very useful in local management as it was not accompanied by guidelines for the sustainable management, use, and development of wetland resources.

- Wetlands in the region have not been sustainably managed for a number of reasons, including a piecemeal approach by managers, a lack of appropriate data and information, and the limited involvement of stakeholders.

- The livelihoods of communities dependent on wetland ecosystems are affected by development decisions in many parts of the watershed and coastal environments. Natural resources in wetland areas – land, water, forests, wildlife, aquatic biological resources and water bodies – are linked by processes such as water distribution, salt water invasion and prevention, fish migration and sedimentation. Such linking needs to be considered in management decisions.

- Sustainable natural resource management has been frustrated by an overly sectoral approach. Two separate and conflicting approaches to natural resource management have been observed, with unsustainable exploitation of natural resources for short-term gain occurring on the one hand, and strict preservation and protection of environmental 'hot spots' on the other hand. The lack of an integrated, holistic approach has resulted in, among other things, 'islands' of protected areas surrounded and negatively impacted by external development and influences.

- Agriculture continues to be viewed as the engine of rural growth by government authorities, even though it may not necessarily be so in all cases. Emerging in a period when the country faced food security problems, this view has persisted within government agencies. Agriculture, although a dynamic sub-system of natural resource management, was not the most important economic sector in either study site. Farmers seemed to be more able to cope with the market than government; in the Mekong Delta, a large proportion of land has been converted from agriculture to aquaculture.

Recommendations

- Improve data and information use, and develop management support tools. Improved links between data/information generation and decision-making, particularly at the district level, would better address the needs of local communities. The development and adoption of new methods and tools for information capture and management would increase the sustainability of wetland practices.

- Promote institutional linkages, and develop fora and networks for sustainable management practices in wetlands. Wetlands are managed by a wide range of stakeholders who work across administrative boundaries at the local, district, or even regional level. An integrated participatory approach would address the diverse and occasionally conflicting needs of stakeholders.

- Develop local co-management systems. Production in wetland areas relies on common property resources. Although a process of private land-use has been implemented, many wetlands remain common property, making access to and control over them major issues, especially for rural communities. Recent trends suggest co-management of wetlands is a way of addressing conflicts over resources and of developing and promoting good management practices to various wetland stakeholders.

- Continue to develop and apply economic valuation methods. In spite of the potential of wetlands to contribute towards livelihoods, many wetland communities remain mired in poverty. Resources are mismanaged and degraded, and new production systems are poorly developed. Better consideration of the relationship between resources, economics, policy, and the legal framework in wetland management, although it remains a challenge, would improve resource management and help alleviate poverty.

The legal and institutional basis for wetlands governance in Thailand and the economic value of wetlands in Surin and Buri Ram provinces, northeast Thailand

Narong Veeravaitaya, Pongpat Boonchuwong, Choomjet Karnjanakesorn, and Suchart Ingthamjitr

Wetlands are among the most complex and biologically diverse ecosystems in the world, forming only 6% of the earth's surface but housing 20% of known species. While most people think of wetlands as marshes, swamps and the like – which are often public lands – the Ramsar Convention definition does not discriminate on the grounds of tenure and so includes privately owned lands, such as rice fields and fish farms. Policy-makers, managers, and users of wetlands alike need to consider this broader focus. In the case of Thailand, a large proportion of wetlands is privately owned.

Whether wetlands are public or private property is a matter of direct concern to the management of wetlands for both the government and individuals alike. It is especially important considering the importance of wetlands in supporting the two main staples in the Thai diet – rice and fish. These two commodities top the list of a wide range of wetland products, and demonstrate the importance of making explicit to Thai society the economic value of wetlands.

The paper reports on an analysis of the legal and institutional framework governing wetland resources in Thailand, and on an economic valuation of wetland resources based on case studies carried out in the northeastern provinces of Surin and Buri Ram. The objectives of the study were twofold. The overarching development objective was to improve the legal and institutional operational framework for wetland management, and to strengthen the economic rationale for doing so through a better assessment of wetland values. The immediate objective of this exercise, however, was to increase the capacity to manage wetlands in pilot areas, in accordance with the 1997 Constitution of Thailand, which stipulates local involvement.

Wetlands in Thailand

Based on the system of the Asian Wetland Bureau (AWB), the first 41 wetland sites in Thailand were classified through a collaborative initiative of AWB and the Royal Forest Department. With the advent of the Ramsar Convention, wetland classification in Thailand was further refined; it is currently closely based on the wetlands classification systems of the Ramsar Convention, Mekong Secretariat and United States. Strategically, there area three broad categories of wetlands:

- **Wetlands of International Importance.** Following the criteria set by the Ramsar Convention, these wetlands have unique regional or international characteristics. They are home to threatened and endangered species of flora and fauna. There are 61 natural wetlands of this level in Thailand.

- **Wetlands of National Importance.** These wetlands have national uniqueness, and include sites with ecological, historical and cultural importance as well as those located in protected areas. There are 48 natural wetlands of this type in Thailand.

- **Wetlands of Local Importance.** These wetlands have played important roles in local cultures, social values, traditions, religions, beliefs, history, folklore and recreation. There are 19 295 natural wetlands of this level in Thailand.

Institutional arrangements and legal aspects of wetland management in Thailand

The structure and arrangement of institutions for wetland management in Thailand is complex. There are many pieces of legislation protecting

wetland, enforced by various government agencies, such as the Royal Forest Department and the Department of Fisheries. The chapter provides a detailed review of the various legal, institutional and policy frameworks currently governing wetlands in Thailand. Specific attention is given to the role and responsibilities of government agencies, as well as to the division – or in some cases, overlap – of jurisdiction among them.
One significant feature of Thai wetland management is the National Sub-Committee on Wetlands Management, which carries out a number of roles related to formulating policy; monitoring and evaluation of project implementation; and supporting research, integration, and awareness. This sub-committee has formulated several strategic measures and action plans relating to wetlands conservation, use and management.

This study found that constraints arise from the fragmentation of laws and the number of government agencies regulating wetland management. Detailed in the chapter are instances of the overlap of power, and duplication of work, and of ineffective law enforcement, lack of compliance, and centralization of power. Numerous loopholes also exist in the legislation; these are caused by confusion about responsibility for the enforcement of laws. Such difficulties are exacerbated by the government reorganization, which started in October 2002. New agencies are mandated to enforce the same laws as old agencies, and it is estimated that there will be a transitional period of several years before the organizational system is clearly established.

Wetlands within the protected area system are considered well-protected, and remain in good condition. However, the chapter notes a need for the government not only to continue to establish more protected areas, but also to implement programs to enhance compliance, to allocate sufficient funds for law enforcement, and to promote and improve stakeholder participation in wetland management and conservation. With regard to locally managed wetlands, which often constitute a mosaic of common property and privately owned resources such as rice fields and fish farms, the chapter emphasizes the potential of community-based management. Particular emphasis is given to the role of local organizations, such as the Tambon Administrative Organizations, which were established by the Tambon Administrative Organization Act (1994). The main objective of that act is to decentralize resource administration to the tambon, or sub-district, level. Strategies which place local communities at the center of conservation, rule enforcement, and formulation of local rules and regulations can contribute to more effective wetland management.

Economic valuation

As wetlands contain a diversity of multifunctional environmental resources, their development and future conservation needs to be based on their sustainable use, taking into account resource limitations and opportunity and future costs. Incomplete assessment of wetland values can result in increased pressure on resources and in conflict between resource user groups. An estimation of total economic value (TEV) extends calculation of the value beyond physical products to include functions that yield indirect and non-tangible benefits to humans. It requires assessment of several natural processes, such as hydrological systems, geomorphology and the function of plants in water treatment. TEV also takes into account intrinsic values, such as the role of the environment as habitat for migratory birds and in preserving biodiversity, in order to ensure that the value reflects all aspects and can be used for developing effective measures for wise wetlands use.

An economic valuation exercise was carried out to clarify the importance and value of wetlands. Existing secondary information and data were compiled, a literature review on relevant research was conducted, site visits were carried out, and relevant experts were consulted. The wetlands in northeast Thailand were then categorized and their various uses identified; included were both the prevailing resources (direct use) and functions (indirect use) of both public and privately owned wetlands in Surin and Buri Ram provinces. The chapter presents the findings of this exercise. However, quantitative data were only available for direct-use values because most wetlands-related agencies remain focused on direct-use values, and have yet to incorporate indirect and intrinsic values into their view of wetlands, partly because these non-use values are notoriously hard to quantify.

The lack of information on the indirect and non-use values raises several concerns. First, it has hindered an accurate and comprehensive assessment of the overall value of wetlands, not only in this research project, but also in policy formulation, legal regulation, and economic use of wetlands in Thailand. These problems are illustrated in Surin and Buri Ram provinces, where the intense use of wetlands has had significant impacts upon their ecosystems. Such threats, whether from adjacent areas, surrounding areas, or within the wetlands, have contributed to numerous problems, such as water pollution, eutrophication, siltation and reduction of water quality; a decrease in the numbers of aquatic fauna; a reduction of wetland area; and destruction of vegetation.

Recommendations

The results of the study suggest the following recommendations:

To encourage wetland conservation

- Formulate plans for the conservation, restoration and management of important wetlands, and establish agencies directly responsible for plan implementation.
- Improve coordination between relevant agencies and communities involved in wetland conservation, restoration and management, so that the effectiveness of management is increased and adverse impacts minimized.

To improve wetland protection and management

- Develop and implement strategies that place local communities at the center of regulation enforcement, or by which local communities formulate their own rules and regulations.
- Provide a means for villages to share responsibility for wetland resources, and strengthen awareness and public relations activities.
- Establish and promote community organizations and networks to deal with wetland management.

To develop policies and plans for wetland management

- In collaboration with stakeholders, including the general public, formulate a masterplan and guiding principles and action plans for the development of specific wetlands.
- In collaboration with the local community, identify and design conservation zones, multiple use zones, and buffer zones for every wetland site.

To increase information about wetlands

- Conduct studies on wetland biodiversity and continuously monitor diversity and populations of birds and fish in wetlands.
- Conduct action-oriented research on wetlands that provides opportunities for community participation.
- Commission comprehensive studies of wetlands at the catchment level.

Making sense of multiple rules, interests, and values: An examination of the legal and institutional framework and economic valuation of Prukuankreng Wetlands, southern Thailand

Ayut Nissapa, Bussabong Chaijaroenwatana, Somsak Boromthanarat, Wilaiwan Chareonkunanond, and Suchira Kaewrak

The chapter outlines the results of the Mekong Wetland Approach project conducted in the Prukuankreng wetland in southern Thailand between 1999 and 2004. The project analyzed the current systems of governance relating to wetlands, and the methods currently used to evaluate wetland resources, functions and services. Emphasis was placed on the need for information to facilitate wise use and sustainable management of wetlands, and to stimulate stakeholder discussion about wetlands in order to improve their management.

Presented in the chapter are the results of an analysis of the institutional and legal framework relating to Prukuankreng wetland, and an economic valuation of the Thale Noi Non-hunting Area within that wetland. Specific attention is given to recent changes to the institutional framework within the Thai Government, and to conflict among multiple stakeholders over the use of wetland resources. The economic valuation highlights the multiple uses and values of wetlands, and the pressing need to incorporate them into an integrated management system that addresses the range of uses and governance systems and provides equitable solutions and more effective conflict resolution.

Prukuankreng and Thale Noi: The study area

The Prukuankreng wetland reaches into Phatthalung, Songkhla and Nakhon Si Thammarat provinces in southern Thailand and is the largest freshwater wetland in the country. It includes peat swamp forest and freshwater mangroves, and drains both north into the Pak Phanang basin and south into the Songkhla Lake system. The Thale Noi Non-hunting Area covers 45 700 hectares.

Communities living around Thale Noi are highly dependent on the wetland for their subsistence and semi-subsistence livelihoods. While the overall average per capita income in the communities is US$658, it is estimated that 74% of the population are rice farmers, earning an average per capita income of US$422 a year. Of the available employment opportunities in the area, rice farming, fishing, rubber production and *kra-jood*[1] collecting make up the vast majority of livelihoods in the area, despite returning the lowest incomes. Communities in the area are well aware of the importance of the Thale Noi wetland, approaching the Royal Forest Department as early as 1974 to support their efforts to establish the waterfowl and bird sanctuary that now comprises the Thale Noi Non-hunting Area. This eventually led to the successful nomination of the Khuan Khee Sian wetland within the Thale Noi area as the first Ramsar site in Thailand.

Threats and issues

This chapter discusses a number of major threats to the livelihoods of wetland communities. These threats have arisen primarily from changes in the social and economic environment over the last decade. Among these changes has been the declining profitability of traditional fishing and farming activities. In order to maintain previous levels of production, farmers have had to intensify their activities; this has had a number of secondary effects, including increased dependence of farmers on irrigation and wage labor, over-fishing and a significant decline of capture fish stocks, and habitat degradation in the form of wetland sedimentation and coastal erosion.

[1] Kra-jood *(Lepironia apiculata)* is a reed that is used primarily in handicraft production, and the harvest of which constitutes a major livelihood activity and important source of income for many communities surrounding Prukuankreng.

Additional threats include the development of roads, the construction of irrigation systems and forestry activities. Investment from both government and the private sector has led to uncontrolled land use changes in critical wetland habitats, and the subsequent reclamation of peripheral areas of Prukuankreng for aquaculture ponds, farming land or infrastructure development and human settlement.

Development and management of these changes have occurred with little involvement from local communities. As a result, conflicts over resources and environmental degradation have increased. Many development and management initiatives in Thale Noi have failed to address the over-utilization of wetland resources and the need for better institutional arrangements to deal with conflicts over land use.

The legal and institutional framework

Under Thailand's institutional framework, line agencies have jurisdictions across central, provincial and local levels, but there are numerous areas of duplication and, as a result, conflict. To address these problems, a national Sub-Committee on Wetland Conservation was created. Although this committee has produced a national wetlands action plan, it essentially places wetlands under a system of protected area management, neglecting the importance of wetlands to rural livelihoods. Consequently, a number of questions about the practical management of economically productive wetlands have been left unanswered, and strong public participation in natural resource management has not been achieved.

This chapter identifies the diverse legislation that governs wetland resources in Thailand. However various problems inherent within these laws emerge: capacity to implement and enforce the laws is lacking, particularly at the local level; there is also significant overlap and confusion in the jurisdiction of different government agencies. Problems have also arisen as a result of laws that seek to conserve resources through exclusionary measures; these create conflict between the government authorities enforcing these laws and the local communities who find themselves without access to the wetland resources which underpin their livelihoods.

Conflict and competition among stakeholders

The wide range of stakeholders, top-down implementation of legislation, lack of institutional coordination, and a multitude of organizations influencing resource use have resulted in a range of conflicts over the use and management of wetlands and wetland resources in Prukuankreng. These conflicts involve government agencies, NGOs, and local communities, and are briefly summarized as follows:

- **Conflict between communities.** Communities surrounding Prukuankreng are conscious of the ongoing degradation of the wetlands, and have made serious attempts to implement protection and management strategies. Many communities have a system of resource management that operates within their own village area but come into conflict over resource use with neighboring communities. In many cases, these conflicts are based around the local politics associated with resource access, but conflict has also arisen due to competing land uses in wetland areas.

- **Conflict between communities and outsiders.** As Prukuankreng is increasingly recognized as a valuable economic resource, local communities have come into conflict with outside interests that invest in land and infrastructure. These outsiders include land speculators, whose purchase of large tracts of land has resulted in local communities losing the right to use local wetlands. Similarly, habitat degradation has been accelerated by the removal of mangroves, Melaleuca forests and kra-jood by outsiders.

- **Conflict between communities and government.** There are many areas of conflict between communities and the government in relation to land allocation, forest preservation and law enforcement. In many cases, the government has set boundaries after only limited local consultation, leading to solutions that disproportionately affect the poor. Conflict between communities and the government has emerged most clearly in the case of laws under the jurisdiction of the Royal Forestry Department, which focuses on maintaining biodiversity through technical conservation management practices, but

ignores the use of wetlands by local communities for their livelihoods. Tension and distrust have increased, and have become obstacles to the further participation of communities in wetland management and conservation strategies.

Economic valuation of wetlands

A key decentralization objective of the 1997 Constitution of Thailand is to increase the involvement of local administrations in resource management. For wetland management to be effective at the local level it is necessary that decision-making incorporates a complete set of the values associated with wetlands. With this in mind, the economic valuation exercise in this chapter was conducted to:

- apply existing economic valuation techniques to the valuation of wetland resources, functions and attributes
- investigate alternative economic valuation techniques suitable for the analysis of resource use in Thale Noi
- propose ways of incorporating economic value into wetland management practices, particularly at the local level.

An examination of use values and non-use values of wetlands, estimated by means of a range of qualitative and quantitative methods, is presented in this chapter.

Qualitative approach

Qualitative approaches to economic valuation are not well developed for wetlands but, if used in conjunction with quantitative methods, can contribute important contextual information to an integrated approach to wetland management. A rapid assessment survey of eleven villages surrounding the Thale Noi area was conducted every four months during 2002, with questions focusing on the importance of wetland resources, functions and attributes to local communities, town settlements, economic activities, public infrastructure, and social activities. A market trailing exercise and a functional value matrix were carried out, highlighting the multiple functions and attributes of wetlands resources, and their ability to provide a range of goods and services to multiple users.

Quantitative approach

Quantitative valuation of wetlands involved the collection of primary and secondary data during a series of field surveys and meetings with stakeholders. Analysis of the data was done using simple calculation, functional estimation and calibration of values using various techniques, including market value calculations, and surrogate pricing techniques, such as the willingness to pay and travel cost methods. In the case of the latter, such methods can be applied to a range of non-traded wetland resource functions and attributes, including tourism, recreation, cultural and heritage value, genetic resources, habitats and refugia.

Economic valuation of the Thale Noi Non-hunting Area

Estimating the economic value of the Thale Noi Non-hunting Area was complicated by the lack of information on many resources, although attempts had been made to gather such information through various means, including rapid assessment and market surveys. Gaps remain in the data, however, and the chapter focuses instead on a selection of key resources including *kra-jood*.

The total economic use value of resources in the Thale Noi Non-hunting Area is estimated at US$8.09 million, and the annual value of opportunity costs, or non-use values, is estimated at US$7.33 million. This gives a total value of US$15.42 million for the annual use and non-use value of the Thale Noi Non-hunting Area. One of the more notable results is the value of rice production compared with the value of other products derived from off-season use of rice fields. During the off-season, some farmers in Thale Noi convert a portion of their rice farms into fish ponds, and produce approximately 400 kilograms of catfish per season. Viewed in conjunction with the low profitability of rice fields in this area, the value of such supplementary products can be as high as US$1.03 million a year, more than three times the value of rice production.

Using a function-value matrix the study found that the ability of wetlands to provide not only subsistence and economic activities but also indirect wetland functions – such as flood attenuation, habitat, integrity of natural processes, and recreation and tourism – is highly valued by local users. Flood attenuation functions are crucial

– especially for the poor, who rely on wetlands for their livelihood – while culture and heritage values have been largely neglected in wetland management. These indirect and non-use values are not quantified, but their existence demonstrates valuable wetland functions and attributes that can be related to tourism, as well as the cultural basis for protection and maintenance of land, water and the wetland environment.

Not only does the Thale Noi Non-hunting Area provide a range of resources, functions and attributes that are important for sustaining the livelihoods of communities, but, because resources are traded both regionally and internationally, it also delivers value to a number of distant stakeholders. Because of the lack of data and of estimation tools and techniques, any valuation of these wetlands can only be indicative of their minimum value. Nevertheless, by identifying and considering these non-quantified values in decisions, a more integrated approach to wetlands management could be developed.

Policy conclusions and recommendations

Wetlands and their resources represent an important source of livelihood in Thailand. The case study of Prukuankreng, including the Thale Noi Non-hunting Area, provides an example of a wetland facing increasing pressure from a range of stakeholders. The following are some of the major conclusions and recommendations from this project.

Conclusions

- As the economic contributions of wetlands are increasingly recognized, so too are they increasingly valued by a growing number of stakeholders seeking to exploit their resources and potential. The impacts of rapid development, including encroachment onto wetlands and their overexploitation, are most keenly felt by increasingly marginalized rural communities living around the wetlands.

- The legal and institutional framework governing wetlands is complex, and substantial overlap of jurisdiction and confusion of legislation exists. Wetland management would be simplified and clarified by a system that: i) identifies and includes all users of wetlands, particularly poorer users; ii) recognizes that multiple uses of wetlands exist; iii) addresses the gaps and limitations in the governance systems relating to wetlands; and iv) provides equitable solutions and more effective mechanisms for conflict resolution.

- Successful wetland management can only occur when all wetland values are incorporated into wetland management decisions. Tools for the valuation of wetlands, including qualitative and quantitative methods, are, in some cases, not well-developed, and further research is required to improve them.

Recommendations

- Place greater emphasis on the development of systems that resolve conflicts between government and communities by giving further support to the Land Proof and Resolution Committee, which was set up for the purpose of conflict resolution. Specifically, extend the committee's activities to i) wetland-related disputes and issues involving the use of heavy machinery in wetland areas; ii) conflicts between various stakeholder groups; iii) coordination of institutional support; and iv) stakeholder involvement in new legislative structures.

- Coordinate and empower local communities to monitor, regulate and make laws.

- Undertake research to determine the needs and capacity of people to participate in wetland resource management.

- Encourage active application of indigenous and traditional knowledge in formal management systems.

- Set aside funds for the development of a specialized institute for integrated and participatory systems wetland resource management.

Rules, institutions and values
Towards an integrated approach to wetlands governance in Lao PDR

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September 2005

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List of Abbreviations and Acronyms

CPAWM	Centre for Protected Area and Watershed Management
DLF	Department of Livestock and Fisheries
DoA	Department of Agriculture
DoE	Department of Electricity
DoF	Department of Forestry
DoI	Department of Irrigation
EAP	Environmental Action Plan
FIA	Fisheries Impact Assessment
GoL	Government of Lao PDR
IUCN	The World Conservation Union
LARReC	Living Aquatic Resources Research Centre
LNMC	Lao National Mekong Committee
MAF	Ministry of Agriculture and Forestry
MRC	Mekong River Commission
NAFRI	National Agriculture and Forestry Research Institute
NES	National Environment Strategy
NESDP	National Economic and Social Development Plan
NTFP	Non-timber forest products
NUOL	National University of Laos
PDR	People's Democratic Republic
RDC	Regional Development Coordination for Livestock and Fisheries
STEA	Science, Technology and Environment Agency
TEV	Total Economic Valuation
WWF	World Wide Fund for Nature

Introduction

The WorldFish Center undertook a project entitled "Legal and Institutional Framework and Economic Valuation of Resources and Environment in the Mekong River Region – A Wetlands Approach" (hereafter referred to as the Mekong Wetlands Approach) between 1999 and 2004. This was a collaborative project between riparian government institutions, as well as a number of regional organizations including Wetlands International, the Asian Institute of Technology, the Mekong River Commission (MRC) and the World Conservation Union (IUCN).

The aim of the project was to develop an integrated framework for the sustainable management of wetlands by focusing on improved governance and valuation. Within Lao PDR the project focused specifically on an analysis of the legal and institutional frameworks and the capacity for wetlands management at the local level, with the specific aim of improving the livelihoods of the people using these resources. The project succeeded in bringing together a number of different government departments and agencies to discuss issues surrounding the sustainable management of wetlands for the first time.

This chapter presents the findings of two research activities completed during the project in Lao PDR. The first is an analysis of the institutional and legal frameworks that govern wetland management and development, carried out to identify constraints to sustainable management. The second is a review of the economic valuation of wetland resources. Together, these two studies show the link between the perceptions held by different stakeholders regarding the value of wetlands and the investment made by governments in their management.

The chapter is divided into four sections. The first outlines the research approach taken, including a definition for wetlands in Lao PDR as well as the extent of the resources, the status and the challenges. Section two then presents the findings of an analysis of the legal and institutional frameworks governing wetlands. Section three presents the findings of a review of economic valuation. The final section presents the conclusions and policy recommendations for future wetlands management.

The research approach

Defining wetlands in Lao PDR

Wetlands have been a contentious issue in Lao PDR because of their association with conservation. The WorldFish Center's "Mekong Wetlands Approach" reopened discussions on wetlands, creating a forum of different government ministries. This enabled a broad range of perspectives on wetlands to be shared openly. Two initiatives were important in this process. The first was the publication of "Wetlands Importance and Benefits", an information booklet written by the Department of Livestock and Fisheries, which re-opened discussions on what wetlands are, and how and why they are important to Lao society (DLF 2004). The booklet also provided a new term for wetlands – *Din Boliven Nam* – which literally means "land where there is water". This replaced Din Tham, which has a similar meaning but refers mainly to floodplain areas. The new term is broader and free of conservation connotations. This proved an important milestone in the development of an open dialogue and integrated understanding of wetlands.

Discussion also focused on the definition of "wetlands" that is most suitable to Lao PDR. Previously the Ramsar definition has been used:

> "...an area of marsh, fen, peatland or water, whether natural or artificial, permanent of 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 meters" (UNESCO 1994).

This definition was considered less useful in the Lao context because it is very general and covers many ecosystems, including the marine environment, that do not occur. The DLF instead adopted an alternative definition from Cowardin et al. (1979):

> "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water."

This definition has been influential in the Water and Water Resources Law which defines water resources as comprising all living and nonliving resources in the aquatic environment (GoL 1996). A water source, on the other hand, is defined as a place where there is an accumulation of water flowing or at rest, permanent or temporary, both above and below ground level and in the atmosphere. Water sources that come under the definition of wetlands include rivers, tributaries, ponds, canals, swamps, bogs and springs. The Water and Water Resources Law recognises the interconnectedness of these water sources within river catchments.

Water sources and water resources are an important entry point for further discussion of wetlands in Lao PDR as the use of water is directly related to livelihood importance in both policy and planning. Maintaining the use-value of water is especially relevant as the government continues to debate membership to the Ramsar Convention.

Wetland classification

Lao PDR has a diverse topography extending from the floodplains of the Mekong River to the highland areas in the north and east. Wetlands extend across the full range of these environments including the Mekong River, its 14 main tributaries, and more than 100 branches and streams. Most of the water flowing into the Mekong Basin originates in Lao PDR; 35% of total flow in the dry season and up to 80% in the wet season (Mekong Secretariat 1970). About one quarter of the country is considered lowland, consisting mainly of floodplains and rain-fed rice paddies. Some wetlands of national importance are shown in Figure 1. These include wetlands in both the north and south of the country as well in both upland and lowland environments.

Despite the recognition given to the diversity of wetlands, agreement over a national classification system has proven difficult. First, there are a variety of local terms for wetland habitats that are not compatible with the hierarchical classifications offered by IUCN and the Mekong River Commission (Claridge 1996; MRC 1997). Secondly, local terms for wetlands vary between different parts of the country and also between government line agencies, which has also made agreement on a common system difficult.

Despite the difficulties faced, a preliminary classification was developed by the DLF in a Mekong Wetlands Approach meeting in Savannakhet in 2003 (Table 1). Further development of the classification is still needed, specifically to delineate sub-categories with examples. Agreement on wetlands classification is an important step in improving systems of governance over wetlands, as outlined further below.

Current status, threats and challenges to wetlands in Lao PDR

The Mekong Wetlands Approach was initiated in response to the need for better communication, coordination and cooperation between different agencies working at national, provincial and local levels for the sustainable management of wetland

Table 1. Wetland classification in Lao PDR
(Roger 2002)

Wetland	Sub-categories	Lao Terms
River and floodplain	Pools	*Vung leuk*
	Channels	*Khong Nam Lai*
	Irrigation canal	*Khong Solapataan*
	Grass land	*Thong nya nam tuam*
	Seasonal backswamps	*Nong nam tuam bung ruduu*
Shallow lake	Permanent lake	*Taleesap*
	Seasonal lake	*Ang nam tuam bung ruduu*
	Reservoir	*Ang Nam*
Marsh	Natural pond	*Nong thamasaat*
	Man-made pond	*Nong Sa*
	Permanent	*Beung*
	Seasonal	*Beung mii nam bung ruduu*
Peat swamp		*Beuam*
Swamp forest	Flooded forest	*Paa nam tuam*

Figure 1. Wetlands of National Importance

resources. A starting point in this process has been the identification of research that outlines the status of wetlands as well as the current threats and challenges for future work.

Status of wetlands in Lao PDR

There has been little research on the national status of wetlands in Lao PDR. The most comprehensive study to date is an inventory of wetlands carried out by IUCN (Claridge 1996). However, a number of other studies have focused on a range of wetland-related issues such as their importance to Lao culture, rural livelihoods and living aquatic resources management.

- *Livelihood importance of wetland resources* – The nutritional importance of wetlands was studied by Meusch et al. (2003) in Attapeu province. They outline the role of living aquatic resources for poor rural communities with limited alternative sources of protein. On a larger scale, the MRC Assessment of Mekong Fisheries outlines the major characteristics of fisheries in Luang Phrabang (Sjorslev 2000) and Champasak (Singhanouvong and Phoutavong 2002). Bush (2003) compares the livelihood importance of capture fishery

resources to the importance of aquaculture in communities exploiting a range of different wetland areas of Savannakhet. The importance of wetland resources for rural livelihoods in Siiphandone is confirmed by Friend (2001), who described the role of fisheries within a wider range of rural activities.

- *Management of wetland resources* - Baird (2001) outlines the development of co-management systems for community-based fisheries management in Khong District, Champasak. Co-management systems are also described in community fish pond systems by Noraseng et al. (2001) in Savannakhet.

- *Culture and local knowledge of wetland resources* – Local ecological knowledge is increasingly recognised as an important tool in wetlands management. Valbo-Jørgensen and Poulsen (2000) used local ecological knowledge to investigate broad-scale fish migrations throughout the Lower Mekong Basin. On a smaller scale, Baird (1999) describes the use of this knowledge for management of a variety of living aquatic resources in Siiphandone wetlands. Local ecological knowledge has also been used in Savannakhet to investigate the importance of rice field use and management, including living aquatic resources (Meusch 1996).

The importance of wetland resources for rural livelihoods, biodiversity and environmental services is increasingly being recognised. However, much of this research has only been indirectly applied to wetlands. An improvement in the coordination of research under the new concept of *Din Boliven Nam* will ensure that the lessons learned are more appropriately applied in the formulation of management, development and conservation policy. These lessons should also be used to assess the importance of wetland resources for the livelihood of rural communities.

Threats to wetland resources

Wetland habitats and their resources are coming under increasing pressure from many competing interests. These occur at a variety of scales ranging from the local, to national and regional. Living aquatic resources are under increased threat from a combination of improved fishing technologies and increasing population. Pressure to over exploit the resource base is set to increase, driven by rising international trade (Bush 2004). Wetland habitat is coming under threat from infrastructure developments such as irrigation, roads and hydroelectric power. There is some evidence that irrigation has caused a decline in species diversity but only had a small impact on fish productivity (Nguyen Khoa et al. 2003). By comparison, hydroelectric power dams, despite providing extensive reservoir habitat, disrupt the monsoonal hydrological cycles and have a negative impact on migratory fisheries (Poulsen 2003; Roberts 1993b). Urban wetlands, especially those found in Vientiane, are also under increasing pressure from road construction, land reclamation and pollution (Gerrard 2004).

Challenges to wetlands management

The challenge for wetlands management in Lao PDR is to move discussion beyond 'conservation' to an integrated framework that includes livelihoods and ecosystem services. Such a framework should focus on improved governance of wetland resources through the inclusion of multiple perspectives from stakeholders at various geographic scales. Key features of such an approach include better coordination of government activities, and increased support to non-governmental and development organizations so that they can provide technical assistance over wider geographical areas.

Mekong Wetlands Approach

The Mekong Wetlands Approach provides an integrated framework for wetlands valuation and governance. The Approach views wetlands in their broadest sense, integrating governance with environmental services, livelihood use and cultural value. By addressing the threats and challenges outlined above, the Approach is inclusive of a number of perspectives from different line agencies working at all levels of government.

In Lao PDR, attention has focused on the difficulties faced by managers in understanding the importance and integrated nature of wetland resources. By applying the Mekong Wetlands Approach in this study, two aims are addressed. These are:

1. To improve management and policy decisions through the use of strategies and valuation methods that integrate differing perceptions of resource values.

2. To facilitate discussions on institutional constraints between organizations with responsibility over the management of water resources in order to improve the coordination of wetlands management.

The project provided an opportunity to a wide range of stakeholders to share their experience and knowledge of water resources management and development. The participants noted the main benefits as:

- recognition and inclusion of multiple uses
- recognition of the complexity of open systems
- emphasis on the interaction between multiple scales
- emphasis on poor peoples' dependence on aquatic resources
- emphasis on wise use and sustainable management

The approach was particularly useful for integrating the two studies described in this report. By involving multiple stakeholders from local to national level a number of gaps in management were identified. This allowed for the improvement of laws and governance structures so that information on wetlands could be better managed. However, it is not only the information generated from this study that is of importance; the actual process of gathering and analysing the information through the Mekong Wetlands Approach has also been a highly significant outcome.

Methods used

The methods used in this study were developed through a series of regional and national consultations. The process of data collection and subsequent discussion involved representatives from the Regional Development Coordination for Livestock and Fisheries (RDC), the Science Technology and Environment Agency (STEA), the Lao National Mekong Committee (LNMC), the World Conservation Union (IUCN) and the Living Aquatic Resources Research Centre (LARReC).

The legal and institutional framework analysis began in February 2002. A working group from the Department of Livestock and Fisheries collated information on policies, plans, laws, decrees, regulations and orders from several agencies and ministries. These were reviewed to determine those most important for the use and management of wetlands. The analysis was carried out incrementally over three formal national meetings held in August, October and November of 2002. This provided an opportunity to share insights from the data collection exercise and discuss the strengths and weaknesses of the current status of wetlands governance.

The economic valuation of wetlands was carried out by a combined working group of staff from the DLF and the RDC in Savannakhet. Secondary information was collected from a number of national government agencies and from provincial government offices in Savannakhet, Champasak and Attapeu. Several national meeting were held at which the experiences of each of the line agencies were discussed, as per the legal and institutional analysis.

Legal and institutional framework governing the management and use of wetlands

The aim of the legal and institutional framework analysis was to provide a baseline of information from which future laws and regulations can be developed that will better reflect contemporary issues of wetland use by rural Lao communities. The study was divided into four parts: (i) a review of the national policies relevant to wetland and wetland resources, (ii) an analysis of the current legal and institutional framework for wetlands governance, (iii) a review of international agreements related to wetland use and management, and (iv) an outline of the role and duties of government agencies.

National policies

Wetlands are not referred to directly in any national policy. Instead the following reviews a range of policies that refer to the use and management of wetland-related resources including water, agriculture, and living aquatic animals and plants. The areas of policy that are relevant to wetlands are found in development, environmental, and conservation policy. Each area of policy is prepared by line agencies in conjunction with the Prime Minister's Office.

A central feature of all natural resource related policy is the explicit link between development, conservation and poverty alleviation. Wetland resources are a case in point. Studies have shown that between 70% and 90% of all protein consumed in rural communities comes from fish and other aquatic animals (Sverdrup-Jensen 2002). In addition, water resources hold enormous potential for hydroelectric power development and irrigation.

A central component of the constitution is the right of access to natural resources (GoL 1991). The constitution also states that all people have a central obligation to protect and sustainably use these resources. A balanced approach to management in Laos needs to take into consideration the roles and agendas of multiple stakeholders. The government, therefore, has proceeded cautiously in developing any policy that would exclude the use of water resources by either the state or local communities.

Social and economic development policy

Social and economic development policy is outlined in the current National Economic and Social Development Plan (NESDP) passed during the 7th Party Congress for the period 2001-2005 (PIC 2000). Within the NESDP are the national programs for land development, concentrating mainly on the rehabilitation of degraded land through technical means. This includes the improvement of irrigation and soil erosion measures. The plan recognises the importance of promoting education for land development, including the organization of a land development committee. One area that this addresses is compensating citizens who have had their land transferred back to the state for projects that are considered "in the public interest". This is relevant to wetlands that are being impacted by infrastructure development in the interest of national development.

Environmental policy

Environmental policy focuses on the protection of the environment from infrastructure development and agricultural use. Infrastructure development is a major agenda of the government and includes roads as well as irrigation, water storage and hydroelectric power. Environmental policy focuses primarily on the formulation of assessment guidelines and protection measures under the guidance of STEA. The main policy documents are the National Environmental Strategy 2020 and the Environmental Action Plan (EAP) 2006-2010 (STEA 2000).

The National Environmental Strategy 2020 (NES) outlines policy for environmental management and protection. The only water-related problems identified in the NES are waste and pollution from urban areas and mining. Recognition is also given to aquatic biodiversity under threat from over exploitation. No serious problems with wetlands or water resources are identified, but the potential for future problems is noted.

The NES identifies the need for appropriate assessment and mitigation of hydroelectric power and industrial developments. Within this policy, attention is given to the access and use of water resources. This is outlined as a major objective:

> To manage water and water resources to ensure multi-purpose and sustainable use and equal access for the general population, and to provide resources for the development of other sectors (Objective 3, p. 10)

The main framework for the implementation of environmental policy is the Environmental Action Plan (STEA 2000). First developed in 1993, the EAP lays out the structure for responsible management and sustainable use of water resources. This includes the development of a master plan for water resources use and legislation. This is stated in Action 2 of the EAP which outlines the need to implement policies and actions that ensure the sound management and sustainable use of water resources. Other wetland-related areas of the EAP refer to the management of forest resources, biological diversity, water tourism and fisheries.

Environmental protection measures, as outlined in both the NES and EAP, focus on balancing ecological integrity and public participation through inter agency coordination. The EAP outlines environmental assessment guidelines for infrastructure development. This includes protection measures relevant to wetlands, such as the mitigation of soil erosion and land degradation. The government is currently developing Fisheries Impact Assessment (FIA) guidelines with the assistance of the Mekong River Commission. These guidelines are being developed by STEA in conjunction with LARReC (LARReC 2004). The need for FIA was identified in recognition of the broad nature of the existing EIA guidelines, and

the need for impact assessment specific to fishery resources.

Conservation policy

Conservation policy is directly applicable to wetlands in Lao PDR. The two main policy documents are the National Biodiversity Strategy to 2020 and Action Plan to 2010 (STEA 2004). Within these, a direct link is made between the use of natural resources, economic development, rural livelihoods and poverty alleviation. The National Biodiversity Strategy 2020 states that the sustainable use of the country's biodiversity "may be the key to poverty reduction" (p. 1) and includes both terrestrial and aquatic environments. An integrated approach to natural resources management is recommended that emphasises the importance of maintaining use-rights by both the state and the wider population. With respect to water resources the Action Plan states that:

> Biodiversity conservation supports a wide range of economic activities and uses, including irrigated agriculture, medium- and large-scale hydroelectric power, fish ponds and aquaculture, and urban water supply (p. 2).

A direct link is also made between the sustainable use of natural resources and the protection of nature for the reduction of poverty. The policy outlines the need for development and protection of biodiversity to be carried out in accordance with the objectives of the NESDP, NES and the National Poverty Eradication Plan. In accordance with the constitution and these policies the Action Plan identifies the need to maintain water resources – including groundwater, lakes, rivers, streams and wetlands – through their sustainable use.

Summary

There are no specific policies on wetlands in Lao PDR. Instead, there are a number of related policies that direct the management of water and water resources, including those addressing social and economic development, environmental management, and poverty alleviation. A common feature of these policies is the emphasis placed on the sustainable use of natural resources, such as wetlands, in order to maintain rural livelihoods, alleviate poverty and enable economic development.

Legal and institutional framework

There are no laws directly related to wetland resources. However, a number of laws focus on related sectors such as land and water resources, fisheries and environmental protection. Each law establishes the rights and responsibilities of the Lao citizens to both use and protect these resources. The laws directly support the policies as outlined above, including the sustainable use of resources in pursuit of economic development and poverty alleviation.

Rights and responsibilities

The right to use land, water and the natural resources is a common feature of laws relating to natural resources. The Land Law outlined in Box

Box 1. Relevant Articles within the Land Law

Land Law No. 01/97/NA, Date 12/4/97. Department of Justice

Article 1.	Rules of Land Law
Article 2.	Territory of Lao PDR
Article 3.	Land Ownership
Article 4.	Promotion of Protection and Development of Land
Article 5.	Protection of the Interests of Land Users
Article 6.	Obligation to Protect Land and Environment
Article 7.	Land Management
Article 8.	Tasks of Land Management
Article 9.	Land Survey and Allotment
Article 34.	Cultural Land
Article 39.	Wetland Area
Article 40.	Agencies Responsible for the Management of Land and Water Areas
Article 42.	Management of Water Areas
Article 52.	Allocation of Rights to Use Land

1 (Ministry of Justice 2002) places the right to use land and water with local administrations, who in turn give responsibility for land management to individuals or organizations, with the provision that activities will not negatively affect that land. Under this system individuals and organizations maintain the right to use, transfer and inherit land. Specific measures include the reduction of erosion, prevention of water contamination, maintenance of water flow, as well as prohibition on the removal of vegetation in wetland areas, and destruction of marsh and peat areas without written consent from authorities.

The right to use water resources is outlined in the Water and Water Resources Law (DOI 1996). This legislation retains ownership of all water resources with the state but delegates the right of small-scale use to individuals and organizations (Box 2). The right of use is maintained if local regulations are followed. Permission to use existing land is not required. However, if a new use for water resources is proposed, permission must be sought from the relevant local authorities.

Water resources development

Water resources use and development is governed by the Water and Water Resources Law and the Environmental Protection Law (STEA and Ministry of Justice 1999; Box 3). Water resources development includes small-scale projects carried out by individuals, and large-scale projects carried out by the state or organizations. These range from local irrigation systems to large-scale hydroelectric power projects. Specific regulations for the use and management of water resources are given by relevant authorities. In the case of small-scale use this may be village authorities, and in the case of large-scale projects regulations must be sought from relevant Departments and Agencies at the national level. Similar to the Land Law, the right to use water resources is contingent on the ongoing responsible and sustainable management of these resources.

The Water and Water Resources Law outlines four central principles governing the use and development of water resources. These are as follows:

Box 2. Relevant Articles within the Water and Water Resources Law

Water and Water Resources Law No. 02/96, 11/10/1996, Department of Irrigation

Article 4.	Water and Water Resource Ownership
Article 6.	Basic Principles of Water and Water Resources Management
Article 7.	Obligations to Protect Water and Water Resources
Article 8.	Surveying and Listing
Article 9.	Determination of Water Source Type
Article 21.	Conducting Water Resources Development Activities
Article 22.	Principles Governing Water Source Development Activities
Article 23.	Management of Water Source Development Activities

Prime Minister's Decree 204/2001 Implementation of the Water and Water Resources Law

Article 19.	Water Resources development has to be in agreement with all people concerned
Article 20.	In the case of resettlement due to water resources development, the cost of relocation of people will come from the capital of the development project
Article 24.	Impacts of water development and their solutions must be made clear and agreed upon by the people who will be affected.

Box 3. Relevant Articles within the Environmental Protection Law

Environmental Protection Law No. 02/99/NA, STEA and Ministry of Justice

Article 14.	Measures for the Management, Exploitation and Use of Natural Resources
Article 15.	Biodiversity Resources Protection
Article 16.	Protection of Cultural, Historical and Nature Conservation Sites
Article 23.	Protection Measures and Pollution Control

1. Activities must be conducted in compliance with the NESDP, NES and other development plans including the approval of any construction plans.

2. Users must ensure the preservation of water and water resources, environment and natural landscape.

3. Users must prevent negative effects from water use.

4. Users must conduct all activities under the inspection of relevant authorized agencies for water and water resources.

A central component of the Water and Water Resources Law is set out in Prime Minister's Decree 204/2001 (Office of the Prime Minister 2001). It states that the local administration must inform local people about all aspects of water development projects, including environmental impacts. Through a process of consultation, local authorities should be in agreement in order for the project to continue. The decree goes on to say that participation of local people should be extended to providing solutions for any impacts – including resettlement.

The Environmental Protection Law focuses on minimising impacts of development activities on natural resources such land and water. Laws specifically outline the protection measures for biodiversity and pollution control (including wastewater). The Law also focuses on the protection of cultural, historical and nature conservation sites. This is relevant to wetland resources near, or in, national monuments such as Wat Phu Champasak, and recreational resources such as Nong Tang in Xiengkhouang.

Water and water resources use

The right to use water resources is governed by the Forestry Law and Agricultural Law and outlined in Box 4 and Box 5 (DOF 1996; Ministry

Box 4. Relevant Article within the Agricultural Law

The Law of Agriculture No. 01/98/NA, 10/10/98, Ministry of Justice

Article 68.	Environmental Protection of Fishing Practices Fishing must ensure the protection of fish species and other aquatic animals. It is forbidden to use fishing equipment with destructive characteristics

Box 5. Relevant Articles within the Forestry Law

Forestry Law, Ref. No. 01/96, 22/10/1996, Department of Forestry

Article 1.	Function of Forestry Law
Article 3.	Forest Resources
Article 4.	Forestry Land
Article 5.	Ownership of Forests and Forestry Lands
Article 8.	Obligations to Preserve Forests and Forestry Lands
Article 22.	Forestry Activities
Article 23.	Permissions to Undertake Forestry Activities
Article 25.	Exploitation of Wood and Forest-derived Products

Decree of Minister No. 0054, 7/3/96, Rights of Traditional Use of Forest Resources

Article 10, Ch. III.	Rights of Traditional Use of Community Forest Resources

MAF Mandate of Prohibition of Moving Aquatic Animals and Wildlife, Ref. No. 024/MAF 01, 26/12/2001

Delegation of control over the protection of conserved forests, aquatic animals and wildlife

of Justice 2002b). The Forestry Law states that forest resources include aquatic plants and animals found in forest areas. Furthermore, the Law defines forestry activities as all undertakings related to forests, including harvesting aquatic plants and animals. However, there is some ambiguity with respect to aquatic animals. The Department of Forestry understands the Law to cover all aquatic animals found in forests, with the exception of fish, which are the responsibility of the Department of Livestock and Fisheries. Nevertheless, the Forestry Law prohibits the capture of fish and other aquatic animals on the government's protected species list.

The right to catch animals, including fish, is outlined in a Forestry Decree on the use of community forests which gives individuals the right to catch fish and aquatic animals for their subsistence in community forest areas (GoL 1996a). However, the Agricultural Law focuses on the prohibition of destructive methods of catching fish and aquatic animals, both in and outside forested areas. The law prohibits a range of destructive fishing gears such as explosives, electricity and poisons. Ambiguities in the laws relating to the use of and responsibility for fish and aquatic animals are a source of confusion for the governance of wetland resources.

Local rules and regulations

Citizens are given rights over the use of natural resources, but are subject to the centrally planned laws and regulations outlined above. In reality, the government has limited capacity to regulate and enforce resource use. The laws state that authority and permission to use resources are delegated to local authorities. The Forestry Law explicitly outlines the process of decentralising authority over natural resource use. Article 63 of the Forest Law gives responsibility to village administration for their management, including education regarding the importance of forest resources (including water resources and aquatic animals), monitoring changes, drafting laws and regulations and taking an active role in the management of local resources.

There are examples of local rules being recognised and ratified into district and provincial law and regulations. For example, rules were developed by a gathering of user groups, government organizations and communities for the management of the Nam Ngum reservoir fishery (MAF 1995). A range of concerns were addressed, including access to the fishery, gear use, location of protected areas, protected fish species, fish trade, fishing licences, fines and identification of the organizations responsible for enforcement. These rules were then approved by the Ministry of Agriculture and Forestry through Vientiane provincial government.

Summary

There are no specific laws on wetland use, management and development in Lao PDR. However, there are several laws and regulations concerning water and water resources management that come under the Forestry Law, Water and Water Resources Law, and Agriculture Law. There is some confusion over the jurisdiction of laws concerning fish and other aquatic animals. This is especially the case between forest and non-forested areas. The extent to which centrally planned laws are actively enforced is limited by public awareness and the capability of government officials. A possible alternative is the development of village rules and regulations which are specific to local conditions and better understood and enforced by resources users.

International agreements on wetland management

The Lao government recognises the importance of supporting international relations and cooperation in international environmental protection. There are a number of environmental agreements that the government is a signatory to. The most relevant to wetlands include the 1992 Convention on Biological Diversity and the 1995 Mekong Agreement.

The government is currently in the process of deciding whether or not to become a signatory to the Ramsar convention. This process is being carried out through a working group convened by STEA. A number of government departments are collaborating by offering advice on the perceived benefits and costs. The difficulty in ratifying the convention in Lao PDR stems from a perception of potential restrictions that may be placed on the use of wetland resources by the state and its citizens. The main objection stems from the perception that Ramsar is primarily focused on the preservation of wetland resources through the managed exclusion of resource users.

Bilateral international agreements are currently being developed by the Lao National Mekong

Committee (LNMC) on trans boundary wetlands management. The most advanced of these is between Stung Treng and Champasak province. LNMC is also involved in the assessment of navigation projects in the north of the country.

Roles and duties of government agencies

There is no formal framework for the coordinated management of wetlands in Lao PDR. However, the responsible use and conservation of water resources is coordinated through the Water Resources Development Committee (Office of the Prime Minister 2001). This highlights a division between organizations responsible for sustainable management of wetlands and those responsible for extractive uses. The Ministry of Agriculture and Forestry (MAF) has the overall responsibility for management of wetland resources, including agriculture and conservation. Other ministries have related interests in wetlands, using water for transport, construction or electricity production. The Ministry of Communication, Transport, Post and Construction is involved with construction of infrastructure and river transport. The Ministry of Industry and Handicraft is involved with wetlands through construction of hydroelectric power facilities. Within the Prime Minister's Office the Science, Technology and Environment Agency (STEA) consults each of the ministries on policy formulation regarding environmental protection. In addition, the LNMC consults each of the ministries about policy related to trans-boundary issues.

Wetlands in the Ministry of Agriculture and Forestry

The main responsibilities of the ministry include research and implementation of government policies, strategies and work plans. The ministry is also responsible for the development and management of agriculture, forest and water resources. The Agricultural Law outlines the terms and conditions of MAF for agriculture development, environmental protection and data management. Provincial level agriculture and forestry offices have the same mandate, with responsibility to survey production and develop work plans.

Water and wetland management both fit within the mandate of the MAF. The role of the Ministry in water and water resource management was outlined in 2001 in Prime Ministerial Decree 204/2001 (Office of the Prime Minister 2001). The Decree states that MAF is responsible for

> ...the protection, research, development and utilization of water and water resources for agriculture, flood protection including carrying out surveys to collect data on meteorology, hydrology of the Mekong river and its tributaries and other rivers.

There has been some confusion over the responsibility for wetlands within MAF. This is because of a number of institutional changes to the Department of Livestock and Fisheries (DLF) and the Department of Forestry (DoF) since 1975. Wetlands originally came under the DLF until 1983 when the DLF was changed to the Department of Livestock and Veterinary Services. Both wetlands and fisheries were moved to the Department of Forestry, where responsibility was placed under the Division of Conservation and the Centre for Protected Area and Watershed Management (CPAWM). Changes to the government in 1990 saw fisheries move back under the Department of Livestock and Veterinary Services, while wetlands remained under the DoF. This situation remained until the inception of the Land Law in 1997 under which wetlands were returned back to the re-formed Department of Livestock and Fisheries.

The roles and responsibilities for wetland resources have only recently been described by MAF. The overarching goals for wetland management have now been outlined by the DLF (DLF 2004). These focus on developing research as well as extending awareness and management practices to resource users and local government staff (Box 6). These goals have since enabled further discussion with MAF on the specific roles and responsibilities of each of the departments for wetlands. In March 2004 the Office of the Permanent Secretary of the ministry defined the specific role of each department with respect to wetlands (Office of the Permanent Secretary 2004). Each is discussed in turn below:

- Department of Planning (DoP) – The DoP is responsible for the development of a national wetlands inventory. The aim is to improve the coordination of agricultural activities in wetland areas according to specific wetland classifications.

- Department of Livestock and Fisheries – The DLF is responsible for all animals and plants within perennial water bodies,

Box 6. Government Objectives for Wetlands Management in Lao PDR

1. Increase public knowledge and understanding of existing laws and regulations regarding the value and importance of wetlands.
2. Conduct research to develop management systems and an inventory of wetlands in Lao PDR.
3. Improve coordination and participation in the use and management of wetlands by both public and private stakeholders.
4. Strengthen the capacity of government staff in understanding wetland issues.
5. Improve rules and regulations for wetland management so they take into account all wetland resources and are contingent on local conditions.

outside of forested areas. This includes the implementation and enforcement of fishing regulations in wetland areas as well as developing fisheries management systems and coordinating extensions services. In addition the DLF has a duty to coordinate with other ministries and departments to survey fisheries use, to disseminate fisheries information, and implement international quarantine measures (see MAF 2002d).

- Department of Agriculture (DoA) – The DoA is responsible for the development of rice cultivation, recognised as one of the largest uses of wetland areas in the country. The main objective of the DoA is to increase the area of wet rice production to achieve national food security (see MAF 2002a).

- Department of Irrigation (DoI) – The DoI is responsible for land under irrigation. Their work includes the planning and implementation of projects for flood and drought protection and the regulation of irrigation-water discharge. As such, the DoI is directly responsible for increasing the area of wetlands for agriculture, while also controlling seasonal flooding in the area (MAF 2002c).

- Department of Forestry – The DoF is responsible for the management and protection of forests and forest resources. The DoF is also responsible for the protection of wetlands in forested areas, with special emphasis on the water sources (see MAF 2002b).

- National Agriculture and Forestry Research Institute – NAFRI is responsible for research on the production of fisheries through the Living Aquatic Resource Research Centre (LARReC) (MAF 2002e). LARReC is responsible for research on the socioeconomic and biological aspects of fisheries, for developing fisheries regulations and for aquaculture systems.

The role and responsibility of each department is described above in general terms. There is no indication which department is responsible for the overall coordination of wetland management within MAF. The government is now in the process of formulating orders and laws which will describe in more detail their specific role and duties. However, more detail on the coordination of wetland management between departments is still needed.

Decentralisation and the role of local communities

The government policy on decentralisation outlines the selective placement of financial control from the central level to the local level. This process in Lao PDR is considered one of *deconcentration* (Vaillancourt 2001), that is, the delegation of responsibilities from central government to regional branch offices or local administrative units (Arshad and Soukhamthut 2003). This process is also extended to natural resource management as reflected in the Forest Law Article 63. Decentralisation gives powers to villages for planning and implementation of measures that are suitable to local circumstances. However, more assistance from government in the planning process is needed. This could involve support and acknowledgement of local

rules for natural resources such as wetlands. This highlights the need for further analysis of legal frameworks governing natural resources to be carried out at the local level in conjunction with provincial and district officials.

Summary

The roles and responsibilities for wetlands in Lao PDR have been described in general terms within the Ministry of Agriculture and Forestry. However, there remains no clear framework for the practical coordination of management and research. Improved guidelines for wetland management in MAF would assist this process. Coordination between ministries is also needed to implement the laws and general policy goals of the government. Implementation of management and enforcement of laws would also benefit from the integration of local management systems.

Conclusion

The Mekong Wetland Approach has been instrumental in providing an opportunity for various sectors to discuss the different interpretations of the laws relating to water resources. The organizations that participated in this study had an opportunity to understand the integrated nature of wetland development and management in a range of sectors. This is a starting point from which to develop future policy which will integrate these different perspectives.

There are no specific policies or laws on wetlands in Lao PDR. Instead, there are a number of related areas of legislation that cover the development and management of wetlands. Government policy focuses on balancing rural livelihoods, alleviating poverty as well as enabling economic development. Central to this is an agenda for maintaining access to natural resources by both the state and citizens alike. The main areas of legislation reflect this agenda, maintaining these rights as well as outlining the maintenance of rights through the protection of natural resources.

A number of government organizations are involved in the management of wetland resources. However, there is a general division between the Ministry of Agriculture and Forestry, which is responsible for the management and conservation of wetlands, and other ministries, which are concerned with the exploitation of these resources. The roles and responsibilities of MAF departments have been described in general terms but the implementation of management, as well as the coordination between MAF and other ministries, remains unclear. Further development of practical guidelines is needed to avoid overlap of responsibilities at the ministerial and departmental levels as well as to improve the coordination of local resource management systems.

Economic valuation of wetland resources

The responsibility for the use and management of wetland resources is shared between different ministries. The lack of coordination in wetlands governance is directly linked to a lack of understanding of the different economic values placed on these resources by these different government offices. The Mekong Wetlands Approach provided a first opportunity for multiple stakeholders to share their perspectives on the importance and value of wetlands. This was an important step in raising the profile of wetland use by communities, and for dialogue leading to a better understanding of the agendas held by different government sectors. This process facilitates the integration of local interests within provincial, national and regional scales of management and development.

Framework for economic valuation

An important first step in recognising the value of wetland resources is to understand the perspective of the various stakeholders. A secondary information survey was conducted in three provinces of Southern Lao PDR – Attapeu, Champasak and Savannakhet. The survey was carried out through a series of workshops and consultations with provincial level authorities. These meetings gave an opportunity for staff from these agencies to share their experience and understanding of the value of wetland resources.

The survey was based on the Total Economic Valuation (TEV) framework, which breaks down values into categories which can be assessed separately with different methodologies (see Emerton 1998). These categories include both use and non-use values (Table 2). Use values are further divided into direct-use values, indirect-use values and option values. Non-use values are divided into bequest and existence values. The TEV is calculated as the sum of all these values.

Table 2. Summary of wetland values identified by line agencies

Organisations	Use Values: Direct use values	Use Values: Indirect use values	Use Values: Option values	Non-use values: Existence and bequest values
STEA		Fish and OAA Flood protection	Biodiversity	Environment
LNMC	Water supply Fish and OAA			Environment
DoF	Fish and OAA Timber and fuel wood	Soil erosion protection Nutrient storage	Bird conservation Wildlife habitat	Environment
DLF	Livestock Fish and OAA Fish culture		Fish habitat	Environment
DoI	Water supply	Flood protection Ground water storage Soil erosion protection Sedimentation Saline water protection		Environment
DoA	Rice production Vegetable cultivation	Soil erosion protection Nutrient storage		Environment
LARReC	Fish and OAA		Fish habitat	Environment
MCTPC		Soil erosion protection		
MIH		Hydro-electicity		
Other		Tourism Recreation		Culture Traditions Human settlement

Note: OAA = other aquatic animals

The values and perceptions of wetland resources given by each of the participating departments are summarised in Table 2. Direct-use values are more commonly recognised across all government line agencies. In comparison, indirect-use values and non-use values are not as well understood, or as easily identified.

Direct and indirect-use values: Secondary data survey

The secondary data survey compiled a wide variety of reports on the use of wetland resources in each of the three southern provinces. The information highlights some of the generally recognised values of wetlands. The direct-use values identified by participants relate to the areas of responsibility of various line agencies in MAF and other departments. The main areas identified are summarised below:

- **Fishery resources**

  Fish and other aquatic animals are the most readily identified use value associated with wetlands as they include both consumption and trade. Value accrues to people who catch the fish as well as to the many people who sell the fish on to retail markets. The value of harvesting, consuming and trading fishery resources was recognised in each of the three provinces. However, little quantitative information exists. A number of estimates have been made around the country but most studies focus only on the system of trade, with limited indicative information on market value (Bush 2002). In Champasak province some studies have outlined the extent of trade from Siiphandone to Thailand and Vientiane (Bush 2004). Estimates of the annual value of this trade range from US$440 000 to US$1 million (Baird et al. 1998; Phonvisay and Bush 2001). The Savannakhet study provided an estimate based on the first longitudinal study of fish prices in the country. A preliminary value for fish sold in these markets is US$296 797 (Table 3).

- **Agriculture**

  Agricultural value of wetlands includes vegetable production as well as rain-fed and

Table 3. Market value of fish trade in three districts of Savannakhet Province
(Adapted from Bush, in prep.)

Fish Traded	Total (kg)	Average Price (kip/kg)	Total value (kip/day)	Total (US$/yr)
Native capture species	13 454	13 080	3 744 220	130 156
Pond culture	4 677	10 655	1 060 286	36 858
Cage culture	4 924	10 924	1 144 463	39 784
Total	23 055	34 659	5 948 969	206 797

Note: US$1 = 10 500 kip. Calculations do not take into consideration seasonal variation in quantities sold. Surveyed markets: Samakheysai and Savansai markets, Khantabouli District. Khengkhok market, Chumphone District. Seno market, Outhomphone District.

Table 4. Value of irrigated crops
(MAF 2003)

Crop	Area (ha)	Production (tonnes)	Value (kip million)	Value (US$ million)
Rice	101 971	436 254	356 856	324
Vegetables	109 590	630 649	945 974	860

irrigated rice. An estimate of the value of the national rice and vegetable production is given in Table 4. The total values of rice and vegetables are estimated at US$324 million and US$860 million respectively, and are based on estimates of production from the area cultivated. There is no distinction between wet and dry land rice, or to what extent vegetables are grown in wetland areas. More accurate estimates of rice crop values can be carried out at the community level.

- **Forestry**

  The use of forest and non-timber forest products (NTFPs) is very important for rural communities. NTFPs include items such as vegetables, fuel wood and medicinal plants, some of which are collected from wetland areas. Fish have been identified as one of the most important NTFPs in Lao PDR (Foppes and Ketphanh 1997). Estimates of the annual export value of NTFPs from the country are around US$5.5 million (UNDP 2001). However, there is no indication how much of this is from wetland areas.

- **Hydroelectric power**

  It is estimated that Lao PDR has the potential to produce 23 000 megawatts of hydroelectric power. Of this estimated figure only 5% is currently exploited. More work needs to be carried out to identify the value of hydroelectric power, taking into consideration other use and non-use values of affected wetlands.

- **Tourism value**

  Communities can obtain direct income from tourist visits to wetlands. Tourism can also be valued by support services such as guest houses and transport. Ecotourism projects have been developed in both Savannakhet and Champasak around wetlands. In both cases wetlands have become more valuable assets to their surrounding communities.

Indirect-use values

- **Biodiversity**

  Biodiversity is a widely recognised value of wetland areas. Fish biodiversity in the Mekong Basin is estimated at around 1800 species, with up to 500 species in Lao PDR (Baird 2001a; MRC 2001). Wetlands are also important for a number of birds and other terrestrial animals. A number of other aquatic animals are also found in Lao PDR that are under threat, including the Siamese crocodile and the Irrawaddy dolphin (Claridge 1996).

- **Cultural**

  Wetlands have a number of cultural values in Lao PDR. Many fishing activities can still be classified as traditional, including the knowledge associated with fishing gears and fishing activities specific to different parts of the country (Claridge et al. 1997; Shoemaker et al. 2001). There are also a number of animistic religious values associated with wetlands. Examples include deep pools in

large rivers and also lakes in community forests (Baird 2001b; Shoemaker et al. 2001). Despite the importance placed on these values, they are not recognised in planning or management.

- **Environmental services**

  Wetlands also provide a number of environmental services such as flood protection, water purification and water storage (Gerrard 2004). The value of these services is difficult to assess and is not often taken into consideration in planning or management of wetlands.

An integrated assessment of these multiple values has not yet been achieved in Lao PDR. As outlined in Table 2, the various use values are distributed across different government departments. For example, the Department of Livestock and Fisheries is primarily interested in the direct-use value of fish and aquatic animals. In comparison, the Department of Irrigation is concerned with a range of indirect values including environmental services such as flood mitigation. These are not activities associated with the work of the DLF. Similarly, habitat protection is not a direct activity of the DoI. Specific wetlands values are given priority within the work of each department, even though their actions affect a range of other values. The Mekong Wetlands Approach provided participants with the opportunity to understand these values in the wider context of their own work and the work of other departments and organizations.

Case studies

Three case studies highlight the range of values put on wetlands and the variety of methods that can be used in capturing these values. Each example emphasises the combination of use and non-use values and assesses the potential for inclusion in natural resource assessment, planning and management.

That Luang Marsh, Vientiane

Only one economic valuation of a wetland has been done in Lao PDR. This study was carried out on That Luang Marsh in Vientiane as a case study for the Water and Nature Initiative of IUCN (Gerrard 2004). The study aimed to identify and value the uses of That Luang Marsh, a 2000 hectare wetland that provides substantial benefits to the largest urban centre in the country, but which has come under increasing pressure from urban expansion and infrastructure development. The study provides an economic value for both wetland resources and ecosystem services with the aim of these being incorporated into future planning. Both direct and indirect uses of the wetland were investigated. Direct-use values include diverse wetland plant and animal products and water for communities surrounding the marsh. Indirect-use values include flood protection, wastewater purification and water storage. The study did not look at non-use and option values because of the limited time available.

Direct-use values were estimated using a market price approach derived from surveys of consumption and sale of items from the wetland areas. Indirect-use values were estimated using a variety of methods calculating replacement costs for environmental services. For example, flooding was valued by calculating the potential cost of damage to surrounding rice fields; water storage was valued by the replacement cost of irrigating an equal area with an equal quantity of water; and water purification was valued by calculating the cost of alternative methods for treating water.

The total value of the That Luang wetland was calculated to be US$5.12 million per year or US$2 560 per hectare per year (Table 5). Direct uses total US$2.03 million per year, reflecting the importance to livelihoods. This figure reflected the difference between urban, semi-urban and rural communities living around the wetland.

Table 5. Annual value of economic benefits from That Luang Marsh (from Gerrard 2004)

Wetland resources - Direct-use values	(US$)
Rice cultivation	349 681
Garden cultivation	55 017
Aquaculture production	179 671
Capture fisheries	1 092 095
Non-fish wetland products	354 106
Sub total	**2 030 570**
Wetland services - Indirect-use values	
Flood protection	2 842 000
Wastewater purification	70 088
Water storage	166 446
Sub total	**3 078 534**
Total	**5 109 104**

For example, a smaller percentage of urban households collect wetland products. However, those urban households that do are more reliant on the resource as they cannot produce agricultural products on their smaller urban plots of land. A distinction is also made between rich and poor households, with poorer households more reliant on wetland products than wealthier households. These results show the importance of government services reflecting the diversity of needs around a common resource.

The total of the indirect-use values of the wetland was estimated at US$3.08 million per year. The most important of these indirect uses is flood control, valued at US$2.8 million per year. In an urban area such as this the environmental functions of the wetland area are of particular importance. The high annual value highlights the need for better coordination in urban planning, recognising existing environmental services such as drainage and sanitation.

The conclusion of such analysis is that it is more economical to protect wetlands in their current state, and it is this message that should be communicated to planners and managers.

Siiphandone Wetland, Champasak Province

Siiphandone[2] is one of the largest wetland areas in Lao PDR, covering an area of more than 60 square kilometres and located on the border with Cambodia. The importance of the Siiphandone wetland can be evaluated at many levels. Regionally, it is an important habitat for the ecological integrity of the Mekong River Basin; nationally the wetlands are a significant national symbol; locally Siiphandone is an important resource for the livelihoods of 65 000 people that live in and around the wetland. No economic valuation has been carried out on these wetlands. However, a number of studies have been conducted that focus on a range of values associated with community fisheries, biodiversity and agriculture that highlight a range of use and non-use values.

One of the most extensively studied resources in Siiphandone is the fishery, which has been described as one of the greatest artisanal resources of its kind in Lao PDR (Roberts 1993a). Consumption estimates from the area are as high as 42 kg/person/yr with fish and fish products consumed in 52-90% of all meals (Baird et al. 1998). The fishery also supports a large number of people involved in the extensive fish trade networks that extend to Thailand and Vientiane (Bush 2004). Estimates of total trade value range between US$450 000 and US$1 million per year. The fishery, therefore, has a very high direct-use value (Baird et al. 1998; Phonvisay and Bush 2001).

The fishery also has a number of indirect-use values and non-use values that have not been quantified. For example, the fishery is one of the most biodiverse in the country. There are 201 species of fish that have been recorded in Siiphandone as well as a number of molluscs, gastropods and amphibians (Baird 2001a). This has important livelihood benefits. Different fish species migrate at different times of the year extending fishery activities over a full 12-month period, supporting fishers in both the wet and dry season.

Management initiatives have highlighted a number of social and cultural values of the fishery that are often neglected in valuation exercises. Through the Lao Community Fisheries and Dolphin Protection Project, funded by Cooperazione e sviluppo (Cooperation and Development, Italy), a series of management measures were developed (Baird 2001b). These initiatives included the establishment of fish conservation zones, bans on blocking streams, bans on destructive fishing gears, juvenile fish conservation, sustainable frog harvesting, and rice-field fishery management. The primary result of these measures has been a sustainable supply of fish and other aquatic animals. There are also a number of secondary values associated with the sustainable management of the fisheries. These include:

- *Ecological value* – Following the protection of a number of habitats, villagers reported seeing species that had not been seen for a number of years.

- *Community values* – The cooperation of people within and between villages has increased their solidarity. This has developed from community members working together on the protection and management of common resources.

[2] *Siiphandone* means four thousand islands in Lao. This indicates the large scale of the wetland habitat.

- *Cultural value* – Recognition of the importance of wetland areas has raised spiritual and cultural use values. The value of local ecological knowledge has become increasingly recognised as an important tool in management and conservation (Baird, forthcoming). The value of traditional fishing methods has also increased. Cultural importance has also been recognized for particular locations such as Khone Phaphaeng waterfalls.

- *Tourism value* – Conservation of the Irrawaddy dolphin (*Orcaella brevirostris*) and promotion of the island habitats has increased the value of tourism for communities in Siiphandone.

It is important to recognise the wide variety of use and non-use values associated with a wetland such as Siiphandone. The fishery resources are a case in point. Economic valuation normally looks at fisheries in a narrow quantitative manner. However, management initiatives in Siiphandone have highlighted an extensive range of indirect-use values and non-use values that should be incorporated into a wider understanding of the wetland's true value.

Floodplains, Attapeu Province

The third case study focuses on the importance of floodplain wetlands in Attapeu Province. Floodplains have traditionally been seen as an important environment for rice production. Less attention has been given to the value of floodplains as a source of living aquatic resources. The two studies outlined below both argue for a more balanced approach to understanding the value of living aquatic resources and rice production in floodplain areas. The first, by Mollot et al. (2003), outlines the value, influence and importance of flooding to rural communities. The second, a study by Meusch et al. (2003), highlights the nutritional value of living aquatic resources in wetland areas. Both used participatory methodologies to understand the range of values associated with floodplains.

The study by Mollot et al. (2003) shows the importance of flooded areas for living aquatic resources' productivity and for rural livelihoods in Somboie village, which is situated in the Sekong River basin. In particular, the study focuses on the comparative importance of flooded forest and rice field. The results show that people collect a wide range of items in both areas including bamboo shoots, fish, frogs and traditional medicines. However, productivity is not equal across these two areas. Fishing effort is greater in flooded forest areas as fishers know these will yield higher catches of fish. In terms of living aquatic resources, rice fields are only half as valuable. When rice and fish production are considered jointly, however, rice fields are the most economically valuable asset owned by farmers.

The study demonstrates how the value of rice field and flooded forest habitat shifts depending on variation in the hydrological cycle of the Sekong River from year to year. In years of extensive flooding, fishery production is high but rice production is reduced. Alternatively, in years of moderate flooding, fish production is relatively low and rice production high. The study concludes that the value of resources found in floodplain environments needs to be assessed in the context of a balance of benefits from flooding rather than an assessment of the damage caused by flooding to rice crops, as is usually the case.

Meusch et al. (2003) provide a good example of an empirical study that examines the importance of living aquatic resources in wetland areas of Attapeu to food security and nutrition. Their study found that malnutrition is high in this province, with diets especially low in proteins and fats. The main agricultural extension activities pursued by the government are to increase rice area and promote livestock production. However, rice production in these villages is low and livestock are not a readily converted source of protein. Instead all of the villages surveyed relied heavily on animals and plants from wetland areas for a nutritionally balanced diet. The findings of the study therefore, leading on from the argument made by Mollot et al. (2003), suggest that the importance of aquatic resources for nutrition needs to be taken into consideration in addition to rice crops. The report concludes that while there are coping strategies for a lack of rice, there are no such strategies for a lack of aquatic animals. The value of these resources needs to be considered more in agricultural planning and extension. It is proposed that development efforts should continue to meet objectives of rice production but not at the expense of sustainably managing the productivity of living aquatic resources.

Both studies highlight the value of aquatic resources across floodplains. They provide alternative views to the traditional methods of assessing the importance of agricultural products such as rice production by including the value

of fish and other living aquatic resources. This alternative view of the value of flooding is not generally recognised in wetlands planning and management.

Conclusions

This 'integrated approach to wetlands' has provided a starting point for the various agencies to discuss the value of wetlands in Lao PDR. Economic valuation of natural resources is not well understood in Lao PDR, with only one formal study ever conducted. The Mekong Wetlands Approach has provided an opportunity to raise awareness of the multiple values of wetland resources between different ministries. However, there remains no coherent understanding of the variety of values that exist, or about the systematic methods that can be used for assessing these values. As such, further discussion is needed to develop a better understanding of values and valuation techniques.

Extensive information related to wetlands has been collected by each of the line agencies at the provincial level. The information is often qualitative and not directly transferable to economic valuation, but it provides a base on which to develop future studies. The case studies show that, in order to capture the full range of wetland values, a variety of qualitative and quantitative methodologies should be employed including market prices, replacement costs, consumption surveys and participatory-based tools.

Policy conclusions: Challenges and strategies for improved governance of wetlands

Conclusions

Wetlands management has faced considerable opposition in Lao PDR as it has, historically, been linked and aligned with conservation. As a result, little attention has been given to wetland resources, but this does not mean that wetland resources have not been managed. Policy and law have focused on a number of wetland-related resources such as water, aquatic animals and plants, and environmental protection. The Mekong Wetlands Approach has opened a dialogue on wetlands enabling related resources to be integrated under a common management framework. Several positive outcomes have emerged from this process. First, a new term has been given to wetlands - *Din Boliven Nam* – that has shed the negative connotations of protection-based conservation. Secondly, MAF has begun the process of classifying and creating a national inventory of wetlands. These are both important precursors for the better governance and valuation of wetlands and wetland resources.

Legal and institutional analysis

The review of legal and institutional frameworks found that there are no specific laws or policies that refer directly to wetlands. There are, however, a range of policies and laws related to wetland resources. The dominant theme of natural resource use in Lao PDR is the right-to-use of both state and individuals based on a responsibility for sustainable management. This is expressed in all major social, economic and environmental policies, maintaining a balance between economic development, poverty alleviation, environmental management and conservation.

The legal framework reflects the right to use natural resources. Laws are divided into different sectors, including water, land, forests and living aquatic resources. Each law has been developed by the department responsible for those resources. As such, they have been developed in relative isolation from each other and, as a result, there is considerable overlap. This is reflected in the roles and responsibilities of the various line agencies within MAF. Recent discussions within MAF have begun the process of designating general areas of responsibility between each of the departments, but the details have yet to be decided. There is also potential for the legal and institutional framework to be more inclusive of existing local management systems through the government's decentralisation policy. This would allow national and provincial departments to take into consideration local variations in wetlands and to develop appropriate management systems.

The current status of legal and institutional frameworks needs revising in order to accommodate more integrated systems of natural resource management. The analysis shows the potential to develop an integrated approach to wetlands management in Lao PDR and this is the first step in facilitating a process of integrated management on a regional level.

Economic valuation

In order to create better governance systems for wetlands their value must be understood and appreciated. There is currently little information

on the valuation of wetland resources in the country. Economic valuation has yet to be applied by the government, but the need for suitable methodologies is increasingly recognised. The valuation of wetlands will give decision-makers a better basis on which to determine their actions and therefore to manage wetlands in a more sustainable way.

In Lao PDR the emphasis has been on the direct-use values of wetlands and this is reflected in much of the legislation and policy covering natural resource use. Studies on wetland-related activities have found that there are a range of indirect-use values and non-use values. Further research is needed to incorporate these values within a Total Economic Valuation framework. This would require a combination of both quantitative and qualitative methods.

Overall, the results of the secondary information survey show that much of the necessary information on wetlands is still missing. Despite this, the process of bringing together a range of government departments has allowed them to reflect on the values held by each department. Recognising that departments value wetlands differently is an important step in developing an integrated approach to wetlands management.

The Mekong Wetlands Approach has demonstrated the importance of incorporating provincial and local level stakeholders in discussions over natural resource governance. This is a new concept in Lao PDR, but an important one as the government debates the advantages and disadvantages of joining Ramsar. Better recognition of the value of wetlands and of the need to create inclusive, integrated governance systems is an important step in sustainably managing wetland resources in the country.

Recommendations

Improve inter-agency coordination in the management of wetlands

- The MAF should continue its work on developing a national wetlands inventory. This should involve a series of national surveys that build on previous studies by IUCN and MRC, and should culminate in a comprehensive wetlands classification system.

- The specific roles and responsibilities of each of the departments within the Ministry of Agriculture and Forestry should be further defined. Overlapping areas of work between departments would then be identified and further clarification of legislation and work plans could be carried out.

- A national steering committee should be created that is responsible for coordinating and facilitating work between ministries and provincial offices. This committee should be an extension of the existing steering committee for Ramsar membership. The structure of the committee should be modelled on the national Water Resources Development Committee.

- Awareness of the importance of wetlands should be raised within all ministries through the production of research materials, guidelines, and information sheets in the national languages that will assist planning and management.

- Further networking should be developed between the government ministries and departments involved in the Mekong Wetlands Approach, together with the addition of the National University of Laos (NUOL). Strong links should be made with the IUCN Wetlands Project in Attapeu and the WWF Wetlands Project in Sekong to provide strategic research opportunities. Attention should also be given to developing better linkages with Northern provinces on wetland issues.

Development of wetlands legislation

- Develop better legislation for wetland resources by identifying and clarifying overlapping laws, roles and responsibilities. This should be carried out by a committee made up of representatives from all relevant ministries and departments. Improve the understanding and communication between villages and government to facilitate better formulation of laws relevant to local conditions.

- Increase public awareness of existing laws and regulations through publication and dissemination activities. This should involve a range of radio, television broadcasts, posters, and information booklets.

- Develop the capacity of district and provincial offices to identify, record and recognise customary rules and regulations at the

community level. Activities should focus on the improved enforcement of management systems by communities, with the assistance and support of district offices.

Develop capacity for economic valuation

- Develop research capacity for economic valuation within government institutions such as NUOL and the National Agriculture and Forestry Research Institute (NAFRI), and the capacity of ministries to incorporate values into impact assessments, planning and policy.

- Research and develop methods for economic valuation that reflect the broad use of wetlands in Lao PDR. This should be carried out by research institutions such as NUOL and NAFRI in conjunction with provincial and district offices. Methodologies should combine qualitative and quantitative tools. These must reflect the need to know what is important to the resource users and also provide economic valuations for incorporation into economic planning and policy decisions.

- Carry out economic valuations in key wetlands across the country. All research should be carried out with support from provincial and district governments. A suggested field site is the Se Chumphone floodplain in Savannakhet, in partnership with the RDC.

References

Arshad, I. and T. Soukhamthut. 2003. An Evaluation of the Decentralization Process in Lao PDR. *NERI Journal* 1:1-8.

Baird, I.G. 2001a. Aquatic biodiversity in the Siphandone Wetlands. In: *Siphandone Wetlands* (G. Dacanto, eds.), pp. 61-74. CESVI, Bergamo.

Baird, I.G. 2001b. Towards sustainable co-management of Mekong River aquatic resources: the experience in Siphandone wetlands. In: *Siphandone Wetlands* (G. Dacanto, eds.), pp. 89-111. CESVI, Bergamo.

Baird, I.G. (Forthcoming) *Local Ecological Knowledge and Small-scale Freshwater Fisheries Management in the Mekong River in Southern Laos* Blackwell Science.

Baird, I.G. and M. Flaherty. 1999. Fish Conservation Zones and Indigenous Ecological Knowledge in Southern Laos: A First Step in Monitoring and Assessing Effectiveness. CESVI, Pakse.

Baird, I.G., V. Inthaphaysi, B. Phylaivanh and P. Kisouvannalath. 1998. A Rapid Fisheries Survey in Khong District, Champasak Province, Southern Lao PDR. Environmental Protection and Community Development in Siphandone Wetland Project, CESVI, Pakse, Lao PDR.

Bush, S.R. 2002. Review of Fish Marketing in Laos, Working Paper No. 2. AMFC, Mekong River Commission, Vientiane, Lao PDR.

Bush, S.R. 2003. Comparing what matters with what is done: fisheries and aquaculture in the Lao PDR. In**:** Second Large Rivers Symposium, 11th-14th February, pp. 19, Phnom Penh, Kingdom of Cambodia.

Bush, S.R. 2004. Scales and Sales: changing social and spatial fish trading networks in the Siiphandone fishery, Lao PDR. *Singapore Journal of Tropical Geography,* 25:32-50.

Bush, S.R. (In prep.) A Political Ecology of Living Aquatic Resources Management and Development in the Lao PDR. PhD thesis, University of Sydney, Sydney.

Claridge, G.F. 1996. An Inventory of Wetlands of the Lao PDR. IUCN, Vientiane, Lao PDR.

Claridge, G.F., T. Sorangkhoum and I.G. Baird. 1997. Community Fisheries in Lao PDR: A survey of Techniques and Issues. IUCN - The World Conservation Union, Vientiane, Lao PDR.

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, U.S. Department of the Interior, Jamestown, ND: Northern Prairie Wildlife Research Center Online, Washington D.C.

DLF. 2004. Importance and Benefits of Wetlands in Lao PDR. Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, Vientiane, Laos.

DOF. 1996. Forestry Law, No. 01/96, Date 11/10/1996. Published by the Forestry Training Center, Vientiane, Laos.

DOI. 1996. Water Use and Water Resource Law No.02/96, Date 11/10/1996. Published by the Education Printing Enterprise, Vientiane, Laos.

Emerton, L. 1998. Economic Tools for Valuing Wetlands in Eastern Africa. IUCN, Nairobi, Kenya.

Foppes, J. and S. Ketphanh. 1997. The Use of Non-Timber Forest Products in Lao PDR. DoF/IUCN, Vientiane, Laos.

Friend, R. 2001. A people-centred fishery: socio-economic perspectives on the Siphandone wetlands. In: *Siphanone Wetlands* (G. Dacanto, eds.), pp. 75-88. CESVI, Bergamo.

Garaway, C.J. 1999. Small Waterbody Fisheries and the Potential for Community-led Enhancement: Case Studies in Lao PDR. PhD thesis, University of London, London.

Gerrard, P. 2004. Integrating Wetland Ecosystem Values into Urban Planning: the case of That Luang Marsh, Vientiane, Lao PDR. IUCN - The World Conservation Union, Asia Regional Environmental Economics Programme and the WWF Lao Country Office, Vientiane.

GoL. 1991. The Constitution of Lao PDR, Government of Laos, Vientiane.

GoL. 1996a. Rights of Traditional Use of Forest Resources. Ministry of Agriculture and Forestry, Ministerial Decree of MAF No. 0054/1996.

GoL. 1996b. The Water and Water Resources Law, Vol. No. 02-96. National Assembly, Lao PDR.

LARReC. 2004. Manual for managing the EIA process for fisheries and aquatic environments in Lao PDR by national agencies. LARReC, Vientiane.

MAF. 1995. Regulations on Fishing in Nam Ngum Basin, No. 0567/AF, Date 15/06/1995. Ministry of Agriculture and Forestry.

MAF. 2002a. Roles and Responsibilities of Department of Agriculture MAF Order 1145/02. Ministry of Agriculture and Forestry.

MAF. 2002b. Roles and Responsibilities of Department of Forestry. MAF Order 1147/02. Ministry of Agriculture and Forestry.

MAF. 2002c. Roles and Responsibilities of Department of Irrigation. MAF Order 1148/02. Ministry of Agriculture and Forestry.

MAF. 2002d. Roles and Responsibilities of Department of Livestock and Fisheries. MAF Order 1146/02. Ministry of Agriculture and Forestry.

MAF. 2002e. Roles and Responsibilities of National Agriculture and Forestry Research Institute. MAF Order 1149/02. Ministry of Agriculture and Forestry.

MAF. 2003. Agricultural Statistics. Ministry of Agriculture and Forestry, Vientiane.

Mekong Secretariat. 1970. Indicative Basin Plan. Mekong Secretariat, Bangkok.

Meusch, E. 1996. Participatory Assessment of Ricefield Fisheries in Atsaphantong District, Savannakhet Province, Lao PDR. MSc thesis, Auburn University, Auburn, Alabama.

Meusch, E., J. Yhoung-Aree, R. Friend and S.J. Funge-Smith. 2003. The role and nutritional value of aquatic resources in the livelihoods of rural people - a participatory assessment in Attapeu Province, Lao PDR. Publication No. 2003/11. FAO Regional Office Asia and the Pacific, Bangkok, Thailand.

Ministry of Justice. 2002a. Land Law No.01/97/NA. Date 12/04/97. Published by the Sibounheung Printing Enterprise. Vientiane, Laos.

Ministry of Justice. 2002b. The Law on Agriculture No.01/98/NA. Date 10/10/98. Published by the Sibounheung Printing Enterprise. Vientiane, Laos.

Mollot, R., C. Phonthitay and S. Kosy. 2003. Seasonally Flooded Habitat and Non-Timber Forest Products: Supporting Biodiversity and Local Livelihoods in Southern Lao PDR. In: Sixth Technical Symposium on Mekong Fisheries (MRC eds.). Mekong River Commission Fisheries Programme, Luang Phrabang.

MRC. 1997. Inventory and management of the wetlands in the Lower Mekong Basin: Phase 1, Final Report January 1990-June 1996. Mekong River Commission, Bangkok.

MRC. 2001. Mekong Fish Database. Assessment of Mekong Fisheries Component. Mekong River Commission, Phnom Penh.

Nguyen Khoa, S., K. Lorenzen, C.J. Garaway and B. Chamsingh. 2003. Impacts of irrigation development on capture fisheries in the ricebased farming systems of southern Laos. In: Second Large Rivers Symposium, 11th-14th February, Phnom Penh, Kingdom of Cambodia.

Noraseng, P., S. Manothom, K. Phansopha, P. Hirsch and K. Tubtim. 2001. Management of backswamps in Sanasomboun and Phonethong districts, Champassak Province, Lao PDR, SWIM Report No. 1. The Small-Scale Wetlands Indigenous Fisheries Management Project (SWIM Project), Pakse, Lao PDR. Australian Centre for International Agricultural Research, International Development Research Centre, Pakse, Lao PDR.

Office of the Permanent Secretary. 2004. Responsibility of Wetlands Management within the Ministry of Agriculture and Forestry. No. 0325/04. Ministry of Agriculture and Forestry.

Office of the Prime Minister. 2001. Decree Concerning the Implementation of Water and Water Resources Law No. 204/PM. Published by the State Printing Enterprise. Vientiane, Laos.

Phonvisay, A. and S.R. Bush. 2001. Baseline Study of Fish Trade from the Siphandone Fishery, Champassak Province, LARReC Research Report No. 0004. LARReC, Vientiane.

PIC. 2000. Fifth National Economic and Social Development Plan, 2001-2005. Planing and Investment Committee, Vientiane.

Poulsen, A.F. 2003. Fish Movements and their Implications for River Basin Management in the

Mekong River Basin. In: Second International Symposium on the Management of Large Rivers for Fisheries, Phnom Penh, Cambodia, 11th-14th February 2003.

Roberts, T.R. 1993a. Artisanal Fisheries and Fish Ecology below the Great Waterfalls of the Mekong River in Southern Laos. *Nat. Hist. Bull. Siam. Soc.* 41:31-62.

Roberts, T.R. 1993b. Just another Dammed River? Negative Impacts of Pak Mun Dam on fishes of the Mekong Basin. *Nat. Hist. Bull. Siam. Soc.* 41:105-133.

Roger, K. 2002. Wetland Classification in the Lao PDR. Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, Vientiane.

Shoemaker, B., I.G. Baird and M. Baird. 2001. The People and their River: A Study of River-Based Livelihoods in the Xe Bang Fai River Basin in Central Lao PDR. The Lao PDR/Canada Fund, Vientiane, Lao PDR.

Singhanouvong, D. and K. Phoutavong. 2002. Fisheries baseline survey in Champasak Province, Southern Lao PDR. In: Proceedings of the Fifth Technical Symposium on Mekong Fisheries (A.F. Poulsen, eds.), Mekong River Commission, Phnom Penh.

Sjorslev, J.G. (ed.) 2000. Luangprabang Fisheries Survey. AMFC/MRC and LARReC/NAFRI, Vientiane.

STEA. 2000. Environmental Action Plan 2006-2010. Science, Technology and Environment Agency, Prime Minister's Office, GoL, Vientiane.

STEA. 2000. National Environment Strategy 2020. Science, Technology and Environment Agency, Prime Minister's Office, GoL, Vientiane.

STEA. 2004. The National Biodiversity Strategy to 2020 and the Action plan to 2010, Report No. 1066/STEA-PMO. Science, Technology and Environment Agency, Prime Minister's Office, Vientiane.

STEA and Ministry of Justice. 1999. Environmental Protection Law No. 02/99/NA, 1999. State Printing Enterprise. Vientiane, Laos.

Sverdrup-Jensen, S. 2002. Fisheries in the Lower Mekong Basin: Status and Perspectives. MRC Technical Paper No. 6. Mekong River Commission, Phnom Penh.

UNDP. 2001. National Human Development Report. United Nations Development Programme, Vientiane.

UNESCO. 1994. Convention on Wetlands of International Importance especially as Waterfowl Habitat.

Vaillancourt, F. 2001. Fiscal Decentralization in Lao PDR: Principles, Practices and Prospects in 2001. Vientiane: World Bank.

Valbo-Jørgensen, J. and A.F. Poulsen. 2000. Using local knowledge as a research tool in the study of river fish biology: experiences in the Mekong. *Environment, Development and Sustainability* 2:253-376.

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This study provided the first opportunity for the Department of Livestock and Fisheries (DLF) to analyse the legal and institutional framework and the economic valuation of wetland resources in Lao PDR. The aim of the study was to assess current policies, plans, laws, decrees, regulations and orders from several agencies and ministries responsible for the management and development of water and water resources, including wetlands. Our work also enabled us to carry out, for the first time, a broad scale analysis of the values of wetland resources. Representatives from a number of organizations took part, including the Department of Livestock and Fisheries; the Science, Technology, Environment Agency (STEA); the Lao National Mekong Committee (LNMC); the World Conservation Union (IUCN); Department of Forestry (DoF); the Living Aquatic Resources Research Center (LARReC); and the Regional Development Coordination (RDC). Together these provided a range of insights into the current state of knowledge on wetlands at the national level. This was supplemented with secondary information collected at the provincial level in Savannakhet, Champasak and Attapeu.

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Towards a holistic approach to wetlands governance
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Introduction

Cambodia is rich in wetlands and wetland resources. Wetlands cover more than 30% of the land area (MoE 1999), and, as the landscape is generally low-lying and flat, it is not surprising that a large proportion of the country is regularly inundated, particularly in the wet season. The Tonle Sap Lake, the Mekong River and the Bassac Marsh comprise the three major freshwater wetland regions in Cambodia. In addition to these, there are various small wetland sites, such as those upstream of Stung Sen and along the Mekong tributaries in northeast Cambodia. Most Cambodians live in the central plain of the country, where wetlands are located, and depend heavily on wetlands and wetland resources for their livelihoods and income.

With an economy based heavily on agriculture, Cambodia depends primarily on primary production and the collection of resources from the wild. Although wetlands and their resources provide significant goods and services to the people and to the national and local economy, many of these goods are collected for self consumption, and do not enter the market economy. Consequently, wetland uses and functions are difficult to define and value in the Cambodian context.

Cambodian wetlands provide a rich resource base for the national and local economy. Wetlands support a range of different uses: water supply, irrigation, hydropower, fisheries, agriculture, wildlife hunting, wood energy, navigation, recreation, and human settlement. Wetlands are culturally and economically important to the large populations they support, especially to rural communities. Because of their diverse economic values, wetlands are not only a source of wealth but also create conflict among resource users and managers at local, national and regional levels. Competition for resource use is on the rise as the population increases; balancing uses is hindered by poor knowledge, lack of both coherent policy and integrated approaches, and low public participation in the process.

Due to its multiple-use nature, the management of wetlands is usually of great concern to a large number of stakeholders, including public institutions, policy-makers, local communities, producers, NGOs and advocacy groups. The interdependent roles of these groups form the complex institutional and legal framework presently governing the conservation and management of wetland resources. Understanding the strengths and weaknesses of this institutional and legal framework is crucial for all stakeholders wanting to protect and use wetland resources in a coordinated manner.

This report was written to meet, at least partially, the need for a more enlightened approach to the governance of wetlands in Cambodia. It hopes to contribute to a holistic framework for wetlands management by providing a clear understanding of the legal and institutional systems involved, as well as an appraisal of the economic value of wetlands and their resources. It is also hoped that the knowledge generated from this report will be shared among other countries in the region in order to prepare a common approach to improved regional wetland management.

This report consists of six sections. Section two, which follows this introduction, describes the research approach and methods used. Section three provides an overview of wetlands in Cambodia. Section four consists of a review and analysis of institutional and legal issues concerning wetlands within the Mekong Basin; it is based on the inputs of national and provincial officials from various departments and organizations. Section five decribes the various functions and uses of wetlands in Cambodia, and presents a preliminary attempt at assessing the economic value of these functions and uses. Finally, Section six presents general conclusions and a set of policy recommendations based on the findings.

Approach and methods used

Study background

This report presents the findings of the Cambodian component of the WorldFish Center project "Legal and Institutional Framework and Economic Valuation of Resources and the Environment in the Mekong River Region – A Wetlands Approach" (hereafter referred to as the Mekong Wetlands Approach), which was carried out from July 2002 to August 2003. The project in Cambodia was coordinated by the Department of Fisheries, with Mr Srun Lim Song as the National Project Coordinator and Mr Kim Sour as the Liaison Officer.

Objective

The objective of the study was to enhance the quality of life of the Cambodian people by supporting environmentally sound development, and sustaining and improving the values and functions of wetlands in Cambodia. The immediate objectives are to improve the national legal and institutional framework and to increase the local capacity to manage wetlands and their resources and the environment in Cambodia.

Study team

A national working group and three provincial working groups were set up to carry out the study (see Figure 1). The national working group was further divided into two groups: the legal and institutional framework working group and the economic valuation working group, which consisted of five and six people, respectively. Provincial working groups were established in the three provinces that were selected as study sites, namely Siem Reap, Takeo, and Stung Treng. These provincial working groups consisted of nine to ten members drawn from various government agencies responsible for areas such as agriculture, fisheries, tourism, public works and transport, environment, planning, and women's affairs.

Study sites

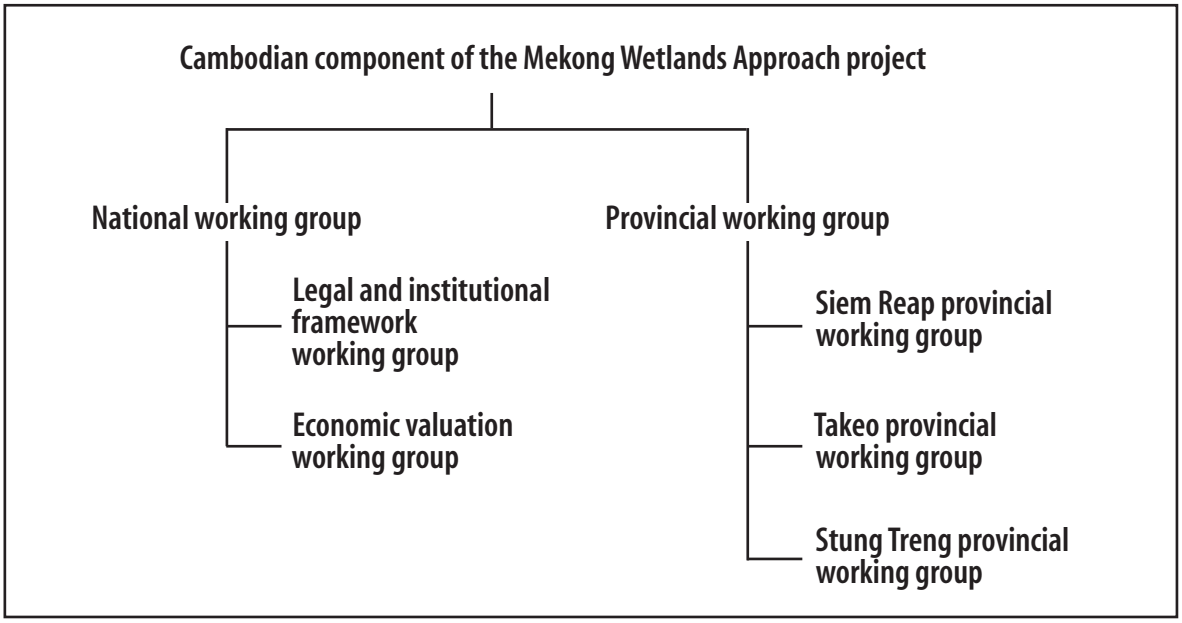
Three study sites were selected to represent the diversity of wetland types in Cambodia, each having unique geographical and hydrological characteristics. The three sites are the upper Mekong River near the Cambodia-Lao border in Stung Treng, the Takeo floodplain which is susceptible to seawater intrusion, and the Tonle Sap floodplain in Siem Reap. Situated in three different provinces, these three sites are also highly representative of the three freshwater wetland regions of the country mentioned above, namely, the Mekong River (Stung Treng), the Bassac Marsh (Takeo), and the Tonle Sap Lake (Siem Reap).

Research approach

The study involved the collection and compilation of extant data relevant to the legal and institutional framework governing wetlands management, as well as to the economic valuation of wetlands. The data from the various working groups were then summarized, before being jointly analyzed by the provincial working groups with the assistance of the leaders of the two national working groups. This report presents a synthesis of these findings.

The many national and provincial workshops convened under the project provided plenty of opportunity to build the research capacity of the working group members. One notable example was the training all working group members received from a regional expert in conducting participatory rural appraisals (PRA) and rapid rural appraisals (RRA), which they then carried out in their respective study sites.

Figure 1. The working groups involved in the study



Constraints

General constraints faced while implementing the project included:

1. The poor quality of existing data within the country. Most of the data collected are based on estimation, although they are from official sources. The limitations of the data used for the economic valuation component are described in further detail in the next section.

2. The limited knowledge and skill of the provincial working groups. The members' limited proficiency in English made it especially difficult for them to analyze documents written in English and to understand wetlands-related concepts, which were mostly written in English.

3. Difficulty in explaining the purposes of the study to people. Many respondents found it hard to value or appreciate many wetland resources, given the fact that many of these are very small and taken for granted (e.g., aquatic plants and insects). In addition, the complexity of government legislation and regulations made them difficult to analyze.

Limitations of the data used for the economic valuation of wetlands

General limitations

Data collection on any aspect relevant to wetlands has been interrupted by prolonged social upheavals in the country. However, comprehensive data collection on a number of production sectors resumed in the early 1980s, and the results were published in the form of government statistics and reports. Most of the data in various national reports at that time are based on guesstimation and input from local informants at various levels. At all levels, data were rounded up, added on, processed or adjusted as deemed appropriate. Finally, the aggregated data were processed and consolidated at the national level.

As accessibility to some geographic areas was restricted for security reasons, the data could not cover all areas within the country. Although some data are very comprehensive, some are considered to be unrealistic. Data and information are generally not updated; moreover, records have been poorly stored and maintained. The absence of clearly defined responsibilities, the transfer of staff, and the lack of standardized and reliable methods are some of the main reasons for poor data recording and maintenance at the provincial level. Limited knowledge, inadequate facilities, and lack of funding are other factors.

Data on resource production are generally considered to be underestimates because individuals in data generation agencies have informal economic interests. On the other hand, overestimation is seen in areas where there is no associated personal interest but there is the incentive to impress parental agencies. Poor information flows between resource and data/information users often result in the data from various sources not being consolidated.

Significant improvement in data collection, analysis and storage has occurred since the early 1990s. More technical and scientific reports appeared, and the quality of reports and data improved. For the fishery sector, in particular, the number of research studies focusing on small-scale fish production, aquaculture and the protection of the resources increased from the early 1990s. However, there was still a lack of coordination and sharing of data among sectoral agencies. As a result, data were poorly consolidated and were frequently reported with many inconsistencies.

Currently, there are no comprehensive data readily available, or in a format suitable for conducting economic valuation. Data and information have been collected mainly for sectoral use, and many are available only as estimates, provided in order to indicate the need for better management. Reports from recent research appear more reliable, and the data are better coordinated and consolidated. However, due to lack of systematic study and limited coverage, the available data are generally fragmented and available only in relation to certain resources, geographical locations and times of the year. In all cases, there has been no peer review of technical and scientific publications, and in many cases data and information have been quoted from one to another publication without their reliability or the method by which they were collected and processed being checked.

Availability and quality of data by sector

At the country and/or regional scale, there are data on resources, production and the contribution

to gross domestic product (GDP) according to sector. These data cover agriculture (cash crops, rice, livestock, fishing and forestry), industry (mining, quarrying, manufacturing, electricity, water and construction), and services (transport, communication, hotel, and restaurant). There are also data for a number of sectors on the cost of damage from natural hazards, such as floods and drought, including human lives, agriculture (rice, animals, crops) and infrastructure (houses and public buildings, roads, bridges, trails, tracks, pipes and irrigation systems).

Agriculture

Data on much agricultural production are well documented and comprehensive. Most of the data are official but, despite this, are considered to be unrealistic. The data are available for ten to twenty year periods, with a few small interruptions for certain commodities. The most comprehensive reports relate to rice and a number of cash crops, including corn, beans, nuts, sesame, tobacco, sugar cane, cassava, sweet potatoes, caster oil and jute. In general, data for these crops provide figures for both cultivated/harvested areas and total production. Particular details are available for rice production, for which there is some segregation between dry and wet seasons. The figures on production, by province in particular, are presented similarly; however, they relate only to certain cash crops, mostly to rice.

Fisheries and aquaculture

Data covering twenty years of commercial fish catch, from both inland and marine areas, are available. However, the official fishery statistics lack information on small-scale fishing, which constitutes a substantial share of the total catch. Similarly, data on marine catch do not differentiate between inshore and offshore catch. Moreover, these data are considered by many to be unreliable as they under-report the situation.

Recent and more accurate data on the fish catch are available for certain fishing activities at a number of freshwater fishing grounds, such as Dai fishing along Tonle Sap River, and from a number of other studies of selected fishing lots in the Tonle Sap Lake. There are also reports on fish production under various systems of culture, including pond, cage, pens and rice fields. However, these reports do not cover the latest farming operations by small-scale farmers, especially the pond systems, which are assisted by various NGOs. Data on processed fish and processing methods are available for the medium and large-scale operations. Some data on rice field fisheries are available for a few eastern provinces but they are too few to represent the number of provinces in the country where rice field fisheries exist. Some figures of the total catch for inland fishing grounds and for the country as a whole are available from estimates that, because they incorporate estimated catch from small-scale fishing and many other factors, are believed to be more accurate.

There are substantial reports on the management side of the fisheries sector. They address the status of the fisheries and their management within the country as a whole, as well as issues specific to certain fishing grounds. There are also reports that relate to the significance of fish and fish products in the national economy, and to the livelihood and diet of the people, property rights in fishing, and government policy for promotion of fishery development. Data and information are not available for fishery products such as turtles, snakes, shrimps, wood products, and water bugs. There are incomplete data on labor employed in all levels and types of fishing, including seasonal and migratory fishers.

Some environmental characteristics relevant to the production of fishery resources are available. They include the extent of certain fish habitats, and physical factors such as flood levels, flow patterns in the Mekong River, and the extent of flooded forest depletion and degradation. The data on wildlife are limited to certain areas, and to species of significant conservation value. Limited data and information are available for the aquatic flora in the Tonle Sap Lake and in the Stung Treng Ramsar site.

Transport

Almost all data and information on water and wetland-associated transport are available in the form of official government reports. Some useful and relevant data are on large-scale commercial port infrastructure, watercraft and the volume of cargo and associated services.

However, there is a general lack of data on small transport facilities, such as small mechanised and non-mechanised boats used by people for local transport, and watercraft used as housing.

Tourism and recreation

Data and information related to the tourism and recreational uses and services provided by wetlands are not well defined and/or are separated from the overall tourist statistical data. No data and information are available on the number of tourists, the location and carrying capacity of water-based tourism sites, annual visitors to individual recreational sites, annual income and revenue earned by individual recreational sites, the number of businesses at individual recreational sites, expenditure by visitors at each site, the number of and income accruing to tourism services, the level of investment in wetland-based tourist facilities, the number of visitors travelling by boats, and for provinces other than Siem Reap and Phnom Penh.

Pollution

Data on the amounts of waste generated by industry, and the amount of treated sewage are available from selected industrial establishments. The figures on revenue from fines for failure to comply with environment regulations are also available. These data are, however, questionable. Estimated data on urban sewage wastewater are available for certain provincial capitals (e.g., Siem Reap, Battambang, Kampong Chham and coastal provinces).

Data relevant to the livelihoods of the poor

In general, the data relate primarily to large-scale and commercial production and/or use. The most applicable data relevant to the livelihoods of the poor are those on rice production. Data on this are collected at the local level and consolidated at the provincial level before they are processed and presented for use at the national level. The data that best reveal the livelihoods of the poor are those collected at the local level.

Wetlands in Cambodia: An overview

The concept of wetlands in Cambodia

The concept of wetlands became well known to many after the signing of the Convention on Wetlands in Ramsar, Iran in 1971. However, it remained relatively unfamiliar to Cambodian sectoral agencies and stakeholders until the early 1990s. At first, the lack of a local word for the concept greatly hindered communication. When the first two documents related to wetlands were translated from English to Khmer (Davies and Claridge 1993; Rees 1990), the term 'wetlands' was translated into 'floodplains' (*'tumneap lich toek'*). This perception of wetlands as floodplains is understandable, given that 90% of Cambodia lies within the Mekong basin and is subject to annual flooding from the Mekong (MoE 1999).

In a wetland workshop held in Phnom Penh in early 1994, there were complaints about the literal translation of the term 'wetlands' in English or 'zones humides' in French into *'dei saeum'* in Khmer, which means 'any wet soil'. Eventually, to broaden its meaning to include more than just a small area of wet soil, the term *'tamban dei saeum'* ('wet zone') was agreed upon.

Despite some disagreement with the use of this Khmer term for wetlands, 'tamban dei saeum' has been increasingly used in written materials. The term was formalized when a Kram[13] was issued by the Head of State in 1996, to endorse a proposal for the designation of three wetland sites as the country's first Ramsar sites.

Nevertheless, many lay people who live in rural areas, who tend to be poorly educated, and who are mostly direct users of wetlands, are not immediately familiar with the terminology. Although the term is becoming increasingly common, the location and extent of wetlands in the country – apart from the Tonle Sap Lake, the Mekong River, and the Bassac March – remain relatively unknown.

Characteristics of wetlands

While several attempts have been made to define and categorize wetlands in the country and in the region, there is, as yet, no national definition of wetlands in Cambodia. Thus, the Ramsar definition (see Box 1) is frequently used – although the full meaning of this definition is not always appreciated. The MRC-DANIDA (Mekong River Commission – Danish International Development Agency) Inventory and Management of Cambodian Wetlands Project, Phase I, has tried to define wetlands in the Cambodian context as areas meeting the following criteria (RGC 2000):

[13] A piece of legislation issued by the Head of State to promulgate a law adopted by the National Assembly and the Senate.

- presence of hydrophytic plants, i.e., plants that are able to tolerate inundation by water for a period greater than six weeks
- soils that are classified as hydric soils
- areas inundated by water for a period on an annual or semi-annual basis.

Box 1. Ramsar definition of wetlands (UNESCO 1994)

> "…areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters."

As Cambodia is relatively very flat, large areas of natural and modified landscapes, including many residential areas, fall within wetlands. Wetlands differ in size, shape, the species they contain, vegetation pattern, soils, geology, slope, water quality, period of water availability, flow, depth, drainage pattern, pH, fertility, and many other characteristics (Said et al. 1992). As the above criteria show, features that characterize wetlands include the presence of open water surfaces and the types of plant and animal communities that inhabit the areas. However, due to seasonal flooding, some of these distinguishing characteristics can only be observed during certain periods of the year. This is a feature commonly associated with Cambodian wetlands.

Wetland distribution and types in Cambodia

Major inland wetland sites in Cambodia can be categorized into three main wetland regions – the Mekong River (468 km in length) and its floodplain, Tonle Sap Lake (varying between 2 500 km^2 and 13 000 km^2) and its floodplain, and the Stung Sen (about 3000 km^2). Coastal wetlands include Koh Pao and Stung Kep, both situated in the southwest of the country.

The unique seasonal hydrological relationship between the Mekong River and Tonle Sap Lake plays a significant role in the ecological and socioeconomic output of the areas and the livelihood of the population. As Cambodia's landscape is relatively very flat, floodwaters cause drastic seasonal changes in wetland features. The inflow from the Mekong River and from many river systems in the Tonle Sap catchment, coupled with the reverse flow of the lake in the dry season, means that the whole area functions as two different systems at different times of the year.

The inundation in the wet season converts a substantial area of lowland in the middle of the country into an enormous open water system. In the dry season this is fragmented into many different small wetland systems. At low water levels, small, open water systems, which may be either interconnected or isolated, can be found in the flooded forest system of the Tonle Sap floodplain, which extends along both sides of the Mekong River and the Bassac Marsh. Large areas of marsh and swampland also emerge at the periphery of isolated lake systems.

The flooded forest is a common feature of the Tonle Sap floodplain; in general it is 20-30 km wide, but in Battambang, its width reaches up to 65 km. The area of flooded forest around the Tonle Sap floodplain has reportedly shrunk from 800 000 ha in the early 1970s to 300 000 ha in the late 1980s (Dennis and Woodsworth 1992). This represents 85% of the total flooded forest area in the country. (Narrow patches of flooded forest are also found in the floodplain of the Mekong River and the Bassac Marsh.)

The most prominent man-made wetlands in the country are rice-fields. These are constantly being expanded, and can be found mostly in the floodplains. Fields of cash crops, known as *Chamkar*, occur primarily as pockets within flooded forests, but are also extensive in areas northwest of the Tonle Sap floodplain, including Siem Reap and Kampong Thom. *Chamkar* fields are also found along the levees bordering the Mekong, Bassac and Tonle Sap rivers. Rice fields and *Chamkar* are located mostly on cleared wetlands. Other increasingly common man-made wetland features include aquaculture and water storage ponds. Table 1 summarizes the major wetland ecosystems found in Cambodia; it includes both man-made and natural wetlands in inland as well as coastal areas.

Natural wetland ecosystems in coastal areas include mangrove forests, coral reefs, seagrass beds and mud flats. Mangrove forests occur mostly in Koh Kong province. Salt pans and some limited rice fields form major man-made wetland types in the coastal areas, particularly in Kampot province and Kep municipality.

Table 1. Extent of wetland ecosystems in Cambodia

Habitat type	Area (ha)
1. Rice fields (1999)	2 158 000
2. Secondary flooded crop fields	529 900
3. Permanent waters	411 100
4. Flooded forests	370 700
5. Flooded secondary forest	259 800
6. Mangroves (1994)	85 100
7. Flooded grassland	84 900
8. Swamps	1 400

Sources: Mekong Secretariat (1994) ; RGC (2001).
Note: 1992/93 data except where indicated otherwise.

Wetlands and land use

According to the land use classification map of 1997, wetland habitats have undergone significant change due to rapid agricultural expansion and human settlement. Most of the urban wetlands have been drained and filled for housing and industrial development. In Phnom Penh, natural reservoirs and lakes have substantially declined in size due to landfill; this has resulted in frequent flooding in much of the city during heavy rain. In Takeo and Siem Reap, large areas of wetland forest are being cleared for flood recession rice[14] farming and other uses. During the project period (2002), it was observed that the forest on the Mekong banks in the Stung Treng Ramsar site was being cleared for upland crop farming and timber production. Several logging concessions have been granted in areas bordering the Stung Treng Ramsar site. This may threaten the ecosystem functions of riverine wetlands through accelerated soil erosion and sedimentation.

Population distribution in wetlands

Though Khmers make up the majority of the population, a number of ethnic minorities inhabit wetland areas. Populations belonging to various minority groups have been found living in the three locations selected for this exercise.

Stung Treng wetlands are home to a dozen ethnic minorities, among which Laotians form the largest group. Hunting, slash-and-burn agriculture, and fishing are the main economic activities of the Laotian people.

In the Tonle Sap Lake area, especially in Siem Reap, there are large Vietnamese communities. Some Muslim Khmers have also settled in Phnom Krom commune, where fishing is the main occupation. Most fishing communities in the Tonle Sap Lake traditionally live in floating villages.

There are also Vietnamese communities living around the Takeo wetlands. Trade, fishing and navigation are commonly practiced by this ethnic group, as Takeo is located on the Vietnamese border.

Threats to wetlands

Overfishing

Many wetlands are threatened by increased fishing effort, which is being undertaken to meet the growing population. Total fish production may be more or less stable but it appears that the size of fish being caught is decreasing, indicating that the stock of fish is not able to regenerate. The fact that smaller fish are now being retained in the catch, rather than returned to the water, further aggravates the situation. Another strong indicator of overfishing is the significant drop in the proportion of catches made up by particular species of fish. There is considerable debate as to the main cause of over-fishing; however, it seems likely that it results from the combination of a number of deleterious fishing activities, both within fishing lots as well as in public areas. The three selected wetland locations in this study have experienced similar overfishing trends.

Degradation of flooded forest

The largest threats to the flooded forests are the clearing of forests to make way for agricultural land, the collection of firewood, forest fires and the collection of wood for fish traps. This is probably why many flooded forest areas have been replaced by shrubland or grassland. The growing infestation of weeds, like water hyacinth and *Mimosa pigra*, may also be associated with the accelerated deforestation and the increased nutrient load associated with pollution and/or runoff.

Bird and egg collection

This tends to be widely practiced, as it provides an important source of income for the poorest villagers. The collection process involves clearing

[14] Recession rice transplantation takes place as the water recedes at the beginning of the dry season.

pathways through, and thus damaging, the flooded forest in order to reach nesting sites. Waterfowl meat and eggs have relatively higher economic value than domestic birds, thus providing an incentive to collect these species for the market.

Harvesting of snakes and turtles

There is a strong market demand in China for snake meat and, in Vietnam, for both turtles and snakes. In addition, due to the rising market price of fish, snakes are being caught in increasing numbers for domestic crocodile feed.

Habitat fragmentation

The increase in human settlement, agricultural expansion, and infrastructure development has resulted in the fragmentation of many important wetland habitats. The Tonle Sap Lake is a typical example of a natural habitat that is now surrounded by an agricultural belt and an increasingly busy national road. Natural corridors for animal migration, except waterbirds, between the wetlands and upland forest are being gradually cut off. As a result, many elephants, tigers, wild pigs, and wild buffalos have difficulty accessing the wetlands for food and water. The division of the wetland areas into fishing lots, all with intensive fishing and human disturbance, also leads to ecosystem fragmentation.

Degradation of forests adjacent to wetlands

Logging in the upland forests surrounding the wetlands also has negative effects on wetland biodiversity. Some animals, such as crocodiles, turtles and snakes, depend on forest habitats adjacent to wetlands for reproduction. Consequently, widespread logging around the Ramsar site in Stung Treng may diminish the biodiversity value recognized by the international community. Although logging is now increasingly being monitored and controlled, it is still a matter of real concern, as forest management plans are not effectively practiced.

Irrigated agriculture

Conversion of wetlands for agricultural purposes is common. Much of the wetland area in Takeo and Siem Reap is now used for growing recession rice; this activity is bound to have an impact on water quality and flooded vegetation. Floating rice is also cultivated in some areas, such as the Tonle Sap Lake. (The impact of this crop, however, is less severe as it is grown during the flooding season without much fertilizer or chemical input.) Irrigation structures may also have effects on river ecology if they are built across the rivers. Evidence of the environmental impact of the Yali Dam can be found in some wetlands in Stung Treng and Rattanak Kiri provinces. Intensive agriculture increases fertilizer input into the wetlands, affecting water quality and biodiversity.

Transport and communication

Wetlands contribute significantly to transport and communication between cities and rural areas. As the demand for such transport grows, the number of boats and vessels will increase, resulting in increased disturbance to the wetland biodiversity. Additional ports and harbors are likely to be constructed, with possible channel improvement in some parts of the river. These may have some impact on the ecology of downstream wetland areas. For example, if the rapids in Stung Treng and Kratie were removed, the ecological impact would probably be high, as the rapids support the reproduction of certain fish species and organisms, and purify the flowing waters.

Tourism

Wetlands have great potential for tourism development in Cambodia. Siem Reap, for example, has become an attractive site for both cultural and nature-based tourism. The presence of wildlife of international importance, combined with the unique cultural heritage of the surrounding area, has already established Tonle Sap Lake as a major destination for nature enthusiasts. Similarly, more and more foreign tourists are visiting Stung Treng to enjoy the presence of dolphins and the views of unique riverine forests. The tourism industry has the potential to bring much revenue to the country and to the local people. But tourism may have negative effects on environmental quality because of inadequate waste management and poor urban planning. Siem Reap is a growing tourism center with 400 000 tourists visiting annually. This number is expected to double in the very near future, which would lead to an increased burden on the city for better infrastructure, water supply, and waste management. In sensitive areas, like bird sanctuaries, large numbers of tourists may have significant ecological and social impacts.

Dam projects on the Mekong River system

Despite dams having significantly altered the hydrology of the Mekong River system, leading to the loss, or decrease in area, of a number of wetlands, the Government of Cambodia still plans to construct many more hydroelectric dams. Although, officially, there are still plans for dams on the Mekong itself, the Government lacks the funds required for such large-scale projects. Nevertheless, the construction of dams on Mekong tributaries by other countries will almost certainly go ahead; this is bound to have further impacts on the seasonal flooding cycle of critical wetlands.

The institutional and legal framework

Institutional framework

Institutional setting

The diversity of wetland resources and functions defines the complexity of institutional arrangements governing the development, planning and management of wetlands. All wetland resources are considered to be state property, and are managed according to the Supreme Law, the Cambodian Constitution. The structure of the state powers under the Cambodian Constitution consists of three key branches: the Senate and the National Assembly, the Council of Ministers, and the Courts. The Senate (61 members) and the National Assembly (123 members) have the power to adopt or initiate the laws and regulations administering all of the country's resources. The Council of Ministers consists of the Prime Minister, the Deputy Prime Minister, Senior Ministers and other Ministers and has the power to govern in accordance with the Constitution and laws passed by the National Assembly. Normally, any proposed laws are discussed amongst Ministers in order to firm up consensus before they are passed to the National Assembly. In addition, the Prime Minister is empowered to adopt sub-decrees and regulations proposed by line ministries. According to the Constitution, all the powers belong to the people, but their power is exercised through their representatives, elected every five years as members of the National Assembly. The Courts and Judges are given the power to decide legal disputes and ensure the compliance of all Cambodian citizens with the laws.

There is no single ministry specifically responsible for the management of wetlands. Wetlands involve several sectors – agriculture, forestry, fisheries, water management, environment, navigation, tourism and recreation, etc. Several ministries are responsible for sectors relevant to wetlands, as shown below. This framework is summarized in Table 2.

Ministry of Environment

Established in 1993, the Ministry of Environment (MoE) has a broad mandate to protect, conserve and develop the environment and natural resources in a sustainable manner. Key provisions designating the mandate of MoE are articulated within Environmental Law (December 1996), the Law on the Establishment of MoE (January 1996) and the Sub-decree on the Organization and Functioning of MoE (September 1997). The Ministry employs 600 staff at the central level and around 600 staff at the provincial level. Its key aims are to:

- promote environmental quality and public health through pollution control
- ensure the rational and sustainable conservation, development, management and use of natural resources
- conduct environmental impact assessments
- promote public participation in decision-making, management, and enforcement.

There are three departments relevant to wetland management within MoE.

- The **Department of Nature Conservation and Protection** is mainly responsible for the administration of protected areas and the conservation of biodiversity. Two offices relating to wetland management are the Office for Wetland, Watershed and Coastal Zones and the Office for Multiple Use Areas and Protected Landscapes. The Royal Decree on Protected Areas (1993) is the major legal instrument guiding the Department's task. The Department is also the focal point for a number of conventions, such as the Ramsar Convention and the Convention on Biological Diversity. The Department is in the process of preparing protected area laws relating to the administration of all protected area systems.

Table 2. Institutional arrangements and legal framework

Agency	Areas of concern	Related departments/agencies	Regulations and laws	Comments
Ministry of Agriculture, Forestry and Fishery	• Fishery and aquatic resources • Agriculture • Forestry • Wildlife • Community rights	• Department of Fisheries • Department of Agronomy • Forestry Department	• Fishery Law • Forestry Law • Sub-decree on standard and management of Agricultural Materials • Sub-decree on community fishery	Fishery Law still being revised; Community fishery sub-decree still being drafted.
Ministry of Environment	• Protected areas • Wetlands and coastal zone • Water pollution • Solid waste • Environmental Impact Assessment	• Department of Nature Conservation and Protection • Department of Pollution Control • Department of Environmental Impact Assessment	• Environmental Law • Royal Decree on Protected Areas • Sub-decree on Water Pollution • Sub-decree on Solid waste • Sub-decree on Environmental Impact Assessment	There are other policies, such as the National Economic Action Plan, National Wetland Action Plan, Biodiversity Action Plan, not yet endorsed. Protected Area Law is being developed.
Ministry of Water Resources	• Energy • Irrigation	• Department of Water Resources Management and Conservation • Department of Irrigation and Drainage • Community organizations	• Water Law • Community Irrigation rules	Water Law is not yet adopted. Sub-decree and prakas will be prepared.
Ministry of Land Management, Urbanization and Construction	• Land use • Land tenure and ownership	• Land Title Department • Land Use Planning Department	• Land Law	Not yet adopted
Ministry of Rural Development	• Rural water supply • Rural health care • Community development • Rural economy	• Department of Community Development	• Council of Agricultural Rural Development Mechanism	
Ministry of Public Works and Transport	• Navigation	• Department of Waterworks	• Sub-decree on private transport • Sub-decree on river navigation	
Ministry of Industry, Mines and Energy	• Hydro-electric dams	• Department of Hydro-electricity		Management relies on Water Law, Sub-decree on Environmental Impact Assessment, and Rules for Water Utilization of MRC.
Ministry of Tourism	• Tourism companies • Travel agencies • Tourism guides		• Draft Tourism and Entertainment Law	
Cambodia National Mekong Committee	• Coordination for sustainable water development • Monitoring • Information	• Secretariat for Tonle Sap Biosphere Reserve • Water Utilization Program Unit • Basin Development Plan Unit • The Environmental Program Unit	• MRC Agreement • Rules for water utilization	

- The **Department of Pollution Control** is responsible country-wide for the control of pollution, including air, water, and waste pollution. A number of sub-decrees under this department include the Sub-decree on Pollution Control (1999), the Sub-decree on Solid Waste Management (1999) and the Sub-decree on Air and Noise Disturbance Control (2000).

- The **Department for the Review of Environmental Impact Assessment** is responsible for the environmental impact assessment of all scheduled development projects as a means of ensuring long-term development occurs with minimal environmental and social impact.

Ministry of Agriculture, Forestry and Fishery

The Ministry of Agriculture, Forestry and Fisheries (MAFF) is the oldest institution; it has a broad mandate to develop and manage agricultural and natural resources. Its key areas of concerns are:

- agriculture, soil improvement and agronomy
- livestock production and health
- agro-industry
- forestry and wildlife
- fisheries.

Clearly, MAFF has a major stake in the development and protection of wetlands in Cambodia. The MAFF consists of 12 technical departments, of which the following three departments are the most relevant to wetland management.

Department of Fisheries

This department is responsible for the management and development of fishery resources. The Fishery Law prescribes a framework for the management, protection, conservation, use, exploitation and development of fisheries designed to ensure sustainability of fishery resources in the interest of society, the economy and the environment. In addition, it administers a number of sub-decrees governing the fishery domains. The Department of Fisheries is also responsible for the promotion of community fishery organizations in the inundated areas. The Department is a focal point for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). According to the revised draft Fishery Law, fishery resources include freshwater and marine organisms, which comprise living and non-living aquatic animals and plants which depend on the fishery domains, including mollusks, corals, amphibians, aquatic insects, aquatic reptiles, aquatic mammals, and waterbirds.

Fishery domains consist of freshwater and marine domains. Freshwater domains include rivers, tributaries, streams, creeks, reservoirs, inundated forests, canals, ponds, deep water holes, and lakes.

The Department consists of three divisions: Planning, Marine Fishery and Inland Fishery.

Department of Forestry

The Forestry Department is responsible for the sustainable management and development of forest, non-forest resources and wildlife. Forestry Law is the crucial regulatory instrument, providing a framework for management, harvesting, use, development and conservation of the forests in the Kingdom of Cambodia. Forest is divided into two categories: permanent forest reserve and private forest. Flooded forest and forest under protected areas are subject to management by separate laws. The new Forestry Law was adopted in 2003. The Department is also responsible for organizing community forestry within its designated geographical boundaries. Flooded forest and mangroves are, however, under the jurisdiction of the Department of Fisheries. Inland mangroves (*Melaleuca leucadendron*), on the other hand, are managed by the Department of Forestry.

Department of Agronomy

The Department of Agronomy has a mandate to manage, protect, and develop agriculture production and soils in a sustainable manner. Its main task is to develop policy, regulations, plans, and projects for agricultural production, for monitoring of crop production and technology, and for inventories and classification of soils.

Ministry of Land Management, Urbanization and Construction (MLUC)

The MLUC is responsible for management and allocation of land for sustainable development

throughout the country. The Land Law (2002) is the most important legal document for the administration and monitoring of land allocation for all uses. Land use planning is partly relevant to wetland zoning and management. Specific management plans for certain types of land are developed by line agencies, such as MAFF and MoE.

Ministry of Water Resources and Meteorology

The Ministry of Water Resources and Metorology is charged with managing water resources in an efficient and sustainable manner. The mandate and structure of the Ministry are prescribed by the Law on the Creation of Ministry of Water Resources and Meteorology (June 1999) and the Law on Water Resources Management. The Ministry's main functions are: (i) the formulation of water policies; (ii) study and research; (iii) technical investigation for multi-purpose dams, irrigation, drainage, water supplies and river works; and (iv) planning, design and rehabilitation of existing projects and their operation and maintenance. Its key areas of concern are the quantity and quality of water resources, water use by sectors, and hydro-electric power generation, but it does not have authority over related resources, such as fishery and wildlife. The Law on Water Resources Management is the major legal instrument authorizing the Ministry to carry out its task, although the Law has not yet been adopted. The Ministry of Water Resources comprises three divisions: General Inspection, the Directorate for Administrative Affairs, and the Directorate General for Technical Affairs. The Directorate General for Technical Affairs has several departments relevant to wetland management, including the Department of Water Resources Management and Conservation, and the Department of Irrigation and Drainage.

Ministry of Rural Development

The Ministry of Rural Development (MRD) has a mandate to promote rural development in Cambodia as articulated by the Sub-decree on Organization and Functioning of the Ministry of Rural Development. MRD's key areas of interest are rural water supply, rural health care, community development, and the rural economy. One of its departments, the Department for Community Development, is indirectly associated with wetland management through its work with communities in wetlands. The MRD carries out its task through an established Council for Agricultural Development (CARD) which comprises provincial, district, commune, and village development committees. The MRD has no specific regulations governing wetland natural resources.

Ministry of Public Works and Transport

The Ministry of Public Works and Transport is designated to manage and plan all infrastructure development in Cambodia. Navigation and port development are the main issues relevant to wetlands.

Ministry of Industry, Mines and Energy

This Ministry is responsible for the development of industry, mines and energy. Of particular concern is energy development, which may have an effect on wetland ecology, especially through the construction of dams. Under the directorate for energy, there is a Department of Hydro-Electricity which has authority to decide on hydroelectric dam development.

Ministry of Tourism

The Ministry of Tourism has the authority to promote cultural and natural tourism throughout the country, in collaboration with the private sector. Efforts have been made for the promotion of nature-based tourism in wetland areas, especially in and around the Tonle Sap Lake, Stung Treng and coastal islands.

Cambodia National Mekong Committee

The major task of the Cambodia National Mekong Committee (CNMC) is to establish communication between relevant ministries, and to coordinate at the national level the implementation of the 1995 Mekong River Agreement, particularly as it relates to development plans for the Mekong Basin and to rules for water use. The recent Sub-decree on the Secretariat for Tonle Sap Biosphere Reserve has expanded the coordination role of CNMC to include the sustainable management and conservation of the Tonle Sap Lake. CNMC has three core units with functions relevant to wetland issues – the Water Utilization Unit, the Environmental Program Unit and the Basin Development Plan Unit.

Provincial administration

Provincial administration is divided into districts, and districts are divided into communes. Communes are responsible for maintaining security and social order, resolving resource management disputes, and supporting development in the provinces and districts. At the commune level, commune councils are established with the goal of encouraging local participation in resource planning and development.

Institutional issues relating to management of wetlands

Coordination

As wetlands fall under the jurisdiction of several ministries and resource users, coordination is very important to ensure coherent wetland management and conservation across all levels. There is currently no coordination mechanism dealing specifically with wetland planning and management.

Normally, regulations and laws are developed by sector departments and adopted through the coordination of the Council of Ministers; regulations and laws can address part of the wetland problem on a sector basis. As wetlands function as an ecosystem, sectoral planning will not guarantee coherent policy action and may not address cross-sectoral problems associated with public participation, human resource development, socioeconomics and biodiversity research. One example of the impact of this failure is the widespread logging around the Stung Treng Ramsar site; left unchecked, this will result in diminished biodiversity, loss of ecotone habitats along the Mekong River and its tributaries, and a change in the hydrological regime. Some efforts have been made to develop a wetland action plan addressing the legal and institutional aspects, including overall coordination (see Box 2). However, the Draft Wetland Action Plan has yet to be adopted. Furthermore, there is no agreed wetland classification system guiding the inventory of wetlands by providing a knowledge base for the use of wetland resources according to their values and significance.

Box 2. The Draft Wetland Action Plan (1999)

> The Draft Wetland Action Plan (1999) consists of five sections: institutional and wetland legislation; an information base for conservation and management of Cambodia's wetlands; Cambodia's wetlands; management of Cambodia's wetlands; and, human resource development. The first section addresses the institutional coordination and wetland legislation, including international agreements such as the Convention on Biological Diversity and other relevant treaties. The last section has a focus on awareness-raising, human capacity-building and public participation. The Draft Wetland Action Plan is a comprehensive policy document dealing with most of the issues encountered.

Despite the fact that the Draft Wetland Action Plan has not yet been adopted, some form of coordination has been set up for particular areas – for example the Tonle Sap Biosphere Reserve – by way of an inter-ministerial body operating at the national level (See Box 3). Coordination is almost absent at the provincial and local levels, although there are some NGOs, for instance the Food and Agriculture Organization (FAO), working to promote cross-sectoral coordination in provinces where they are based. Evidently, coordination is needed for planning, development of laws and regulations, enforcement, human resources development, wetland inventory and research, and conflict resolution.

Wetlands may also be affected by transboundary impacts from neighboring countries. Bordered with Laos and Vietnam respectively, the Stung Treng and Takeo wetlands may be typical cases of potential transboundary conflicts caused by hydroelectric dam and irrigation development. This shows that regional coordination is critical to ensure wetland sustainability across the region. In this respect, the role of the MRC as a regional body is important to coordinate wetland management among countries.

Box 3. Coordination mechanism for the Tonle Sap Biosphere Reserve

A Sub-decree on the Establishment, Role and Functions of a Secretariat for Tonle Sap Biosphere Reserve was adopted in 2001. The Secretariat (TSBRS) is administered by a secretary from the Cambodia National Mekong Committee, and three deputy secretaries from the Ministry of Environment; the Ministry of Agriculture, Forestry and Fisheries; and the Ministry of Water Resources, respectively. The TSBRS consists of three divisions, namely, the Strategy and Policy Division; the Research, Monitoring and Database Management Division; and the Administration Division. The major role of this Secretariat is to facilitate coordination and to strengthen cooperation among national and international agencies, provincial authorities, and civil society in order to protect and sustainably manage the Tonle Sap Biosphere Reserve. It serves as an information clearing-house and facilitates exchange of information among various stakeholders and institutions. The Secretariat will facilitate development of an integrated strategy for sustainable development and conservation of the Tonle Sap Lake's natural resources. It is hoped that the Tonle Sap Environmental Management Project, funded by the Asia Development Bank, will strengthen the Secretariat in carrying out its task.

Decentralization

All government ministries have technical departments and offices established at all levels of administration – from the national, down to the provincial, district and commune level. Such a system allows for the transfer of administrative power from the central organ to the local administration. The efficiency of power delegation depends on many factors, one of which is the role and responsibility of the local departments in planning, program implementation, law enforcement, and decision-making. There is a common perception of ineffective and limited power-sharing between the central ministry and the local departments dealing with resource management, and with wetlands in particular. Some work, such as planning and program implementation, might be better handled by local departments than by the central organ. A top-down approach may be efficient for enforcing country policy, but it may cause delays, and it does not provide the flexibility needed to respond to emerging problems at the local level. For example, the establishment of forestry communities has been slow, as the final approval is made at the central level. Cases have been observed where monitoring and enforcement by local departments in protected areas, and in forestry and fishery concessions, is restricted by limited resources and poorly defined jurisdiction, roles, and responsibilities. Furthermore, local departments are not given sufficient power in relation to planning, enforcement, decision-making, and monitoring of the resources. To be sure, some power is delegated to the local people through the establishment of commune councils. The Social Economic Improvement Agency Program (SEILA) is one example of a successful decentralization program. Supported by the United Nations Development Program (UNDP), it provides support to local people for training and small-scale project planning and implemention.

Law enforcement

Wetland resources fall under the jurisdiction of several ministries, each having its own laws and regulations. Law enforcement is commonly found to be deficient and ineffective when it comes to wetlands; this is due to limited capacity and resources, the low income of enforcement officials, unclear power delegation from higher administration to the local authorities, lack of legal status for regulating certain resources, overlapping mandates, and poor coordination between agencies.

For instance, local officers do not have sufficient power to control and enforce compliance in forestry and fishery concessions. Enforcement of regulations in the Stung Treng Ramsar site and in the core areas of the Tonle Sap Biosphere Reserve falls under overlapping jurisdictions of departments belonging to MAFF and MoE. Movement of some forest and wildlife products between wetlands and terrestrial areas may not be easily controlled without coordination among several responsible departments. For example, certain species of snakes, monkeys, and turtles can be found in either forest or aquatic habitats, which are under the jurisdiction of different agencies. As it is often unclear which agency is responsible for enforcement, there is usually either duplication or absence of enforcement

efforts. Effective law enforcement also requires the cooperation of all stakeholders, and agreement on rules governing resource use and enforcement procedures (fines, arrests, confiscations, arbitration and legal action). In practice, it has been observed that private resource users, especially fishery and forestry concessionaires, often make rules for controlling the resources within their concession areas without consultation with communities, often leading to abuses of community rights and violence.

Public involvement

It is increasingly recognized that public involvement is crucial to the sustainable management of wetland resources. Public involvement is important for the success of government policy, awareness-raising, law enforcement, resource management, and project planning and implementation. In Cambodia, public involvement is promoted mainly by sector agencies – through the education system, the establishment of community-based management, public meetings and awareness campaigns. However, progress has been slow as there are still no clear regulations on community participation and the rights of local people to voice their concerns. In addition, the responsible agencies are reluctant to transfer resource management responsibilities to communities because of the low level of organizational skills and the limited capacity of communities to control and enforce resource access rules. Should the Draft Wetland Action Plan be adopted, a coordinated framework for public involvement may be implemented.

Conflicts

As wetlands are of interest to diverse groups, conflicts between resources users are to be expected. Conflicts can be grouped into three categories: conflicts among resource users, between managing agencies, and between countries (transboundary conflicts).

Conflicts among resource users are caused by the inability to harmonize resource use patterns and, thus, benefit-sharing among two or more resource users. In wetland areas, fishery conflicts are commonly found between small-scale fishermen and large-scale fishermen, because fishery resources are not equitably shared (see Box 4). In 2000, to ease the problem, the government abolished over 50% of fishing lots and transformed them into common property resources under community-based management.

Unclear resource use patterns may also cause conflicts – for instance, agricultural expansion may result in diminished flooded forest area and change the ecology of wetlands, thus leading to negative effects on other resource users such as fishermen, wildlife hunters, and firewood collectors.

Box 4. A case of wetland resource conflict in Kampong Krasang, Borei Chulsar district, Takeo province

A project of the EU-supported Support Programme for the Agricultural Sector in Cambodia (PRASAC) was implemented in 1995 with the aim of promoting agricultural rehabilitation in four districts of Takeo province. The project supported digging 167 km of large canals to allow the irrigation of dry season rice. Canal No. 90 was dug in 1996, within Fishing Lot No. 1. After completion of the canal, PRASAC set up water user communities called 'kric' to coordinate water use and management. After the establishment of the Farmer Water Use Community (FWUC), a conflict arose between the lot owner and FWUC. The reason was that fish in the lot gathered in the canal, which was managed by the FWUC. Legal action was taken, with the matter being brought to the provincial governor for resolution. With the united support of FWUC, the conflict was resolved by the decision of the governor to declare the fishery resource to be under the jurisdiction of FWUC. Following the fishing lot reforms in 2000, Lot No. 1 was abolished and returned to the local community for the establishment of community fisheries. However, another conflict emerged when competition arose between farmer-fishers and FWUC for the resources in Canal No. 90. The conflict was again resolved through the Provincial Mixed Committee, when all farmers were given equal rights to fish in the canal on a small-scale basis.

At the national level, conflicts are seen among several ministries, notably the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Environment, the Ministry of Water Resources and Meteorology, the Ministry of Public Works

and Transport, and the Ministry of Tourism. Overlapping mandates and poor coordination are the major causes of conflicts among agencies, and these in turn are brought about by the lack of a coherent policy and common strategy on wetlands.

Cambodian wetlands can also be affected by developments in neighboring countries. Development projects for the purposes of hydropower generation, irrigation, and flood control may have adverse effects on wetlands far beyond national boundaries. For example, the Stung Treng and Takeo wetlands in Cambodia may be vulnerable to modification because of developments in Laos or Vietnam. Regional bodies like MRC can play a vital role in reducing conflicts, although more work needs to be done before an effective conflict resolution mechanism can be put in place.

Legal Framework

Law 1296/NS-RKM/24DEC96 was adopted on December 24 1996; it concerned Cambodia's accession to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention). While this law prescribes Cambodia's obligations in the implementation of the Ramsar Convention, it does not provide specific tools regulating the use and protection of wetland resources. Through the Ramsar Convention, three sites – Koh Kapik, Boeng Tonle Chhmar, and Stung Treng – were included in the list of wetlands of international significance. Although some initiatives have been taken to develop a Draft Wetland Action Plan, it has not yet been adopted by the Council of Ministers. Moreover, as yet, there is no agreed wetland classification system to guide the drafting of management and conservation plans. As stated above, the major laws and regulations concerning wetlands that do exist are vested with line agencies.

Fisheries

The Fishery Law promulgated in 1987 gives the Department of Fisheries a broad mandate to manage fishery resources. Although the 1987 Fishery Law is considered obsolete in the present socioeconomic and environmental context, it remains the most important law governing wetland resources. In a bid to fill the gap in the present fishery regulations, a new fishery law, dubbed the "Fisheries Conservation, Management, and Development Law", is being prepared by the Department of Fisheries, with the assistance of the World Bank.

Fishing categories

Article 1 of the old Fishery Law defines fishery resources as all living animals and plants able to reproduce and live in the fishery domain. The fishery domain is divided into freshwater and marine fishery domains. The freshwater fishery domain includes rivers, tributaries, lakes, streams, canals, inundated forests, and any waterbody connected with the above. With this definition, during the wet season, the whole Tonle Sap Lake at the maximum water level of 10 m (absolute sea level) falls under the fishery domain, and this includes the grassland and rice fields susceptible to flooding.

The present fishery regulations prescribe three fishing categories – industrial fishing, middle-scale fishing, and small-scale family fishing – which are permitted in fishery domains of different categories. Article 3 divides the fishery domain into three groups: fishing lots, fishing sanctuaries, and inundated forests. In addition, Article 4 prescribes the protected fishing areas as any open waterbody (permanent open lake or stream) outside the above-mentioned fishing areas. In other words, fishing is permitted in fishing lots and in the public areas outside the fishing lots, but not in fishing sanctuaries. However, the Fishery Law fails to mention the existing traditional land uses and the rights of diverse stakeholders who rely on the wetland resources for subsistence livelihoods. As such, the relationship between all fishery domain categories and existing land use is unclear and confusing.

Fishing sanctuaries are subject to strict protection for the purpose of fish fauna reproduction. However, most of the fishing sanctuaries are believed to be located, without a clear scientific basis, in the wrong place, thus offering little contribution to the conservation of fishery resources.

Except for small-scale family fishing, all fishing lots and middle-scale fishing have restrictions on technique, gear, and period imposed upon them by proclamation of the Ministry of Agriculture, Forestry, and Fishery.

Fishing lot management

Fishing lots are granted through auction to fishing enterprises or private solidarity groups (e.g., cooperatives) for exclusive and transferable rights to fishing (Article 7). Fishing lots are still believed to be an efficient regulatory tool and the most important source of revenue for government institutions. Fishery experts believe them to be the cheapest way to manage fisheries. Fishing lots also help to impose some limits against overcrowding. If managed properly, the fishing lots will not only provide income for the Department of Fisheries and generate considerable revenue for the government at the macro-level, but will also contribute significantly towards sustaining the fishery resources. At the micro-level, they should also create a lot of jobs for rural families. In reality, however, this system has not worked satisfactorily in terms of either revenue collection or fishery sustainability.

Government fishery statistics are not reliable and often underestimate catch levels (van Zalinge et al. 2000). As a result, revenue collection is incomplete. The so-called research lots never produce any reports concerning the fish catch, or fishery-related information. Before 2001, 200 fishing lots and 13 fishing sanctuaries were demarcated by the Department of Fisheries and fishing lot owners. However, the designation and demarcation of fishing lot boundaries is technically and legally deficient.

The old Fishery Law does not encourage public participation in the designation and demarcation of fishery zones. This was evidenced by the proclamation by the Ministry of Agriculture (Article 1, and Proclamation No. 0044 dated 24/5/89), which was brought into effect with little consultation and in a manner that ignored the role and rights of other government agencies and communities. In fact, due to the limited capacity and the lack of financial resources of the Department of Fisheries, these fishing lots and fishing sanctuaries were demarcated on the basis of maps adapted from the 1956 Fishery Law, and without solid and updated scientific information. Naturally, the locations of boundaries are poorly documented and are easily ignored at the ground level. The demarcation process is usually done in the interest of maximizing economic benefit, without proper consultation with local communities; as a result the deprivation of traditional rights is prevalent. This is why the fishing lot system is said to be the major source of prolonged conflicts in the fishery sector.

Article 18 of Sub-decree No. 26 (OR.NOR.KRO dated May 1989) prescribes the rights of fishing lot owners to undertake the provisional arrest of illegal poachers within their respective lot boundaries. Given the poor capacity and lack of resources of the Department of Fisheries, the delegation of enforcement power to the private sector, at least during the open fishing season, is understandable and justified. However, enforcement by the fishing lot owners, who normally have a very limited understanding of the legal and enforcement procedures, is likely to be inefficient and open to abuse. In such circumstances, fishery officials do not have the power to control the compliance of the lot owners. As a result, both the fishing lot owners and fishers from other fishing categories violate fishery regulations. Illegal fishing methods, such as pumping the lake, building dikes across the stream, and electric fishing are reportedly practiced by lot owners and ordinary fishermen.

The recent abolishment of several fishing lots for community-based management is regarded as a good step toward improving the fishery management. The new fishery law should provide sufficient power for local communities to control resources and participate in decision-making and law enforcement.

Open-access fishery

This open-access fishery domain is made up of the open lakes and rivers, the flooded forest, the areas set aside within the fishing lots, and the rice fields outside fishing concessions and sanctuaries. Middle-scale fishing usually occurs in the open waters, using seine nets, arrow-shaped traps, gill nets, and brush bundles; licensing fees are levied according to the type and size of the fishing gears.

Family fishing does not require any license and is allowed always and everywhere in the public area, and also in the fishing lots during the closed season (Article 11). Access to areas inside the fishing lots is set aside by a document known as the 'standard burden book' defined by the Ministry of Agriculture. Such recognition of fishery subsistence is regarded as a positive side of the fishery law, because it safeguards the right of the community to participate in resource management. However, in practice, public fishing areas are vaguely defined and only marginally support the growing needs of family-scale fishing. Family fishing employs mainly traditional gears adapted to the flooded forest and small streams,

which are largely taken up by the fishing lots. Most of the public fishing areas in the open lake are licensed to middle-scale fishermen, who use modern fishing gears, such as large seine nets and river trawl nets, which extend up to 2-3 km in length. Moreover, the public areas are often controlled by powerful men and authorities who reduce further the areas available for family fishing. Conflicts between family fishing and middle-scale fishing are on the increase. Family fishing rights in the productive fishing lots are denied and manipulated through the spatial and temporal limitation of fishing rights. In some lots, family fishing is not permitted throughout the year. Often, either the burden book is never exposed to public scrutiny or members of the public are not made aware of its existence. Therefore, to survive, subsistence fishing families have little choice but to resort to more illegal fishing, clearing of forests, and wildlife hunting.

Community fishery management

The fishery sector is currently undergoing major reforms. The recent move by the Prime Minister to allocate about 56% of the fishing areas to fishing communities is aimed at improving food security for rural people.

Fishing communities anticipate that some control over fishery resources, based on non-transferable communal ownership, will be delegated to the local communities. There is, however, still a lot of confusion regarding resource control, conflict resolution, resource sharing among community members, and between communities and non-community members, as the concept is still being developed on a trial and error basis. While the current draft of the Sub-decree on Community Fishery Development has yet to be adopted, there is already much debate on whether or not middle-scale fishing should be exempted from tax. Past experiences have shown that community-based management cannot succeed without continuous support in terms of legal status, capacity-building, community resource planning and control, resource-sharing and conflict resolution. In Cambodia, such support has been introduced mainly by international organizations such as FAO, the International Development Research Centre (IDRC), the Deutsche Gesellschaft Fur Technische Zusammenarbeit (known as GTZ), as well as NGOs such as Concern, the Cultural and Environmental Protection Association (CEPA), etc. (see Boxes 5 and 6). However, it is not certain whether or not the communities can continue to employ community-based management on their own after the withdrawal of the outside support. While there are reportedly over 200 community fishery organizations established across Cambodian wetlands, only a few are officially recognized by the Department of Fisheries. Furthermore, even these community fishery organizations have neither resource management plans nor a clear legal status, which is the cause of much uncertainty in many communities. If this situation persists, it will breed mistrust among community members. Clearly, experience in community-based resource management is still lacking and, where it has been established, it is still very much a learning process.

Land use

A new Land Law was adopted in August 2001; the law provides a new framework for resource allocation and land tenure throughout the country. The Law consists of 19 chapters with 268 articles. Several articles relevant to wetland management are described below.

Article 3 of the Law gives a broad mandate to the Ministry of Land Management, Urban Planning and Construction to administer state land and real estate and to issue land titles throughout the country. Under Article 7, land ownership prior to 1979 is not recognized. Only Khmer citizens have the right to own land in the Kingdom of Cambodia (Article 8). Article 16 prescribes that all natural resources and land belong to the state and cannot be sold or transferred. Articles 23 and 25 recognize the rights of indigenous ethnic minorities to land, and the rule that no authority can have rights over the land of the indigenous minorities.

Land concessions granted to private groups for economic development activities, such as mining, ports, airports, industrial zones, agriculture, fisheries concessions, etc., are not administered and regulated by this law (Article 50). Nevertheless, all land concessions have to be registered at the Ministry of Land Management, Urban Planning and Construction (Article 53), meaning that the Ministry's endorsement is needed. Land concessions can be granted only in State-owned land if there are no adverse impacts on infrastructure, waterways, ponds and natural reserves essential to people's livelihoods.

Uncertainty surrounding the current land management regime is caused by the absence of an appropriate land use policy or master plan. The Law on Country Planning, Urbanization, and Construction is not effective, as no single landuse

Box 5. Community fishery organization in Stung Treng

In 1997 the Fishery Office of Stung Treng, in collaboration with the NGO, Cultural and Environmental Protection Association (CEPA), established 16 fishery communities in Siem Bok; between 1998 and 2002 an additional 14 fishery communities were set up. CEPA also continued to support the organization of several fishery communities in Sesan, Thalaboriwatt, and Stung Treng districts.

Each fishery community is represented by a committee composed of a chief, a deputy chief and three members. All community fishery organizations are recognized by the provincial governor, but have no official recognition from the central Department of Fisheries.

There is a general observation that community fisheries bring some positive change to wetland management. There has been a decline of illegal activities in area where they exist. For example, the O Mreh community is gradually enforcing community regulations and preventing illegal activities, by working with commune police and fishery officials. At present, illegal fishing methods, such as poisoning, explosion and electrocuting, are gradually disappearing. Common reasons for the low success of other community fisheries include a lack of understanding about community fishery, fear of threats by poachers, no assistance to facilitators, no funding, no basic facilities and means for control, and poor living conditions.

Box 6. The Anlong Samnar community fishery organization in Chi Kreng, Siem Reap: A success story

As a result of government reform, over 50% of fishing grounds have been allocated to community organizations. Local people can exploit the grounds on a family scale and form community fishery organizations for the protection and conservation of fishery resources.

Located in Anlong Samnar, Chikreng district, the Anlong Samnar community fishery organization was set up with the support of the FAO. Training was first conducted for facilitators, who then assisted the process of community organization. A Community Committee was elected and headed by a chief and deputy chief, assisted by an accountant, a secretary, a patrol group and an awareness extension team.

In the first year of operation, management was not good, because the concept was new to everybody. But it has gradually improved as collaboration among local authorities and fishery and other technical officials involved in the areas improves. It was reported that, in 2003, this community fishery organization succeeded in preserving about 1000 tons of reproductive fish in Stung Chreou. This success was possible because community members strongly believe in the ability of their commune leader to stop illegal activities and enforce community regulations. Such examples of community-based resource conservation have succeeded in improving community livelihoods from year to year.

master plan has ever been developed for any province. This is why large areas of wetlands have been converted to agricultural land or drained and filled in for urban expansion. Such areas are often prone to damage by flooding, pests, and low productivity.

Environmental conservation and protection

Environmental conservation and protection is defined and promulgated in Cambodian legislation. Article 59 of the Constitution entrusts the state to protect the environment and natural resources, and to develop a precise plan to manage the environment, which will enable the Ministry of Environment to adopt laws, regulations, and policies for environmental protection at the national and international level. The Environmental Law, which was adopted in 1996, provides a very broad statement of general principles, on the basis of which specific provisions are subsequently developed to address issues concerning the environment and natural resources. The Environmental Law has very limited power to regulate and prevent environmental crimes. The most important

regulatory framework relating to natural resource conservation, and wetlands in particular, is contained in the Royal Decree on the Protection of Natural Areas (1993). The Royal Decree designates 23 protected areas covering about 18% of Cambodia. These are classified into four categories, namely national parks, wildlife sanctuaries, multiple use areas, and cultural landscapes.

The Tonle Sap multiple use area and Ream national park have been set aside for the conservation and wise use of wetland resources. In addition, some wetland areas have been designated through international conventions and treaties, such as the Ramsar Convention (Koh Kapi, Boeng Chhmar and Stung Sen) and the Biosphere Reserve Network (Tonle Sap Biosphere Reserve; see Box 7). But, as is the case for most

Box 7. Tonle Sap Biosphere Reserve as an approach for improved wetland conservation

In 1997, under the Tonle Sap Biosphere Reserve Program, the Ministry of Environment initiated a pilot project in Prek Toal, Koh Cheveang commune, Battambang province. The pilot project aims to promote environmental education and awareness at the grassroots level; to conduct regular ecological research and monitoring; to promote the conservation of flooded forests and wildlife of international significance; to identify alternative livelihoods and incentives for community participation; and to explore the potential for ecotourism. The first-ever environmental research station was built as a facility for carrying out daily activities in accordance with the above objectives. The station employs 25 villagers and is administered by two environmental staff under the overall supervision of the chief of the Technical Coordination Unit for the Tonle Sap, with the financial support of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the Wildlife Conservation Society (WCS). Currently, the research station has the following activities.

Conservation and monitoring of endangered waterbird species. The Prek Toal Core Area of Tonle Sap Biosphere Reserve is home to a large number of wildlife species, especially large waterbirds. Due to their high value and frequent disturbance by poachers, two observation posts were erected so that local staff can be on duty day and night to watch and observe the birds. Financial support was obtained from WCS. Thanks to these efforts, many nesting sites are intact and many chicks have successfully hatched. The number of bird species is counted and recorded by field staff.

Environmental Awareness. Several forms of environmental awareness-raising activities are promoted by the station, such as participatory meetings, workshops, video presentations, dissemination of brochures and posters etc., to target the elders, the adults and children. Brochures, posters, and awareness materials are disseminated to adults and communities across the communes. Both school-going and non-school-going children are invited to the station and join the field tours to learn about the fish, birds, wildlife, and flooded forest so that they can understand the importance of resources surrounding their commune. It is hoped that they will pass on this greater awareness to their parents.

Alternative livelihoods. Several programs have been initiated to identify alternative sources of income for communities that depend on wildlife hunting, waterbird collection, and timber cutting. A credit program, run in conjunction with the micro-intervention projects funded by the Belgium Development Cooperation, was established in Koh Chiveang commune. About one hundred families were given loans and grants for small-scale fishing, pig-, chicken- and duck-raising, aquaculture, and fish and vegetable trading. With small financial intervention, poor families have the incentive as well as compensation to stop illegal activities such as wildlife hunting and forest cutting. In this way the pressure on natural resources is reduced. Training in aquaculture and animal husbandry is also provided to the beneficiaries.

Ecotourism. The presence of waterbirds of international value offers high potential for ecotourism development, which provides income to local communities and government. With the collaboration of travel agencies and NGOs, the station has initiated ecotourism-enabling activities since 1999. Though at present ecotourism-generated income is relatively small compared with revenue from fishing tax, it promises to increase to a sizeable portion in the next 10 years, given proper administration and clear regulations.

international conventions, the actual management and legal arrangements implemented are based on the policy of the host government and several agencies. Although the three Ramsar sites are listed as wetlands of international importance, these sites are not managed under a management plan (Although a management plan was developed for the Boeng Chhmar Ramsar site, it was not implemented). In the absence of wetland regulations, existing laws, such as the Fishery Law, remain the only legal tool for wetland management. There is a need for better legal administration, especially in wetland conservation. Currently, the Ministry of Environment is reviewing a draft protected area law, which contains specific provisions to promote conservation and protection of protected areas and wetlands. As wetlands involve a complex and diverse network of resource users, institutional coordination is critical to ensure their cohesive and integrated management.

Economic valuation of wetlands

Wetland values and valuation

Wetland values can be both very obvious and very subtle. Direct use of resources, such as fishing, hunting, use of water for irrigation, etc., can be identified in both societal and economic terms (Said et al. 1992). Characteristics that do not necessarily provide a function or support a use can be referred to as intrinsic (or non-use) values. These intrinsic values include high biological diversity, landscape or aesthetic quality, high endemism, significant gene pools, presence of rare or endangered species, source of information or data for better understanding of the ecosystem, etc.

Not all people feel the same way about wetlands. Ideas about the values of wetlands differ between the poor and the rich, between direct and non-direct users, between local residents and outsiders, and among other stakeholders. There are cases where wetland residents do not (or only poorly) value wetlands, and cases where individuals living away from wetlands have a strong appreciation of certain types of wetland uses. For example, some of them may like to frequent wetlands for recreational purposes and, therefore, have high appreciation for such uses.

Regardless of the direct benefits received from wetlands, a poor understanding of how wetland systems work is probably why wetlands are typically undervalued. The open and/or unlimited access to the use of wetland resources and services may influence attitudes towards wetlands, and thus the way wetlands are valued. When access to the resource and services becomes limited, resources become scarce or resultant benefits decline or are lost, and people become more aware of their values and begin to appreciate past levels of access. Valuation or appreciation reflects attitudes and choices between uses. Box 8 lists the many benefits provided by wetlands.

Wetland functions and uses

The interactions between the components within wetland systems are called functions (Barbier et al. 1997). These functions include nutrient cycling and exchange of water between the surface and the ground water and the atmosphere; and, flood and storm water absorption, etc. The output of the functions is expressed in the form of goods and services provided by wetlands.

Uses could be defined as direct use of one or more of the characteristics of a wetland, and may include extraction of plants and animal products, water supply, and non-extractive aspects of uses such as water transport, recreation/tourism, research sites, monitoring sites, education sites, waste disposal, water treatment, energy production, etc. (Said et al. 1992). The results from uses are expressed either in the form of harvested products, various services, or data and information about, and understandings of, wetlands. Uses can vary from place to place, at different times of the year, and acording to groups of users. The common uses of wetlands in Cambodia include fishing, farming, water supply, flood regulation, recreation, water transport and settlement.

Major wetland uses by sector

Wetlands are chiefly used for agriculture, fishing and hunting, aquaculture, water supply, extraction of timber and non-timber forest products, tourism, water transport and habitation, and conservation. All of these sectoral uses are interrelated and have evolved from local traditional practices that were frequently small-scale and non-destructive, to the present large-scale and sophisticated type of uses that are possible due to improved technology.

Agriculture

There are 3.78 million ha of cultivated lands in Cambodia, roughly equivalent to 20% of the country. As rice is the staple food for the

Box 8. List of wetland benefits (after Howe et al. 1991)

1. Water supply
   a. Direct use by people
   b. To other locations
   c. To aquifer
   d. To another wetland
2. Flow regulation, primarily flood control
3. Prevention of saline water intrusion
   a. Groundwater
   b. Surface water
4. Protection from natural forces
   a. Shoreline protection and erosion control
   b. Windbreak
5. Sediment removal/storage
6. Nutrient removal/storage
7. Toxicant removal/storage
8. Source of natural products (on site)
9. Source of natural products (off site)
10. Energy production
11. Water transport
12. Gene bank
13. Significance for conservation
    a. Significant habitat for the life-cycle of important animals and plant species
    b. Presence of rare species, habitats, communities, ecosystems, landscapes, processes or wetland types.
14. Recreation/tourism
15. Social-Cultural significance
    a. Significant component of the landscape/aesthetic significance
    b. Religious and spiritual significance
    c. Support of distinctive human activities
    d. Wilderness
    e. Historically important sites
16. Research and education sites
    a. Sites for scientific research
    b. Locally distinctive features
    c. Education sites
17. Contribution to the maintenance of existing processes or natural systems
    a. Ecological and geological processes and systems
    b. Carbon sink
    c. Prevention of development of acid sulphate soils
18. Good representative of a particular class of wetlands

Cambodian people, rice farming is the major economic and livelihood activity. Most of the rice fields are located on denuded or cleared wetlands. The total area of rice fields in the country increased substantially from 1.735 million ha in 1988 to 1.929 million ha in 1997 (FAOSTAT 1998) and to 2.158 million ha in 1999 (RGC 2001). More than half of the rice fields are found in Battambang, Takeo, Kandal, Kampong Speu and Prey Veng. Rice is generally grown under rain-fed conditions, with only limited areas receiving some irrigation. This invariably leads to low average yields, as productivity is highly dependent on the irregular rainfall pattern. Generally, rice farming in wetlands is practised in four different forms: wet season rice, flood recession rice, dry season rice, and floating rice.

Wet season rice farming is normally conducted in higher lands that may be inundated during normal and big floods. The production from the land depends primarily on the seasonal flood cycle and the amount of rainfall. Wet season rice, sometimes called rain-fed lowland paddies, covers an area of about 1.747 million ha (MoE 1999), equivalent to about 90% of the total paddy area.

Flood recession rice is cultivated immediately after the flood recedes, while dry season rice is cultivated at various times during the dry season. The fields are fully irrigated, either with water stored in reservoirs or from the natural waterbodies. Deep areas of wetlands, normally on the margins of the flooded areas of the Tonle Sap, Bassac and the Mekong river systems, are prominent sites for flood recession rice. As this type of paddy is cultivated in fertile soil, with annual silt deposition from the seasonal flood, it is considered the most productive technique, and contributes an estimated 8.6% of Cambodia's rice crop. Rice farming in Cambodia generally yields a single crop per year. However, on recession and dry season rice fields, farming may be undertaken more than once a year at places where irrigation facilities are available. However, the potential for crop diversification is small, as less than 5% of the land is presently cultivated with other annual crops, and the prospects for expansion are limited by domestic market and production constraints. Table 3 shows the land area planted to major seasonal cash crops.

Floating rice is cultivated deeper in the flooded areas. Some 120 000 ha are planted, with such paddies representing about 6.6% of the total rice crop. This form of farming takes place

Table 3. Cultivated areas under major crops ('000ha)

Crops/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Rice (paddy)	1890	1910	1844	1857	1924	2086	2153	2076	2104	2158
Corn	47	52	50	43	52	52	49	49	45	60
Cassava	11	11	10	10	11	14	14	11	9	14
Sweet potato	8	9	10	8	11	10	11	9	9	9
Vegetables	30	35	32	30	35	42	46	36	23	31
Mung beans	28	30	28	21	27	26	28	28	25	27
Sugar cane	6	6	6	7	8	9	7	8	7	8
Soybeans	15	14	16	20	25	17	29	33	31	35
Peanuts	4	4	4	7	8	10	12	10	10	11
Sesame	10	16	14	11	11	9	12	16	15	16
Tobacco	16	17	18	9	15	14	14	15	14	8
Rubber	54	53	52	47	43	44	44	43	43	40
Jute	2	1	2	2	2	1	2	2	1	0
Total	2121	2158	2086	2072	2172	2334	2421	2336	2336	2417

Source: Ministry of Agriculture Forestry and Fisheries in the Second Five Year Socio-Economic Development Plan (SEDP II) (RGC 2001).

predominantly in the flooded forest areas in the Tonle Sap floodplain.

Income from agriculture is very low and even farmers with two hectares of land typically obtain a gross margin of only about US$250-500 per year[15] (RGC 2001). This represents only 30-60% of the income required to meet a family's basic needs. The per capita consumption of rice is estimated at 165 kg/yr (438 g/day) of milled rice (CIAP 1993); rice only contributes 75% of total calories consumed (FAO 1994a), with the remainder coming from corn, root crops, fruits and vegetables.

Cash crop farming is normally conducted along the silted stretch of levees on the Mekong riverbank, on islands, and in the floodplain of the Tonle Sap, particularly in Kampong Thom and Siem Reap. Many small areas of cleared flooded forest elsewhere in the Tonle Sap and Mekong floodplain are also used for cash crops and vegetable gardens.

Typical wetland cash crops include corn, beans, peanuts, sesame, tobacco, sugar cane, cassava, sweet potatoes, castor oil and, to a lesser extent, jute. The crops are planted in large fields called *Chamkar*, normally in mono-crop farming systems. Other less prominent crops, including pumpkins, gourds, cucumbers, watermelon and tomatoes, are cultivated either inbetween some of the above cash crops, or separately in smaller fields. Some of these types of crops need irrigation before they can mature, while others need irrigation only at planting and grow with natural soil moisture. Table 4 shows the production of various cash crops in the 1990s.

Relatively few chemicals are applied in wet season rice fields compared with those used in dry season rice and crop production, where chemical fertilisers and pesticides are used to enhance production. Shams and Ahmed (1996) observed that minimal use of chemicals in wet season rice crops in Pursat allowed for many fish, crab, snails, molluscs and frogs to reside in rice fields. Although no incidences of pollution arising from fertiliser and/or pesticide application have generally been reported, a few cases of fish poisoning have occurred that may be linked to the inappropriate use of agricultural chemicals. The Cambodia-Australia International Rice Research Institute Project surveyed 482 dry season rice farmers and found that 80% of interviewed farmers used pesticide and 39% observed dead fish following application (Gum 2001). Uncontrolled agricultural chemicals are reportedly available on sale in markets in Phnom Penh and in a number of provinces. There are no reports available on the amount of chemicals used by farmers or on chemical residue discharged into the natural system from the farmland; this is unfortunate given the substantial landuse changes that have occurred in the last few years.

[15] Gross margin is defined as gross income minus cost of cash inputs, assuming all labor is unpaid family labor (RGC 2001).

Table 4. Annual production of major crops ('000 tonnes)

Crops	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Rice (paddy)	2500	2400	2221	2383	2223	3448	3458	3415	3510	4041
Corn	88	60	60	45	45	55	65	42	49	95
Cassava	60	56	80	51	65	82	70	77	67	229
Sweet potatoes	31	39	60	48	36	39	38	29	30	33
Vegetables	170	249	210	221	197	193	250	177	128	182
Mung beans	12	13	14	11	17	20	14	15	9	16
Sugar cane	258	145	142	145	219	202	171	188	133	160
Soybeans	22	35	40	39	23	17	28	56	28	35
Peanuts	7	8	8	5	5	7	6	7	7	9
Sesame	5	8	6	5	4	4	5	3	5	7
Tobacco	8	9	9	5	12	11	10	10	10	6
Jute	2	1	2	2	2	1	2	2	1	0

Source: Ministry of Agriculture Forestry and Fisheries in SEDP II (RGC 2001).

Fishing and rice field fishery

The inland fishing industry is one of the main users of wetlands in Cambodia. This is largely a result of the extensive river and lake system, which is subject to annual flooding. Apart from the major fishing grounds of Tonle Sap and the Mekong mainstream, there are many large and small isolated lakes which also serve as fishing grounds in the dry season.

Compared with rice farming, fishing activities are engaged in by a more diverse group of people. They include the well-off groups who control the concession areas, the rich who subcontract fishing rights from the concession holders, the poor farmers who fish seasonally to supplement their rice harvest, and the poorer groups of people who sell labor to the rich in order to gain access to fishing grounds. The involvement in fishing is substantial. According to Ahmed et al. (1998), 92% of 5 117 households surveyed had access to subsistence fishing in common fishing grounds. Thuok and Sina (1997) estimated that 88% of the population in 170 villages in and around the Tonle Sap floodplain depend on fishing and fishing-related activities. In a commune in the inundated forest zone in Siem Reap, where little land is available, Thuok and Song (1999) estimated that 67% of the population rely on fishing.

The large-scale or commercial fishing industry operates in the fishing concessions, where the labor is hired and official figures show an average commercial production of 73 000 tonnes per year. However, the total inland capture fisheries yield is estimated to be at least 300 000-400 000 tonnes per year (Thuok and van Zalinge 2000). Industrial fishing in the concessions, and middle-scale fishing outside the fishing concessions, are subject to payment of either a fixed fee or one that varies with the gear type and size.

Although fishing is the second most important economic and livelihood activity next to rice farming, the return per unit of effort is higher from fishing. Small-scale family fishing is normally for own-consumption; earnings from the surplus are used to supplement income from agriculture. Annual per capita fish consumption is estimated at 43.5-75.6 kg (Ahmed et al. 1999). Some 20 000 people living along the Se San River in Ratanakiri reportedly rely heavily on fishing and the collection of bird eggs, reptiles, and riverine vegetables for food and medicine. Azimi et al. (2000) noted that 15% of the entire population of Cambodia depends on Tonle Sap fisheries for their livelihood.

Fishery products also contribute a significant share of the national revenue. Assuming an annual output of 300 000-400 000 tonnes, Degen et al. (2000) calculated the value of fish products to be between US$150 million and US$200 million per year. van Zalinge and Thuok (1999) estimated the total catch – including commercial and family scale fish production – to be over 500 000 tonnes per year. The family-scale or subsistence fishery is considered to be as important as commercial fishing in terms of production and distribution. It was estimated that 90% of people in Stung Treng fish for food and subsistence livelihood (EWG 2000).

Rice field fishery, on the other hand, provides a common way to supplement the household consumption of rural farmers. However, no records of this fishery exist – and it is also difficult to report systematically on the annual rice field fish production from different parts of the country. The data on rice field fisheries are difficult to obtain. Those that are available come from a number of projects and are only for selected regions. Nationwide figures are, at best, only rough estimates.

With a total rice field area of 1.8 m hectares, and an estimated yield of 50 kg/ha, the annual production of edible aquatic animals from rice fields could well be about 100 000 tonnes. This is higher than the official figure for commercial fish catch provided by the Department of Fisheries (Gregory and Guttman 1999). Assuming the lowest estimated fish yield from rice fields of 25 kg/ha/yr, total fish production from the rice fields in the country would be about 43 500 t/yr. This would be sufficient to meet the annual protein requirements for 1.35 million people (Gregory 1997). Gregory (1997) also notes that, despite the importance of fish and aquatic animals as food to rice-farming families, these sources of protein have rarely been studied by researchers, and are usually ignored in rural development projects. The level of production from rice field fishery may vary from place to place. In Kampong Thom, Shams and Hong (1998) observed that rice field fishery is highly dependent on rainfall and flooding and is also influenced by soil type and agricultural practices.

Fish is the major product for both commercial and small-scale family fishing. However, some other aquatic animals less frequently caught in large amount and mostly harvested by and for the poor, are molluscs, crab, bivalves, snake, turtles, shrimp, water beetles and various other insects. It was reported that one third of the catch from rice fields in Svay Rieng comprise species other than fish, such as crab, shrimp and frog (Gregory and Guttman 1999). The average annual rice field fish catch was around 681 kg/household/yr, 18% of which consisted of aquatic animals other than fish. The annual value of this rice field fish catch was approximately US$100 per household, which is equivalent to 42% of the total annual average value of rice production per family in Svay Rieng (Guttman 1999).

According to Gum (2001), aquatic resources commonly found inside rice fields and used by rural families include fish, crabs, snails, beetles, morning glory, lotus and water lily. Table 5 lists various estimates of the dietary contribution of rice field fisheries.

Table 5. Contribution of rice field fisheries to the diet

Level of fish consumption (kg/capita/year)	Spatial coverage	Source (cited in Savy 1999)
20-25	National	Lagler 1976
13.6-19.0	Southeast	Tana 1993
42	Southeast	Gregory et al. 1996
40	South	CIAP Unpub.
38	South	APHEDA 1997
76	Fishing communities	Ahmed et al. 1998

Source: (Savy 1999)

Aquaculture

Keeping and fattening fish to market size for sale, especially for sale in the closed fishing season, is one of Cambodia's long-standing traditions. But as resources from the wild have become scarce, and as affordable technology for aquaculture farming has become available, there has been a remarkable increase in aquaculture practices. Thuok and Sina (1997) noted that around 10% of fish production in the country came from aquaculture, and most of it from cage culture in the Tonle Sap Lake, a form of aquaculture highly dependent on the productivity of natural aquatic resource systems. Other cultivated aquatic animals include crocodiles, eels, frogs, freshwater shrimp, and water snakes. Aquaculture is practised in man-made enclosures, either cages or pens in the natural waterbodies, or in ponds. Only selected species of commercial value, which include both local and introduced species, are cultivated in cages; less valuable but fast-growing local varieties are raised in pond systems.

Local species of snake-head fish and a few varieties of catfish are predominantly raised in cages that are placed mainly in running waters. Feeding practices are intensive, the concentration of stock is high, and the variety of inputs – ranging from equipment to animal-based feed – is large. Some problems with water pollution and euthrophication have been reported by local people in various areas, although it has not been determined whether or not the cause of this is overfeeding from cage culture systems. Most cage fish farming systems in the Tonle Sap have proven to be profitable.

Pond farming is conducted in man-made impoundments, mostly in Kandal and in a number of provinces further away from the Tonle Sap. Many small-scale pond systems have been promoted in the past few years – particularly in Svay Rieng and Takeo provinces – through the joint efforts of the government and NGOs to ensure food security for the local poor. Intensive pond farming, using seed varieties of high commercial value, such as local catfish, African clarias, and carp, is undertaken by business people, while extensive or semi-intensive farming, using mostly native fast-growing species that require less feeding input, is promoted among the local poor. Pond culture has been carried out, mostly successfully, in areas where access to fishing in public waters is limited; commonly raised species include tilapia, carp and catfish. Fish ponds are normally located close to sources of water or in wetland areas. In contrast to shrimp pond farming in the mangroves of coastal areas, eutrophication or pollution from inland pond farming has not been reported. Table 6 shows the annual aquaculture production of fish and crocodiles in the four major inland regions in Cambodia.

Water supply

Most major urban areas in Cambodia are located either beside a river or beside a reservoir. Apart from irrigation and industrial uses, water is used for drinking, washing and bathing, and for recreation. Water is drawn from natural waterbodies, man-made reservoirs and ponds, and wells.

Most people living in floating villages in Tonle Sap Lake use lakewater directly, while those living along the Mekong and Bassac rivers use either groundwater or water from the river. Many households in southeast Cambodia store water in ponds or reservoirs for domestic use in the dry season. Table 7 shows the extent of irrigated rice fields around the Tonle Sap Lake. According to the Ministry of Water Resources and Meteorology (2002), Cambodia's aquifers contain 17.6 x 10^9 cubic meters of groundwater. The last few years has seen improved access to water due to expansion of irrigation systems.

Table 6. Inland aquaculture production of fish and crocodiles

Year	Tonle Sap Lake		Tonle Sap river		Upper Mekong		Mekong Delta
	Fish (tonnes)	Crocodile (head)	Fish (tonnes)	Crocodile (head)	Fish (tonnes)	Crocodile (head)	Fish (tonnes)
1984	181	-	1 129	-	124	-	148
1985	1 445	-	1 235	-	151	-	69
1986	758	-	1 229	-	160	-	53
1987	886	-	1 352	-	210	-	51
1988	1 905	-	2 130	-	340	-	125
1989	2 886	4 372	2 015	-	338	-	189
1990	3 697	5 459	1 906	188	439	-	265
1991	3 778	5 930	1 987	163	508	-	397
1992	4 783	3 607	3 006	50	1 033	-	208
1993	4 834	4 574	1 750	235	463	-	308
1994	4 699	5 884	2 286	235	325	75	280
1995	5 322	11 486	2 148	3 200	631	-	558
1996	5 307	19 267	1 455	933	589	-	534
1997	7 789	15 576	2 500	1 165	525	129	590
1998	7 620	39 541	3 585	1 100	570	109	675
1999	8 330	23 267	3 830	1 453	767	110	1 210
2000	7 266	23 384	4 431	2 261	105	110	1 153
2001	6 960	31 000	4 000	3 420	1 370	110	1 460
2002	6 375	42 468	4 950	6 902	1 080	10	1 880

Source: Statistics from the Department of Fisheries

Table 7. Irrigated lands in selected provinces around the Tonle Sap Lake

Province	Irrigated area (ha)
Banteaymeanchey	31 000
Battambang	46 000
Kampong Chhnang	16 000
Kampong Thom	37 000
Siem Reap	13 500

Source: MAFF 1993; FAO 1994a

Harvest of timber and non-timber forest products

Wetlands are a source of various kinds of plant-based products, ranging from wood to non-wood products. Although the flooded forest does not provide the quality timber found in terrestrial forests, its products can be used for local construction of sheds and small houses. Wood is used to construct support structures, such as stilts; non-timber forest products include bamboo, which is used to make rafts, and reeds, thatch and leaves, which are used for roofing. Plants from the flooded forest are used to produce fishing gears and fish aggregating devices. Water hyacinth is used for making hammocks, and also for forming beds for mushroom cultivation. However, there is a lack of quantitative data on the use of these and many other non-forest products, such as thatch, water spinach, lotus, waterlily, waterbeetles and waterbugs.

Rural Cambodians use wood from the flooded forest for heating and cooking, particularly for fish processing (smoking). Overall, 96% of rural households in Cambodia use fuelwood (NIS 1996 quoted by NEDECO and MIDAS 1998a). In villages at Boeung Chhmar, the percentage of fish-smoking households varies from 20% to almost 100%. In Balort, it was reported that, on average, households use between 30-40 m^3 of flooded forest wood for fish smoking each year (Mam and Sok 2001). The same authors noted that fuelwood is also bought for smoking fish in the Tonle Sap, at US$2.50-US$3.00/m^3. Gum (1997) reported that 70-80% of villagers in Peam Seima, Battambang province, cut fuelwood at the rate of about 0.7-1.0 m^3/person/day for sale. Each household was also reported to use 7-8 m^3 of fuelwood per year for cooking.

People from different regions in the country, as well as those from neighbouring countries, use wetland plants and animals for medicinal purposes. The level of such use depends primarily on the accessibility to modern medicine and traditional cultural practices. People in outlying areas of the country tend to rely more on plants or animal parts (from either wetlands or terrestrial ecosystems) for medical purposes. In Stung Treng, for example, there is reportedly a fairly widespread use of wetland plants for medical purposes (Kuy Sea, pers. comm.). In Takeo, most users of wetland plants for medicinal purposes are Vietnamese. On average, 100 to 150 boats cross the border daily to Takeo province, mostly to collect wetland products (Hang Try, pers. comm).

Tourism and recreation

The potential ecotourism sites include areas in the Tonle Sap Lake such as Prek Taol, Kampong Khlang, Boeng Chhmar, Stung Sen, and areas along the Mekong, such as the dolphin-watching sites at Kampi in Kratie province and at Anlong Chheuteal in Stung Treng province (see Box 9). Prek Taol is being developed into a wetland tourist destination where visitors may watch waterbirds, see crocodile-farming and witness the fishing practices of the local people.

Box 9. The potential for dolphin eco-tourism in Anlong Chheuteal, Stung Treng

> In Anlong Chheuteal, there is a lake about 21 meters deep (in the dry season) covering an area of 1 hectare. About 7-14 Irrawaddy dolphins frequent the area all year round. It is located within the Cambodian part of the Mekong River, just by the border with Laos. Many visitors, from Laos and other countries, access the area from across the border. Mostly between November and May, visitors cross the river by small boat and either stand on rocks or on board the boats waiting to see the dolphins. On average, about 10 visitors visit the area each day. It is not known if an entry fee is paid by the visitors for access from Laos. However, an informal fee (20 000 Riels (about US$5) per boat) is collected by border police in Cambodia. Due to poor access, researchers and government officials are the main visitors to the area.

There are many other recreational sites in the country that may or may not be attached to the cultural monuments for which Cambodia is famous. More and more, local people appear to

use water-based recreational sites during weekend picnics. Lakesides and waterfalls are among the most popular places for weekenders. The people benefiting from the wetlands recreational and ecotourist sites include boat and canoe operators, local guides, guards, and sellers of handicrafts, drinks and snacks. Profit is generated from traditional performances and shows, low-cost accommodation, entry and administration fees, and concession fees from private eco-lodges. NEDECO and MIDAS (1998b) estimated an initial investment of US$160 000 would be needed for tourism development in Prek Toal, particularly for boats and construction. Given the current tourism trend (in 1998) at Siem Reap, and the potential at Prek Toal, they estimated an annual gross income of US$1-2 million once the project is operating at full capacity, of which the total annual economic benefit to the local community could range from US$100 000–200 000.

There is much potential for nature-based tourism, particularly waterfalls. Many provinces in Cambodia have privately managed wetland-related recreational sites. Attractions of the wetland sites include rural exploration, wildlife viewing, fishing, floating villages, temples and archaeological sites, river-based tourism, bird-watching, and white-water rafting. The eastern coastal area, including Sihanoukville, Kampot, and Kep and their surrounding areas, has the potential for beach holiday resort development, island cruises, and nature-based tourism.

Water transport and habitation

The extensive river system in the country provides important transport routes and a substitute for the mostly damaged and/or poorly maintained road infrastructure. Water transport is particularly important in areas where access by road is either difficult or impossible. Water transport is virtually essential in north and northeastern Cambodia. The Mekong River and the Tonle Sap (both the river and the lake) are the two major transport routes in the country that provide access by water from the capital city of Phnom Penh to the outlying provincial towns of Stung Treng and Siem Reap. The annual flood in the wet season expands the navigable routes. According to the Ministry of Public Works and Transport, the total length of navigable waterways is 855 km and 1 544 km in the dry and wet seasons, respectively. Apart from these commercial transport routes, water channels are used by small boats and various forms of watercrafts to enable local people to commute between communities. Table 8 shows the number of registered vessels using the inland waterways of Cambodia.

For some, the water is also a place of settlement. Residences firmly established on high stilts or on floating craft are seen in large clusters on Tonle Sap Lake, and smaller settlements are also seen along the Mekong and the Bassac rivers. Settlements on water can either be permanent or seasonal. Some people live on boats for a certain time of the year, particularly during the fishing season. Living on water is not as common in the Mekong as it is in the Tonle Sap.

Conservation

By the Royal Decree of 1 November 1993 on the Creation and Designation of the National Protected Area System, the Tonle Sap and its floodplain (316 250 ha) was designated as a multiple use area, while the upper part of the Stung Sen (402 500 ha) was designated as the Kulen wildlife sanctuary. Three Ramsar sites were designated – one in the upper part of the Mekong, north of Stung Treng, one in the Tonle Sap, and one in the coastal area. Ang Trapeang Tmar is the most recent site to have been designated as an eastern crane sanctuary.

The flooded forest in the Tonle Sap and its floodplain system, has also been designated as a protected forest and Biosphere Reserve. The Biosphere Reserve system protects areas with high biodiversity value, thereby sustaining productivity, maintaining a viable population, and ensuring habitat protection within and adjacent to protected areas. More than 500 species of fish have been recorded in the Mekong river in Cambodia, while 215 species of fish (FAO 1994b), 225 species of birds, and about 40 species of reptiles have been documented from the Tonle Sap (NEDECO and MIDAS 1998a). Almost 200 species of vascular plants have been recorded in the preliminary survey of plants in the Tonle Sap (McDonald et al. 1997). Box 10 lists the endangered species found in Cambodia's wetlands that would be likely to benefit from conservation efforts.

Other wetland uses and functions

Livestock raising

Livestock farming is an important part of the production system supported by wetlands. Cattle, including ox and water buffalo, are grown for use

Table 8. Number of registered boats and vessels in inland waterways

Designated craft type	1993	1994	1995	1996	1997	1998	1999	2000
Dry cargo boats	2	18	33	26	26	4	7	7
Passenger, cargo, express and tourist boats	30	39	66	16	28	12	13	15
Tankers	-	3	9	1	4	1	-	3
Tug boats	15	6	23	7	19	5	15	2
Barge pontoons	20	12	13	7	11	18	5	2
Ferry boats	1	1	2	2	2	-	-	-
Service boats	3	2	5	-	2	9	4	-
Fishing boats	28 482	37 528	33 476	33 089	30 094	27 637	25 554	29 888
Foreign boats	83	37	11	33	15	14	1	-

Source: Ministry of Public Works and Transport, 2000; Department of Fisheries annual statistics.

Table 9. Annual production of livestock in Cambodia (million head)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Cattle	2.2	2.3	2.5	2.5	2.6	2.8	2.8	2.8	2.7	2.8
Buffalo	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7
Pigs	1.5	1.6	2.0	2.1	2.0	2.0	2.2	2.4	2.3	2.2
Poultry	8.2	8.8	9.9	10.7	10.0	10.1	11.4	12.1	13.1	13.4

Source: Ministry of Agriculture Forestry and Fisheries, 1990 to 2000.

as draft animals, and feed on grass and other vegetation that grows in wetlands. Ducks and geese are mainly fed in rice fields. Pigs and some other poultry feed on crops such as water spinach, grass and rice that are grown in wetlands as by-products from agriculture. Table 9 shows the annual livestock production in the 1990s. However, it does not express how much each type of livestock depends on wetlands rather than terrestrial resources.

Waste dilution and treatment

Another important use of wetlands is the dilution of pollutants and the transport of wastes from various sources. Wetlands provide surface and groundwater for direct use. Where wastewater is discharged without prior treatment, as is the case in Cambodia, wetlands play a significant role in diluting and removing contaminants. As Cambodia is located in the lower part of the Mekong, with most urban areas located in the floodplain, and as there are no wastewater treatment facilities, the sewage discharge principally goes either to rivers or to wetlands. For example, most of the sewage from Phnom Penh and the provincial town of Takeo goes to wetlands, while in Siem Reap and the provincial towns in Stung Treng, the sewage is discharged into the Siem Reap and Se Kong rivers respectively.

Box 10. Endangered species found in Cambodia's wetlands. (Source: MoE 1999)

Aquatic species:

Irrawaddy dolphin	*(Orcaella brevirostris)*
Chinese white dolphin	*(Sotalia chinensis)*
Siamese crocodile	*(Crocodylus siamensis)*
Giant catfish	*(Pangasianodon gigas)*
Isok barb (Trey Trasak)	*(Probarbus jullieni)*

Waterbirds:

White-winged duck	*(Cairina scutulata)*
Sarus crane	*(Grus antigone)*
Giant ibis	*(Pseudibis gigantea)*
White-shouldered ibis	*(Pseudibis davisonii)*
Greater adjutant stork	*(Leptoptilos dubius)*
Lesser adjutant stork	*(Leptoptilos javanicus)*
Milky stork	*(Mycteria cinerea)*
Spot-billed pelican	*(Pelecanus philippensis)*

Industries and urban outlets are major point sources of pollution and, as there is no prior treatment of such wastewater before it is discharged into the waterbodies, wetlands become the sole treatment medium of the liquid waste. For the floating villages, all liquid and solid wastes are discharged and/or dumped directly into the waterbody without prior screening or treatment. Chemical fertilisers and pesticides, which are being increasingly used, often end up in wetlands, where a certain quantity is trapped in plants, while the rest is flushed away by the annual floodwaters.

Flow and flood regulation

Many small local waterbodies also help to regulate the flow of excess water from particularly heavy rainstorms. In the wet season, the Tonle Sap Lake, in particular, absorbs a large volume of floodwater, both from the river network within its catchment and from the Mekong River itself. According to Carbonnel and Guiscafre (1962-63), cited in ORSTOM and BCEOM (1993), the annual inflow from the Tonle Sap catchment and from the Mekong amounts to 28.0 x 10^9 m^3 and 27.9 x 10^9 m^3, respectively. Approximately 75 x 10^9 m^3 of water is discharged annually from the Cambodian part of the Mekong catchment into rivers and other wetland types. Many small reservoirs and the river system throughout the country also serve to mitigate local floods caused by heavy rainfall in the wet season.

Storm barriers

People living around the Tonle Sap Lake and along the coastline appreciate the significance of the flooded forest and mangroves in protecting their settlements from storm surges and waves and in stabilizing the shoreline. Being highly exposed to powerful windstorms, especially in the wet season, these people move their floating houses very close to the flooded forest in the wet season to avoid damage from wind and waves.

Energy production

Although increasingly high hopes are being placed on the potential for energy production from wetlands in Cambodia, most of the sources of energy from wetlands currently being used comes from renewable resources in the form of fuelwood and charcoal. Only a few small-scale hydropower generation plants have ever been realised in the country. The total potential for energy development is about 10 000 MW, of which the capacity to generate only 13 MW has been developed. This capacity is provided by the plants at Ochum II (1 MW) and Kirirum (12 MW); the proposed plant at Kamchay is still under study (MOWRAM 2002).

However, the potential for serious, irreversible and pervasive impacts from hydropower is becoming a major concern. For example, local people along the Se San in Ratanakiri and in Stung Treng have experienced numerous negative environmental and social impacts resulting from the development and operation of the hydroelectric dam at Yali Falls in Vietnam (see, for example, Fisheries Office 2000).

Sociocultural aspects of wetland uses

The sociocultural ties of Cambodians to wetlands are reflected in their daily lives and some cultural festivals. Many people have formed strong ties with wetlands as a result of their dependence on water and aquatic resources for their livelihoods. These people have inherited such skills and customs as, how to survive on fishing, living aboard floating craft all year round, and farming on the edges of reservoirs. Some of the many cultural celebrations include the water festival, the spiritual offering at the onset of the fishing season, and the wrapping of the crop harvest.

Wetland uses and functions most important to the livelihoods of the poor

The poor include those who depend primarily on wetlands and wetland resources for their subsistence livelihoods. They are mostly farmers who also fish seasonally after harvesting their crop, and those who live permanently on the waters and depend primarily on fishing for their subsistence. Due largely to limited knowledge and financial capacity to invest in fishing, these groups normally have limited access to most of the wetland resources, and are only able to benefit from certain wetland functions. However, certain wetland functions, such as flood regulation, storm protection, water for fish farming, and water transport, benefit all the people living under the same environmental settings.

Some of the uses and functions most important to the poor are those that link directly to their local livelihoods; they include crop farming, fishing and fish farming, collection of non-timber forest products, domestic use of water and water usage for irrigation, local water transport, habitation, and diluting of pollutants.

Farmers benefit from the fertile wetland soil for rice farming and for home gardening. As their agricultural outputs are insufficient for their household consumption, they normally pursue other livelihood activities, such as fishing, fish farming, hunting for aquatic animals, and collection of non-timber forest products, such as firewood and vegetables, both for own-consumption and for sale.

Dry season crop farmers in particular benefit from the use of water and of soil moisture in wetland areas. These people normally have their farmland close to the waterbody, and use surface flow and pumped water to irrigate their crops. The role of wetlands and aquatic plants in diluting and absorbing pollutants is also important to the poor, who often use untreated water for drinking, washing and other domestic activities.

Although living on water can be more costly than living on land, people can generally settle on water for free, as no space purchase is required. Using their own boat and other water craft, people can generally move around without having to pay for specific plots for settlement. Although living on floating craft can be risky, particularly in the wet season when there are frequent rain storms, the flooded forest serves as an important barrier from these life-threatening hazards.

Table 10 shows the perceived values of selected wetland resources in three locations – namely Preah Rumkel, Chong Kneas and Angkor Borei in Stung Treng, Siem Reap and Takeo provinces, respectively.

Wetland values that are very important to local users yet are difficult to capture in economic terms and/or are not well appreciated

The most important wetland values for local users are those that relate to their livelihoods, income generation and welfare. The following sections describe some very important values that are difficult to capture in economic terms and/or are not well appreciated by the well-off or by those who do not live in wetland areas.

Products for subsistence livelihoods

Many people in rural Cambodia live on products they collect or produce themselves. The very poor often eat whatever they get for the day. People in rural areas are also accustomed to sharing food. Consequently, the market mechanism does not always operate, as money is often not used in the exchange of small and cheap items that can be easily obtained locally. Frequently, rural people share fish or vegetables for daily cooking, a practice that is not common in urban areas. Rural people normally purchase grocery items such as monosodium glutamate (MSG), sugar and salt, from retailers outside their communities, but they would not normally buy items that are available

Table 10. Values of selected wetland resources in Preah Runkel, Chong Kneas and Angkor Borei, as estimated by provincial working groups

Resources	Amount of products			Direct use value			Number of users		
	Preah Rumkel	Chong Kneas	Angkor Borei	Preah Rumkel	Chong Kneas	Angkor Borei	Preah Rumkel	Chong Kneas	Angkor Borei
Medium value fish	****	****	****	****	**	****	***	****	****
Low value fish	****	****	*****	****	*	****	****	****	****
Snails	****	**	***	***	*	***	***	***	**
Water snakes	**	**	*	**	**	****	**	*	**
Freshwater turtles	**	**	*	***	****	****	**	*	**
Bivalves	**	**	-	**	*	-	*	***	-
Shrimp	**	***	**	*	***	***	**	****	***
Crab	****	**	**	**	**	***	***	***	***
Frogs	****	**	-	**	***	-	**	***	-
Water beetles	-	**	-	-	*	-	-	***	-
Water birds	**	**	*	-	***	***	-	**	**
Waterlily	-	**	***	-	*	***	-	*	**
Water spinach	-	**	***	-	*	***	-	*	**
Water hyacinth	-	**	-	-	*	-	-	*	-
Inundated forest & vegetables	***	****	**	**	**	***	**	****	****
Bamboo	-	*	-	-	***	-	-	**	-

*Note: ***** = very high; **** = high; *** = moderate; ** = low; * = very low; - = not applicable.*

locally. The grocery items that are bought may be different in some characteristics but are not necessarily more expensive or better in terms of caloric value or quality than the local food items that are shared in the community. Since the amount required for daily consumption is small and easily obtained, sharing does not seem to be a problem for these rural communities. Sometimes, the grocery items are obtained in exchange for certain food items obtained locally, frequently at the expense of a larger amount of locally obtainable products.

Therefore, the main factors influencing whether the economic value of wetland products can be captured or appreciated are the type and amount of goods that can be easily obtained locally. Because many of these products do not normally enter the market, their price is often not known; they are therefore not regarded by locals in monetary terms.

Local water transport

It is not known how many small- and medium-sized boats are used locally, or how many kilometers each of them travels every day. As living on water has become such an integral part of the lives of the rural poor, and since almost every time they go outside their homes they have to board a watercraft, people do not pay much attention to their daily use of boats.

Because most of the craft are for multiple use, it is futile to keep track of how much time the boat is used for certain activities. People are more interested in using their boat to catch more fish or to get their rice seedlings to the field for transplanting, than in recording how much time it is used for various purposes. On the other hand, passenger or tourist boat operators know exactly how far and where they have traveled for the day, as well as how much they have earned from and spent on their boats. However, records of such trips are rarely kept.

Settlement

Wetlands are also used for habitation. While many wetlands are defined as state property, in reality they are open access, as there is no price or market for them. Settlement in these open access wetlands is practically free. Fish traders and grocery sellers are often willing to pay for a strategic location in which to station their floating house in order to gain access to trade. However, people are generally not willing to pay for access to the same area. Thus, unless people perceive a direct benefit from settling in a particular wetland location, or unless access to that location is difficult (i.e., they have to pay for the right of access), most people do not appreciate this 'habitat value', making it difficult to capture and quantify.

Use for home gardening and small-scale livestock farming

Many rural people keep a home garden for own-consumption and subsistence. Since the local market does not work well and labor input is not known, it is difficult to capture the real value of this use in monetary terms. However, home gardening is very common for rural people, and contributes significantly to local consumption.

Estimating the economic value of wetlands for small-scale livestock farming can be very difficult when, for example, there is no way of knowing how much the livestock depend on the wetland and how much they depend on the terrestrial environment. Other factors making monetary assessment difficult include the insignificant amount of products involved and the lack of a well-functioning market.

Provision of spawning and feeding grounds for aquatic animals

One of the important roles of the flooded forest is the provision of spawning and feeding grounds for fish and other aquatic organisms. Local fishers learn of the relationship between the extent and quality of the flooded forest and the productivity of a waterbody. They have come to realise that fishing was better in the past, when the flooded forest was less degraded and covered a larger area.

However, it is difficult to capture or appreciate such values in economic terms. There is still a lack of understanding of how much natural productivity is produced in any one system under the influence of many different variables. The mobile nature of productive resources is another reason why it is difficult to distinguish between on-site and off-site benefits.

Storm barriers

Although the effect of storms in Cambodia is not as devastating as that of floods, it presents a

relatively high risk for local people living in small unstable dwellings in the Tonle Sap and in coastal areas. Wetlands provide significant protection to these people by attenuating the force of storms and preventing coastal erosion. This type of benefit is also difficult to value as currently there is no market for it.

Sustaining soil fertility

The large amount of sediment deposited by floods on wetlands is usually regarded as a negative effect. However, siltation of rice fields is deemed important as can be seen through the many colmatage canals[16] built by people along the Mekong and Bassac. The implication of sediment for farmers is both negative and positive. While it tends to reduce the storage capacity of reservoirs used for irrigating dry season paddies, its deposition in rice fields helps to maintain soil fertility and thus increase rice yield and reduce the need for fertilizer input.

Cultural values

Some traditional practices such as the water festival, spiritual celebrations at the beginning of fishing activities or at the wrapping of the crop harvest are perceived to be important and should not be overlooked. These practices, although associated with the production cycle of the wetland system, are difficult to value as they cannot conclusively be shown to result in increased productivity.

Promising methods for assessing the value of wetland resources to the livelihoods of the poor

An appropriate valuation method should ideally capture and assign values to all uses and functions, particularly those that benefit the poor, those that are difficult to capture in economic terms, and those that are poorly appreciated by users. On the one hand, some promising new valuation methods may require the values to be expressed not in monetary terms but in terms of their percentage contribution to the livelihoods, survival or welfare of a particular local group of users or of a larger group of society. (A conversion multiplier for different groups may have to be developed in order to consolidate the value for local, regional or global expression.) On the other hand, the valuation methods should be able to capture the value of all individual elements in the system, including mobile resources, and to express the value of the system as a whole, taking into account the spatial scale of the system, e.g., the habitat, ecosystem or catchment level.

Policy conclusions and recommendations

Conclusions

Institutional and legal framework

The complex institutional arrangements governing wetlands management has impeded coordination between the various agencies responsible for different aspects of wetlands management. The resulting lack of effective regulation and enforcement has given rise to conflict among resource users, between managing agencies, and even between countries.

There is currently no inter-ministerial coordinating mechanism for wetlands planning and management at the national level. One exception is the Secretariat for the Tonle Sap Biosphere Reserve, although its purview is restricted to a particular area. Coordination at the provincial and local level is even more sorely lacking, although there are some NGOs working to promote cross-sectoral coordination in the provinces where they are based.

Despite efforts to decentralize authority for wetlands management to the provincial and local levels of government, many decisions are still made by the central government. This causes delays and limits flexibility in responding to problems at the local level. Although local communities are being encouraged to participate to a greater degree in resource management, they are disempowered by a lack of constitutional support for their rights to participate in decisions that concern their livelihoods.

The legal framework governing wetlands management is founded upon various pieces of legislation that govern resource use (Fishery Law 1987), land use planning (Land Law 2001), and environmental conservation (Environmental Law 1996; Royal Decree on the Protection of Natural Areas 1993). This fragmented approach reflects the complex institutional framework, and does not provide a clear legal basis for the holistic and integrated management of wetlands. This has led

[16] Canals built to channel fertile silt to rice fields during the flood season.

both to conflicts about resource use, and to a decline in the resource base itself.

The Draft Wetland Action Plan addresses many of these institutional and legal shortcomings. However, this document, which has been under various stages of review and revision, has yet to be adopted by the Council of Ministers.

Economic valuation of wetlands

Wetlands provide a wide range of values, some of which are more apparent than others. Wetlands are particularly difficult to value because of the different ways they are perceived by stakeholders with different interests. In addition, many of the ecological functions of wetlands are poorly understood, and therefore are not taken into account during valuation. The lack of both adequate property rights and of an effective regulatory framework also influences attitudes towards wetlands and how they are valued. For these reasons, policy-makers tend to underestimate the total economic value of wetlands.

Most of the existing data related to wetland valuation is concerned with direct uses of wetlands. The sectors most involved in wetland use in Cambodia, in terms of economic earnings, are agriculture, fisheries, aquaculture, water supply, extraction of timber and non-timber forest products, tourism, water transport and habitation, and conservation. Other uses and functions of wetlands include livestock farming, waste dilution and treatment, flow and flood regulation, protection from storms, energy production, and sociocultural uses.

Wetland values that relate to the livelihoods, subsistence and welfare of the poor are especially important because many poor people live in or around wetlands and depend heavily on wetland resources for their livelihoods. However, for several reasons, these values are also often very difficult to capture in economic terms, and are therefore often overlooked in policy. First, many resources harvested from wetlands seldom enter the market economy, making it difficult to assign them a monetary value. Secondly, many wetland functions are so much a part of people's daily lives that they are poorly appreciated, even by those to whom they provide the most benefit. Finally, a lack of understanding of how certain wetland functions work prevents their full value from being realized.

One promising direction towards a more comprehensive wetland valuation method is to express values not in monetary terms, but in terms of the percentage contribution they make to the livelihoods of a particular group of local users. A good valuation method should also be able to capture the values of all individual elements in a wetland system, including mobile resources, at various spatial scales.

Recommendations

Adopt a coherent national strategy for wetlands management

- **The National Wetland Action Plan (NWAP)** should be adopted and agreed upon by responsible agencies so that wetlands are managed in a coordinated and concerted manner, which recognizes the important roles of government agencies, NGOs, communities, and the private sector. One action prescribed in the NWAP is the formation of the National Wetlands Steering Committee to deal with the management of wetlands resources in both coastal and freshwater wetlands and to improve the legal framework. The NWAP has been drafted for many years but has not yet been approved by the Councils of Ministers. The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme, in partnership with the Ministry of Environment, is reviewing the NWAP, after which it will be resubmitted to the Councils of Ministers for endorsement. However, since many of the actions in the current draft NWAP have already been accomplished, an updated set of actions would be required; these actions would need to be addressed to the relevant ministries for implementation. The Ministry of Environment, the Ministry of Agriculture, Forestry and Fisheries, and other relevant ministries will have to work closely to address the issue of sustainable use and better management of wetlands resources.

Improve the legal framework to support Integrated Wetlands Resources Management

- **Guidelines on the implementation of laws** will be required to improve the effectiveness of enforcement. Public awareness is the key issue by which to promote the understanding of newly promulgated laws at the provincial, district and local level. Guidelines on the interpretation and implementation would be

especially useful at the local level, as local communities often do not understand how to implement new laws. Guidelines would need to be developed at the national level through comprehensive consultation within and between government agencies. The guidelines would need to interpret the Fishery Law and particularly the Sub-decree on Community Fisheries in order to assist local communities to implement these laws. The guidelines should include such matters as the demarcation of the physical boundary between community fisheries and fishing lots, coordination and consultation between commercial and small-scale fishers, subsistence fishing gear in specific localities, and the management plan for community fisheries and fishing lots.

- **Decentralization.** In 1996 the Royal Government of Cambodia introduced the Social Economic Improvement Agency Program (SEILA) to pilot a system relating to the planning, financing, management and implementation of local development in five provinces. The SEILA programme has since expanded throughout most of the country. The Government has made a commitment to use the decentralization and deconcentration approach, which promotes the participation of the people in the organization and management of natural resources and project development. Participation occurs through the delegation of power to the provincial and district governments and commune councils, which are closest to the people. This process allows local people to make decisions on issues concerning their daily lives. The Government hopes to address fisheries management by: (i) developing a comprehensive legal framework that will ensure conservation and sustainable development; (ii) building the capacity and enhancing the efficiency of the Department of Fisheries; (iii) minimizing excessive exploitation of resources; and (iv) reducing resource use conflicts. Through the decentralization process the Government can improve awareness of wetlands among commune council members, and incorporate wetland plans into commune development plans. The sub-district[17] and village development committees are some of the institutions in place that could assist the establishment of the community fisheries process. This decentralization will facilitate close collaboration among local authorities, relevant local government agencies, and the SEILA program, and contribute to better management of wetland resources and to reduced conflict over the use of wetland resources.

- **Assess the impacts of fisheries reform to improve policy implementation.** The Department of Fisheries has been reviewing the impact of policy reform in Cambodia. The project is supported by the UK Department for International Development (DFID) and Oxfam. The result of the review could strengthen the draft Fishery Law and Sub-decree on Community Fisheries. The recommendations of the review could be incorporated into policy, in order to strengthen the chance of implementing sustainable use of wetland resources.

- **Recognize and protect the customary access rights of local communities to wetlands resources.** Except for the fishing lot concessions, the awarding of forest and farm land concessions are top-down decisions. The decisions are made without any consultation with local governments and communities, even though the impact on local livelihoods and the customary use of these resources is great. For example, the construction of a nearby hydroelectric dam is currently changing the lives of the ethnic minority living along the Se San river by reason of the fact that it is changing the water regime. The conversion of flooded forest into farm land will also have an impact on the customary use of wetland resources. For example, in Svay Rieng province, where the *Melaleuca* forest has been cleared for rice fields, frogs, snails, vegetables and mushrooms are no longer gathered for food, and the ability to acquire medicinal plants has been lost; the culture of harvesting these products no longer exists.

- **Incorporate economic valuation of wetlands resources into policy.** The results of the economic valuation of wetland resources of the Mekong Wetlands Biodiversity Programme can build upon the knowledge of policy-makers and contribute to policy development.

[17] A sub-district is equivalent to a commune.

This will provide incentives to change from the unsustainable use towards the wise use of wetlands resources, thus contributing to the overall policy goal of poverty alleviation.

Improve the distribution of responsibilities among government institutions

- **The inter-ministerial coordination mechanism** at the national level should be improved, and it should lead consultation across ministries on the development and implementation of wetlands-related policy and regulations.

- **A high-level commission** should assess and resolve areas of overlap among the various government agencies. The Council of Ministers is the agency best positioned to open and lead an inter-ministerial debate on the draft law and sub-decree, where the problem of overlapping roles and responsibilities still exists. The goal is to promote the coordination of responsibilities for the management and sustainable use of wetlands resources. Currently, in many cases, the consultation process is conducted as a mere formality, and the comments and suggested changes are not carefully considered before being integrated into the law. This must change. It may be necessary to create a higher level legal commission within the ministries concerned, in order to resolve the areas of overlap and conflict.

- **Management plans** should be prepared for important wetland sites in the country. They should specify the division of responsibilities and points of collaboration among various agencies. The lessons about coordination, learned during the government agencies' development of the management plan, will help the process of conflict resolution.

Improve mechanisms to better manage competition and coordinate wetland use among stakeholders

- **Coordination between regional stakeholders.** At the regional level, the MRC should take a proactive role in coordinating the dialogue among all regional stakeholders in the Mekong Basin. This is particularly critical in the development and management of cases that have transboundary implications, such as the construction of dams.

- **Community-based management** needs legal and institutional support from the government and NGOs. The purpose of the Royal Government of Cambodia in releasing the fishing lot areas to community fishers was to reduce the conflict over the use of fisheries resources and to improve the livelihoods of the people who depend on them; it is part of the poverty alleviation policy of the government. While the Fisheries Law is still in draft form, and prior to its adoption by the National Assembly, the community fisheries Sub-decree could be approved. The lessons learned from the introduction of community fisheries into the country by local and international NGOs will facilitate the expansion of such fisheries. Although funding assistance from local and international NGOs will greatly assist the Department of Fisheries develop community fisheries, there is still a lack of experience in this area. Greater capacity-building in the area of community fisheries development is required; this may involve activities such as study tours to learn from best practices in neighboring countries, and short training courses. The training of trainers will be an important step towards training community fisheries practitioners at the local level. Existing community fisheries' rules and regulations will require further development, best achieved through intensive community participation in the review process. Fisheries extension services will be required to promote public awareness of the value of wetland resources to the livelihoods of the local community, so that these resources can be managed in a sustainable manner. Lessons learned from the community-based management initiatives of local and international NGOs can be incorporated in order to strengthen the community fisheries, Sub-decree development process.

- **Improve the planning and decision-making process** for major development projects and for resource allocation decisions affecting wetlands. Decisions on land concessions and on the allocation of wetland resources should be well-informed, involving consultation with relevant stakeholders. Presently, decisions involving land and resource concessions are made using a top-down approach. Local and international NGO advocacy groups can increase the awareness of decision-makers of the impacts of their decisions on local community livelihoods, demonstrating how

impacts sometimes work counter to government policy. Environmental impact assessments (EIAs) should be conducted on proposed development projects – especially hydroelectric dam construction, irrigation, flood control, and the creation of fishery and forestry concessions – before any final decisions on their implementation is made.

- **Require full EIAs on development projects that may impact wetlands.** The Sub-decree on EIA is the legal instrument that the Ministry of Environment can use to minimize the impact of development projects on the environment. Although, generally, the EIA applies to all relevant sectors, the Ministry of Environment alone bears the responsibility to implement it. However, there have been projects, such as the construction of National Road No. 1, which have been implemented without consultation with MoE (ICEM 2003).

Support the collection and dissemination of better information on the multiple values of wetlands

- **An inventory of wetlands** and a wetlands database is crucial to better planning and decision-making processes. A mechanism for information-sharing among resource users and managers is also needed. MRC plays a major role in classifying the wetlands in the Mekong Basin; regional and national workshops have been organized to develop the wetlands classification process, and the classification guide has been endorsed by the National Mekong Committees of the four riparian countries. A standardized approach to wetland classification would greatly facilitate the prescription of standard management regimes for various types of wetlands. The Guidelines for Asian Wetland Inventory developed by Wetlands International would be a useful resource in this regard.

- **Awareness-raising** should be conducted at all levels to secure broad public participation. The Ministry of Environment, as the signatory of the Ramsar Convention, has been using publications and networking to raise awareness of the importance of wetland resources .

- **Improve government data collection** by addressing the structural incentives that encourage under-reporting of the fishery catch. Improvements should include: (i) addressing data collection as part of a project component; (ii) developing a mechanism for selecting landing sites; and (iii) improving methods of data collection and analysis.

- **Capacity-building** should be promoted for relevant technical departments in wetland inventory and research. In particular, there is a need to develop a National Red List of Flora and Fauna for Cambodia, listing threatened species. Other capacity-building needs include training of tourist guides on issues such as waterbird identification, flooded forest ecology, and the culture of floating villages. The potential areas for such capacity-building activities are in Tonle Sap, areas surrounding Phnom Penh, and coastal areas.

- **A communication and information-sharing mechanism needs to be developed and operated** at all institutional levels, including the regional and stakeholder levels. The National Administrative Authority of the Ramsar Convention within the Ministry of Environment should be strengthened as a centralized clearing-house for national and international data on wetland management.

- **Promote regional exchange** and discussion of tested methods for cost-effective and appropriate economic valuation of wetlands.

References

Ahmed, M., H. Navy, L. Vuthy and M. Tiongo. 1998. *Socioeconomic ssessment of freshwater capture fisheries in Cambodia: Report on a Household survey.* Mekong River Commission, Phnom Penh, Cambodia, 186p.

Ahmed, M., H. Navy, L. Vuthy and R.A.V. Santos. 1999. Fish consumption pattern in major freshwater fisheries provinces of Cambodia. *Naga, the ICLARM Quarterly*, 22(2): 27-31.

Azimi, A., W. Knowland, J. Carew-Reid, I. Ruzicka, and A. Zola. 2000. *Environments in transition: Cambodia, Lao PDR, Thailand, Vietnam.* Asian Development Bank, Manila.

Barbier, E.B., M.C. Acreman and D. Knowler. 1997. *Economic valuation of wetlands: A guide for policy makers and planners.* Ramsar Convention Bureau, Gland, Switzerland.

CIAP (Cambodia-IRRI-Australia Project). 1993. *Annual report.* Phnom Penh, Cambodia.

Davies, J. and C.F. Claridge (eds). 1993. *Wetlands Benefits. The Potential for Wetlands to Support and Maintain Development.* Asian Wetlands Bureau Publication No. 87; IWRB Special publication No. 27; Wetlands for the Americas publication No. 11.

Degen, P., F. van Acker, N. van Zalinge, and N. Thuok. 2000. *Taken for granted: Conflicts over Cambodia's freshwater fish resources*, Paper prepared for the 8th IASCP Conference, Bloomington, Indiana, 31 May-4 June 2000.

Dennis, J. V. and G. Woodsworth. 1992. Report of the United Nations Conference on Environment and Development (UNCED): Environmental priorities and strategies capacity for sustainable development in Cambodia. Unpublished report, Phnom Penh, Cambodia.

EWG. 2000. *Review of Fishery Conflict in Stung Treng.* Environment Working Group, NGO Forum, January 2000. [Online]. Available: http://www.ngoforum.org.kh/Environment/Docs/review_of_the_fishery_conflict_i.htm

FAO. 1994a. Cambodia agricultural development review options. Confidential Sector Review (Main Text) (CMB 1 SR, UNDP Report No. 42/94) Vol. 1-6, Investment Centre, FAO, Rome, Italy.

FAO. 1994b. Participatory natural resource management in the Tonle Sap region. Project Document GCP/CMB/002/BEL. Phnom Penh, Cambodia.

FAOSTAT. 1998. FAOSTAT Statistics Database. [Online] http://apps.fao.org/default.htm, December 1998.

Fisheries Office. 2000. *A Study of the Downstream Impacts of the Yali Falls Dam in the Se San River Basin in Ratanakiri Province, Northeast Cambodia.* Fisheries Office, Ratanakiri Province in cooperation with the Non-Timber Forest Products (NTFP) Project, Ratanakiri.

Gregory, R. 1997. *Ricefield Fisheries Handbook*. Cambodia-IRRI-Australia Project, Cambodia.

Gregory, R and H. Guttman. 1999. A diverse monoculture: Aquatic animal production from rice fields in southeat Asia, *Catch and Culture Mekong Fishery Network Newletter*5(1): 2-5.

Gum, W. 1997. Fisheries development in northwest Cambodia, May 1996 to February 1997. Consultancy report for Cambodia Rehabilitation and Regeneration (CARERE)/UNDP/RGC.

Gum, W. 2001. *Inland aquatic resource and livelihoods in Cambodia: A guide to the literature, legislation, institutional framework and recommendations.* Consultancy report for Oxfam GB Cambodia Land study Project, November 2000. Oxfam GB, Phnom Penh.

Guttman, H. 1999. Ricefield fisheries – a resource for Cambodia. *Naga, The ICLARM Quarterly* 22(2): 11-15.

Howe, C.P., G. F. Claridge, R. Hughes and Zuwendra. 1991. *Draft report of manual of guidelines for scoping EIA in tropical wetlands.* PHPA/AWI Sumatra wetland project No. 5 (Draft), Indonesia.

ICEM. 2003. *Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region.* Indooroopilly, Queensland, Australia. 148 pp.

Mam, K. and V. Sok. 2001. *Local Livelihood and Biodiversity Protection in the Boeng Chhmar and Stung Sen Core Areas.* Consultancy report for UNDP Tonle Sap Conservation Project. Wetlands International, Phnom Penh, Cambodia.

MAFF. 1993. Bulletin of Agriculture and Statistics of Ministry of Agriculture, Forestry and Fishery. No. 1-4, Phnom Penh, Cambodia.

McDonald, A., B. Pech, V. Phauk and B. Leev. 1997. *Plant communities of the Tonle Sap flood plain*. Contribution to the nomination of the Tonle Sap as a Biosphere Reserve for UNESCO's "Man in the Biosphere Program". UNESCO, Phnom Penh, Cambodia.

Mekong Secretariat. 1994. *Cambodia Land Cover Atlas* 1985/87 - 1992/93. Remote Sensing and Mapping Unit, Mekong Secretariat, United Nations Development Programme; Food and Agriculture Organisation, Cambodia. 124pp.

MoE. 1999. *National Wetland Action Plan*, Draft January

1999. Ministry of Environment and Wetlands International, Phnom Penh, Cambodia.

MOWRAM. 2002. *Draft National Water Resources Policy for the Kingdom of Cambodia.* Ministry of Water Resources and Meteorology, Phnom Penh, Cambodia.

NEDECO and MIDAS. 1998a. *Draft natural resources-based development strategy for the Tonle Sap area, Cambodia.* Final Report. Sectoral Studies: Environment in the Tonle Sap area. Cambodia National Mekong Committee, Phnom Penh, Cambodia.

NEDECO and MIDAS. 1998b. *Potential for Eco-tourism in the Tonle Sap Area, Cambodia.* Mekong River Commission Secretariat/UNDP.

ORSTOM & BCEOM. 1993. *Development Plan for Tonle Sap and Chakdomuk, Phase I,* Draft Final, The Mekong Secretariat, Phnom Penh, Cambodia.

Rees, C. 1990. *A Guide to Development in Urban and Coastal Areas.* Asian Wetland Bureau, Kuala Lumpur, Malaysia.

RGC (Royal Government of Cambodia). 2000. *Wetland classification system for Cambodia.* A report of the Inventory and Mangement of Cambodia Wetland Project (MRC-DANIDA). Phnom Penh, Cambodia.

RGC (Royal Government of Cambodia). 2001. *Second Five Year Socio-economic Development Plan (SEDP II: 2001-2005).* Phnom Penh, Cambodia.

Said, I.M., O. Mohd. Shahwahid, and N. Khan. 1992. *The Economic Value of the Wetland Plant Species and Recommendations to Improve Wetland Conservation in Peninsular Malaysia.* Asian Wetland Bureau Publication No. 80. Asian Wetland Bureau, Kuala Lumpur, Malaysia.

Savy, T. 1999. Aquaculture and ricefield fisheries development for 1998 in southeast Cambodia. in *Proceedings of the Workshop on Legal and Institutional Frameworks, and Economic Valuation of Resources and Environment in the Mekong River Region - A Wetland Approach,* 22-24 March 1999. Department of Fisheries, Phnom Penh, Cambodia.

Shams, N. and M. Ahmed. 1996. *Common and private property linkage for sustainable livelihood in low-land forest-fishery-farming systems of northwest Cambodia.* Paper presented at "Voices of the Commons" 6th Annual Conference of International Association for the Study of Common Property (IASCP), University of California at Berkeley, California, June 5-6 1996.

Shams, N and T. Hong. 1998. *Cambodia's Rice Field Ecosystem Biodiversity: Resources and Benefits.* Deutsche Gesellschaft Fur Technische Zusammenarbeit (GTZ), Cambodia.

Thuok, N. and L. Sina. 1997. *Review of the fisheries and aquaculture sector in Cambodia* (Draft), prepared for the natural resources based development strategy for the Tonle Sap area project, Department of Fisheries, Phnom Penh.

Thuok, N. and S.L. Song. 1999. *Report on Field Survey Work of Fishing Lot No. 6, Kampong Khleang Commune, Sotr Nikum District, Siem Reap Province, Cambodia,* Department of Fisheries, Supported by Project GCP/CMB/002/BEL: Participatory management of the natural resources in the Tonle Sap region, FAO, Siem Reap, May 1999.

Thuok, N. and N. van Zalinge. 2000. *Management aspects of Cambodia's freshwater capture fisheries.* Eleven presentations given at the annual meeting of the Department of Fisheries, Ministry of Agriculture, Forestry and Fishery, 27-28 January 2000. Mekong River Commission and Department of Fisheries, Phnom Penh.. 170 pp.

van Zalinge, N. and N. Thuok. 1999. Summary of project findings. In *Present Status of Cambodia's Freshwater Capture Fisheries and Management Implications,* Mekong River Commission/DoF/DANIDA Project on the Management of Freshwater Capture Fisheries in Cambodia.

van Zalinge, N.P., N. Thuok, T. S. Tana and D. Loeung. 2000. Where there is water, there is fish? Cambodian fisheries issues in a Lower Mekong Basin perspective, p. 37-48 In: M. Ahmed and P. Hirsch (eds.). *Common property in the Mekong: issues of sustainability and subsistence.* ICLARM Studies and Reviews 26. 67 pp.

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.

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List of Abbreviations and Acronyms

DARD	Department of Agriculture and Rural Development (provincial level)
DENR	Department of Environment and Natural Resources (provincial level)
DOST	Department of Science and Technology (provincial level)
FIPI	Forest Inventory and Planning Institute
GMS	Greater Mekong Sub-Region
MD	Mekong (River) Delta
MARD	Ministry of Agriculture and Rural Development
MRC	Mekong River Commission
MONRE	Ministry of Natural Resources and Environment
MOF	Ministry of Fisheries
MOST	Ministry of Science and Technology (formerly MOSTE)
NIAPP	National Institute of Agricultural Projection and Planning
NLU	Nong Lam University, Ho Chi Minh City (formely UAF)
SA	Stakeholder Analysis
TEV	Total Economic Value
VNMC	Vietnam National Mekong Committee

Background

In Vietnam, responsibilities for environmental and natural resource management are shared by various sectoral ministries. Each ministry has its own research and planning body, mandated to provide information for policy-makers. The total economic value of the various wetland products and services has rarely been estimated. The externalities associated with the use of wetland systems have not been captured; heavy social costs have resulted from the degradation and shrinkage of wetlands. The current management approach can hamper the development of the more holistic approach that is crucial if inter-sector issues are to be addressed.

This project sought to build an approach which results in closer collaboration between the relevant management agencies, and in better consideration of interdisciplinary issues. The main achievement of the project was that, for the first time, an interdisciplinary group consisting of participants from various institutions was established and a participatory research approach, involving stakeholders at different levels, was adopted. The report discusses the lessons learned as information was shared among researchers and stakeholders. The findings in this report are based on various documents, such as proceedings and discussion papers, and on field research undertaken as part of the research process. Although substantial information on the ecological and economic status of the Mekong River Delta of Vietnam exists, research concerning legal and institutional aspects and the economic value of the area is limited. A comprehensive economic valuation of wetlands and wetland resources would provide information crucial to decision-making, while an analysis of the current policy, legal and institutional framework for wetland governance could help identify improvements in wetlands management.

Vietnam's resources and economy

Vietnam has a total land area of 331 700 km^2, and a coastline of 3 260 km. Although over 70% of the country is less than 500 m above sea level, three quarters of Vietnam's land area consists of mountainous or hilly terrain. About 28% of the total land area is used for agriculture, while around 35% is forested (MONRE 2004). The country has a population of about 80 million people; up to 80% live in rural areas. The mean population density is about 210 persons per square kilometer. In general, Vietnam is a densely populated country largely dependent on natural resources and primary products for national income.

In the early 1980s, when Vietnam shifted from a centrally planned to a state-regulated, market-oriented economy, agriculture, which employs about 67% of the total labor force, underwent dramatic reform. Institutional and policy changes in the sector enabled Vietnam to become the third largest rice exporting country in 1989, and the second largest in 1996. As a result of agricultural reform, the production of rubber, coffee, tea, and aquaculture products also expanded rapidly.

Finding ways to promote economic development and alleviate poverty while simultaneously protecting the environment is a significant development challenge for Vietnam. Despite recent gains in agricultural production, approximately 30 million Vietnamese (37% of the population) live in poverty, and the country faces a number of serious environmental problems. These include high rates of forest loss and widespread degradation of land and water resources. From 1965 to the early 1990s, the forest coverage declined at an estimated rate of 350 000 ha/year, with coverage as a percentage of total land area falling from 40% to 26%. Deforestation occurred in both upland and wetland forests. Of the nearly 19 million hectares of forested land in 1965, only 8.8 million remained by 1993. Bare land (denuded forests and fallow land) covered about 13 million hectares (nearly twice the total cultivated area). In many locations, environmental degradation is expected to worsen, especially as agricultural and industrial activities intensify and expand into sensitive areas, including wetlands.

Geography, climate and coastal processes

Located at latitude 8° 33′ to 10° 55′N and longitude 104° 30′ to106° 50′E, the Mekong River Delta of Vietnam extends from the border of Cambodia to the Gulf of Thailand and the East Sea, and includes 12 provinces: Long An, Tien Giang, Dong Thap, Ben Tre, Vinh Long, Tra Vinh, Soc Trang, Can Tho, An Giang, Kien Giang, Bac Lieu and Ca Mau. Approximately 3.9 million hectares of the delta is in Vietnamese territory. With the exception of several isolated mountains in the region, the altitude of the delta ranges from sea level up to just 5 m; in effect, the entire delta can be classified as a large wetland area.

The delta enjoys a tropical monsoon climate, with a pronounced dry season from December to March or April and a pronounced wet season from April or May to November. The average annual rainfall ranges from less than 1 500 mm in the central and northwest regions to over 2 350 mm in the south, with about 70-80% of the precipitation concentrated within four months at the height of the wet season. The mean annual temperature is about 26°C throughout the delta, with a 5% fluctuation. Together, the rainfall and temperature result in relatively high humidity throughout the year.

Although the variation of climatic conditions is not significant, wetlands in the Mekong River Delta are diverse because they are governed by three natural processes: the flow regime of the Mekong River; the tidal regime of the sea; and other factors that govern the formation of natural wetland ecosystems.

The flow regime of the Mekong River is highly seasonal. The river starts to rise shortly after the onset of the monsoon rains in late May, and attains its maximum level in September or October. It then falls rapidly until December, and slowly thereafter reaches its lowest level between April and early May (Anh 2001). The lower Mekong River exhibits pronounced seasonal variations in flow, reflecting rainfall patterns and upland activities. This flow regime strongly affects natural wetland processes as well as the livelihoods of local people.

With a coastline of about 600 km, the coastal and estuarine wetlands of the delta are affected by the tidal regime. This is diurnal in the Gulf of Thailand and semi-diurnal in the East Sea. In general, there are two high waters and two low waters each day, but the two low waters sometimes vary. The average daily tidal range is between 3.5 m and 4.5 m in the East Sea and between 0.5 m and 0.8 m in the Gulf of Thailand. The tidal effects extend throughout the delta area in Vietnam, and about 500 000 hectares of land are affected by seawater intrusion during the dry season. Salinity penetration into various branches of the Mekong varies from 20 km to 65 km. Because of the large inflow of freshwater from the Mekong, salinities along the eastern coast of the delta are very low, particularly during the flood season. The maximum salinity occurs at the end of the dry season, in April. Towards the end of the wet season, in September and October, the combination of floodwaters from the rivers, local rainfall and tidal inundation can result in the flooding of 3.4 million hectares of land in the Vietnamese portion of the delta (Anh 2001, see also Figure 1). While saline invasion has a negative impact on agriculture, the tidal regime governs daily activities of local people, such as the use of boats in the coastal canals.

The depth of sediment in the wetlands of the delta varies from 500 m near the river mouths to 30 m at places in the inner delta. In some places, deposition in the delta continues to extend the Ca Mau Peninsula south and west at a rate of 150 m per year. Riverbank and coastline erosion have recently become major problems in many areas.

The long history of the delta's formation is reflected in the various soil types. Although soil classification in Vietnam has been adapted to the FAO-UNESCO system, available soil maps are still not consistent. According to maps from the National Institute of Agricultural Projection and Planning (NIAPP), recent alluvial soils are found mainly in the floodplains along the banks of the Tien and Hau Rivers. These soils are only slightly acidic (pH values of 4.5–6.5) and account for 1.11 million hectares, or 28% of the Vietnamese portion of the delta. However, the main soil types of the delta are sulfate soils or salty sulfate soils. These cover an area of 1.59 million hectares, and are mainly in the Dong Thap Muoi and Long Xuyen area (Long An Province). Salty soils are found along the coast from Ganh Hao (Ca Mau Province) to Go Cong (Tien Giang Province), Can Duoc and Can Giuoc (Long An Province). They cover an area of 808 749 ha (21% of the delta).

The reclamation of acid sulfate soil has been the main concern of many agricultural development institutions, and water management in this area has been designed to accommodate acid sulfate soil reclamation.

Wetland classification in the Mekong River Delta

Early zoning of the Mekong River Delta was based mainly on its agricultural potential, and reflected different stakeholders' perspectives on the development of the region. The Mekong River Commission's Project for Wetland Inventory and Classification provided a systematic framework for wetland classification. With its diversified ecological conditions, Vietnam has examples of almost all the wetland types of the region, from

inland floodplain to coastal marshes and estuaries (Thinh 2002). For the purposes of this report, however, the Mekong Delta is classified into three main ecological zones: the mangrove ecosystem of the coastal fringe; the swamps or melaleuca ecosystem in the depression areas, and the estuarine ecosystem. As part of the research project, a detailed classification was made and 40 wetland types were identified; the five most promiment types are listed in Table 1.

Wetlands flora and fauna

In the Mekong River Delta there are two types of wetland forest—the mangrove and the melaleuca. The mangrove forest consists of 46 plant species, 38 of which are of some known economic importance. In sequence from the sea, the mangrove forest is dominated by species from the genera *Avicennia*, *Bruguiera*, *Rhizophora* and *Nipa*. The melaleuca forest consists of 77 plant species, with *Melaleuca leucodendron* predominating throughout.

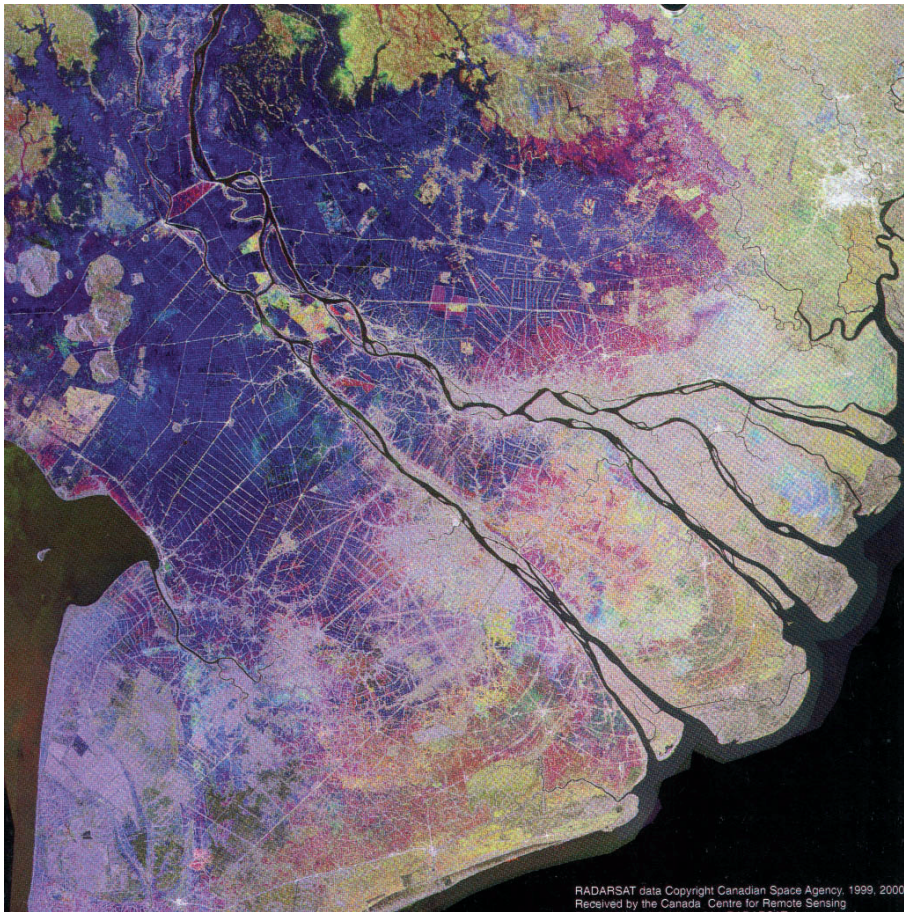
By 1980, almost 2.5 million hectares of the delta were under cultivation, mainly for rice. Some 40 plant species have been identified in the rice paddies.

The fauna of the delta includes 23 species of mammals, 386 species and subspecies of birds, 35 species of reptiles, 6 species of amphibians and 260 species of fish. Of special interest is the avifauna, which includes about 92 species of waterfowl and a variety of other species associated with wetlands. The Dong Thap Muoi wetlands are an important habitat for the endangered eastern strain of the Sarus Crane (*Grus antigone sharpii*). This crane, which used to nest in the area, disappeared during the war years, but returned in the 1980s as a non-breeding visitor; over 1000 individuals were reported in the spring of 1988.

Table 1. Classification of major wetland types in the Mekong Delta

Class	No. of Types	Percent
Marine/coastal	13	29.15
Estuarine	15	17.58
Riverine	7	35.71
Lacustrine	1	1.06
Palustrine	4	6.10

Figure 1. Satellite photo of the Mekong Delta taken during the flood season (CSA 2000)



Reptiles include the monitor lizard (*Varanus salvator*), the python (*Python reticulates*), four species of water snakes (*Enhydris* spp), the endangered river terrapin (*Batagur baska*) and the estuarine crocodile (*Crocodylus porosus*). Several decades ago, pythons (*Python reticulates*) were kept for the production of leather, but the activity was later dropped due to marketing difficulties.

In the brackish water and coastal zone, the dominant species of fish are *Clupeidae, Scombridae, Sciaenidae, Tachysauridae, Polynemidae, Tachysuridae* and *Cynoglossidae*. Most of the species are diadromous and some, particularly species from the family *Polynemidae* and *Tachysuridae*, seasonally swim up-river to spawn in the gradient or freshwater zone of the estuaries. In the freshwater zone, the most common fish species are the *Cyprinidae, Siluridae, Clariidae, Schilbeidae, Bagridae, Sisoridae, Akysidae, Chanidae* and *Ophicephalidae*. Over 200 species of fish, along with many shellfish, mussels and clams, and prawns and shrimps, notably *Macrobrachium rosenbergii* and *Penaeus monodon*, contribute to the commercial fishery.

The Mekong River Delta: Current status and challenges

Despite the high potential and long history of agricultural development in the delta, poverty has persisted in many rural communities. In addition, the wetland ecosystem is seriously threatened by unsustainable development. A review of the development of the Mekong Delta shows that ecological threats are associated with the new market activities such as shrimp farming or agricultural expansion.

Economically, the Mekong River Delta has been perceived as the great 'rice bowl' of Vietnam, and has attracted development investment from both the government and the private sector. Government developments have included the building of dikes and canals for water management in order to retain the wetlands in their natural state for nature conservation, management of the melaleuca forests for timber production, and facilitation of fisheries production. In the 1980s, in order to expand wet-rice production and thus ensure national food security, much investment went into the development of an intensive canal network. Currently, aquaculture in the area is being expanded in order to capture the economic opportunities from market integration.

Current status of the different wetland regions

Ecologically, the Vietnamese portion of the Mekong River Delta can be subdivided into five main regions. These are described below.

The floodplains of the Tien and Hau Rivers

The floodplains along the banks of the Tien and Hau Rivers cover an area of 1 201 861 ha (31% of the delta). The region consists of recent alluvial soils with only slight acidity (pH of 4.5 to 6.5), and is the most suitable area for agriculture. Along with rice intensification, the area devoted to fruit orchards has rapidly increased in recent times.

The Thap Muoi closed floodplain system

The Dong Thap Muoi (Plain of Reeds) is a closed floodplain system that covers an area of 414 398 ha (10.6% of the delta). Although the government has invested heavily in the area, its agricultural potential remains low. The limiting factors include the high concentrations of sulfates, deep and prolonged inundation during the wet season, and insufficient freshwater during the dry season. A recent local option for land use is private investment in the reforestation of melaleuca, with farmers accruing higher profits from melaleuca plantation than from rice cultivation. At higher altitudes, two rice harvests can be produced each year, but this entails a considerable amount of drainage and irrigation.

The Ha Tien open floodplain system

The Ha Tien open floodplain system covers an area of 217 508 ha (5.6% of the delta). The area is relatively well drained, but is not suitable for agriculture because of the shortage of freshwater during the dry season, and the presence of salt and sulfates in the soil. One view is that the best option for this region would be to maintain it in its natural state.

The U Minh melaleuca forests

The U Minh melaleuca forests cover an area of 189 358 ha (4.9% of the delta). The main soil types are peat and acid sulfate soil, and agricultural potential is low. Forest fires during the dry season continue to destroy large areas. Reforestation with melaleuca would restore the forests and maintain fisheries production.

The tidal floodplain in coastal areas

The tidal floodplain covers an area of 215 974 ha (5.5% of the delta). Large areas of land subject to tidal inundation occur along the coasts of Long An, Ben Tre, Tra Vinh, Soc Trang, Bac Lieu and Ca Mau provinces. Large areas of the inter-tidal zone that were formerly covered with mangrove forest were destroyed by defoliants used during the war. About 40% of the mangrove forests in the south of the delta were destroyed during the war and, although large areas were reforested with mangrove species, the expansion of shrimp farming is now putting pressure on the remaining mangrove forests. Land use would now best be directed towards reforestation with mangrove species, management of the forest resources, and integration of the fishing and aquaculture industries.

Current uses of wetlands in the Mekong Delta

Wetlands in the Mekong River Delta support the livelihoods of local people and contribute substantially to the country's economy. Agriculture, fisheries, aquaculture and forestry are the major wetland uses. The widespread rivers and canal systems facilitate water transport and cage aquaculture. There have been several important agricultural development trends in the area.

Agricultural land has encroached onto various wetlands types. This phenomenon was especially apparent during the 1980s when there was heavy emphasis on national food security and population redistribution.

The increase in agricultural land was effected by significant government investment in water control structures, including those associated with preventing salt invasion, flood control, and reclamation of acid sulfate soils.

In the period of market integration, emphasis was given to production of high quality rice and fruit. This period also saw the expansion of aquaculture, especially shrimp farming, in the coastal provinces, and its integration into rice fields.

With the support of international programs and organizations, the forestry sector has established several national parks, protected areas and forests for coastal protection. However, the pressures from the surrounding areas are usually intense and these protected areas tend to become isolated 'islands', subject to outside activities that have large impacts on the protected areas.

Agriculture

The Mekong Delta includes some of the most productive agricultural land in Southeast Asia, and rice production has a long history there. For several decades, agricultural development was focused on intensifying production, increasing multiple cropping and expanding agricultural areas. Agricultural development has long reflected population increase. The human population of the delta increased rapidly during the past century, rising from an estimated 1.7 million in 1880 to 4.5 million in 1930, 13.5 million in 1980 and 18 million in 2002. Similarly, the area under cultivation has increased dramatically, although this increase has not kept pace with the increase in population. Along with rice, important cash crops and animal products exported from the delta are green peas, bananas, pineapples, vegetables, poultry, pork and fish.

In the 1990s, the government of Vietnam initiated a research program to develop a master plan for the Mekong Delta. Research was undertaken to identify economic development opportunities. During this period, the expansion of the area dedicated to rice production was the main concern.

Agricultural development strategies have been supported by large investments in the water sector. Important projects include the Cai San Project, the Quan Lo-Phung Hiep and the Tiep Nhut on the south bank of the Hau (Bassac) River, the Ba Dong between the Hau (Bassac) River and the Tien River, and the South Ben Tre, Ba Tri and Go Cong in the Tien Estuary. Further expansion of the area of agricultural land in the Vietnamese portion of the delta will prove difficult because most of the suitable land has already been developed for agriculture. Although large investments have been made in the marginal land of the Plain of Reeds, the associated economic, environmental and social impacts have not been assessed.

Fisheries

The lower Mekong River and its delta support one of the largest inland fisheries in the world. During the past decade, the Vietnamese portion of the delta has yielded an annual harvest of about 400 000 tonnes of fish. Approximately 39% of this is derived from the brackish water and estuarine zones. However, fish production has been declining in recent years as a result of over-exploitation, forest destruction, drainage of wetlands for agriculture, and other activities.

Forestry

The mangrove and melaleuca forests constitute an important forestry resource, potentially capable of meeting local demand for construction materials, firewood, fodder for domestic animals, and other forest products. In addition, the melaleuca forests provide five or six liters of honey per hectare per year from wild bees' nests. In Long An Province, melaleuca forests support the cottage industry of 'essential oil' distillation.

The ecosystem functions of mangrove and melaleuca forests have not been clearly understood by local managers. As local government agencies recognize, mangrove forests play a very important role in coastal protection and land reclamation. Mangrove species not only retard the erosion caused by tidal action (of vital significance in a region prone to typhoons), but also accumulate soil around their root systems, thereby accelerating the accretion of new land. However, in general, local stakeholders have not understood the role of mangrove vegetation in the food chain or in the aquaculture industry. While shrimp farmers in mangrove areas have seen a positive correlation between the amount of detritus from mangroves and shrimp yield, in the many mangrove areas that have been converted to shrimp ponds the large amount of leaf litter makes shrimp pond management difficult and is considered a problem.

The current status of conservation in the Mekong Delta

The delta contains some tracts of mangrove and melaleuca forest in relatively good condition. With the support of international organizations, efforts have been made to reforest and protect both mangrove and melaleuca forests.

The 9 000 hectare Tram Chim Sarus Crane Reserve in Dong Thap Province has been upgraded into a national park. The U Minh Thuong National Park in Kien Giang Province was also upgraded along with the establishment of the U Minh Ha melaleuca forests, the Vo Doi Protected Forest (3 945 ha), the Nam Can Mangrove Reserve in Ca Mau Province (7 547 ha), and several smaller reserves and private bird sanctuaries, including breeding sites of waterbirds at Bac Lieu (40 ha) (Bac Lieu Province), Cai Nuoc (20 ha) and Dam Doi (119 ha) in Ca Mau Province. The upgrading of protected areas to national park status invariably involves an influx of national funds to develop infrastructure, especially for the relocation of displaced communities. While this provides an incentive for local governments to seek upgrading of protected areas, it often results in a greater centralization of management authority.

Since 1975, a considerable amount of reforestation work has been carried out in the delta by both state and private investments. In 1992, the barren land (including tidal flats) development program, known as 'the 327 project' was initiated. At the end of the project, a national program ('the 661 program') was implemented to reforest five million hectares of land. Private investment in the reforestation of mangrove and melaleuca forest has recently been observed. However, forest land tenure security issues still discourage investment in forest plantation and management. Controversies were also recorded in the grading of protected areas, as the current forest management system includes all protected areas under a single class, i.e. the class of special use forests, regardless of whether it is a landscape forest, a national park or a bird sanctuary.

Challenges

The whole delta, covering the southern part of Vietnam and a portion of Cambodia, can be considered as a large wetland area of diverse ecosystems, from mangrove forest to inland depressions. The delta is downstream from a basin that is under the jurisdiction of several riparian countries. The whole basin is becoming a very dynamic economic zone. Two regional institutions mandate the development of the basin: the Mekong River Commission (MRC), which focuses on water resources and environmental issues, and the Greater Mekong Sub-Region (GMS), which deals mainly with infrastructure development, and covers a larger area than the MRC.

The local people have adapted to the ecological conditions of the Mekong Delta over a long period, using rice cultivation and fishing activities "to live with the flood." They understand the inseparable linkages.

Massive wetland reclamation for the expansion of rice production started in the colonial period, and work on the reclamation of acid sulfate soil for rice farming was initiated at the beginning of the 20th century, paving the way for a period of agricultural intensification and the reduction of natural inland wetlands. As agriculture intensified

to cope with demographic pressure and to ensure food security, other values of wetlands, such as their aquatic resources and water regulatory functions were overlooked.

Despite the long history of agricultural development in the Mekong Delta, rural poverty has persisted in many communities. Besides this, the wetland ecosystem is now seriously threatened by unsustainable development methods. A look at the time-line of development history of the Mekong Delta shows that new threats come from market actors. For instance, foresters have perceived the recent uncontrolled expansion of shrimp farming as the main threat to mangroves in the coastal provinces, while natural inland wetlands in the Plain of Reeds suffer increasing pressure from agricultural expansion. Wise use and sustainable management of wetlands are the main concern of both local people and the policy makers in central government.

However, building a management system for wetlands in Vietnam which incorporate the principles of wise use and sustainability is a challenging issue.

Firstly, any environment and natural resource management system requires a set of rules that can regulate the behavior of the resource users and other stakeholders. These rules would include norms, criteria and standards implemented to sustain the provision of goods and services from the natural system.

Secondly, wetlands are open systems, hence, the management system needs to be large in scope. This implies the need to understand present and future stakeholders, either *in situ* or off-site, who are, or should be, involved in the management of wetlands. The wide and diversified range of stakeholders includes landless people who rely on wild aquatic resources for their livelihoods, managers of a national park authorized to protect the resources, poor women collecting clams in tidal flats, commercial shrimp farms, and even the 'international community' who want to protect migratory birds.

Thirdly, increasing demographic pressure increases competitive uses of goods and services. Two extreme situations have been observed in the Mekong Delta's wetland management system:

1. Wetland areas that are strictly conserved in the form of national parks or protected areas; for example, recent government efforts to establish and manage national parks in Tram Chim, U Minh Thuong, and protected areas in Thanh Phu and other biodiversity 'hot spots.' These reflect a classical environmental/economic issue, where local people are made to bear the costs of conservation, while the use of resources in these protected areas is controlled.

2. Wetland areas where resources are extracted for short term benefits without any serious analysis of the impacts in the long run. Presently, this happens where local people have found new economic opportunities for cash crops and aquaculture production brought about by a market integration process.

These two extremes have occurred due to weaknesses in the conventional legal and institutional system. A better institutional arrangement needs to be developed to prevent unwanted effects in terms of social costs or irreversible damage to the ecosystem.

From a legal and institutional perspective, choices and actions vary among stakeholders. Policy-makers and implementation staff in government agencies have seen that the legal and institutional framework can provide conditions that govern the behavior of wetland users. However, enforcement of laws and regulations has long been perceived as a most difficult task. On the other hand, local communities—especially the poor—claim that the issue of access to and control of resources is their main concern.

Project objectives and focus areas

The ultimate aim of this project was to enhance the quality of life of the people in the Mekong River Delta by supporting environmentally sound development, and sustaining and improving the values and functions of wetlands in the region.

It was perceived that this aim would be achieved by following the principles of sustainable development. In the context of the project, three dimensions of sustainable development were identified:

- The economic dimension, aimed at increasing the productivity of the resource base, facilitating sustainable livelihoods and contributing effectively to the economic growth of local communities and the nation

- The ecological dimension, aimed at conserving the biodiversity of wetlands and protecting their critical environmental processes

- The social/institutional dimension, aimed at helping local communities enhance their socio-cultural values, and make informed decisions in wetland use and management, thereby progressing toward a more democratic, equitable, and civil society.

The research focused on:

1. A review and analysis of existing laws, including customary rules, and institutions concerning wetland use and management

2. Identification and analysis of economic, social and cultural values of the properties, goods and services of wetlands

3. Development of ways to build/strengthen national frameworks for a multi-sectoral approach to management of wetlands, based on harmonized institutional and legal regimes, and achievement of optimal levels of economic, social and environmental benefits.

The legal and institutional framework provided by government agencies aims to control and command wetland use and management. However, how stakeholders perceive the economic values of the wetlands is the actual motivating force in its management. Access to information is crucial for both policy-makers and resource-users. Non-prejudiced decision-making requires a good information system. Policies, regulations and decisions should be applicable to local stakeholders. Problems at the local level need to be the main drivers of the policy process. Furthermore, stakeholders need to be involved in a participatory learning process in order to develop a common vision of wetland management.

In brief, the research project:

- Emphasizes the need for education and information related to the wise use and sustainable management of wetlands

- Explores the perceptions of stakeholders, including how wetland values are perceived and in what framework decisions are made

- Provides a forum in which wetland management issues can be discussed by stakeholders so that management capacity can be improved through information exchange.

Research approach and methodology

Definitions

The report uses the definition of wetlands provided by the Convention on Wetlands (Ramsar 1971):

> "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters" (UNESCO 1994).

Development of the research approach

In research team discussions, the following important characteristics of a wetland system, and of the Mekong Delta in particular, were identified.

- Wetlands are usually open ecosystems. The systems' components are linked together though various processes, particularly complex hydrological process, and so management impacts include both *in situ* and off-site impacts.

- In each wetland, there are multiple uses and users of wetland resources and services, which are often in competition with each other. Many poor people depend on wetlands and their resources for their livelihoods.

- Wetlands operate at a variety of scales.

- Although the Mekong Delta as a whole can generally be considered a wetland area, it consists of various complex ecosystems; each system has a set of production and regulation functions that are not clearly understood.

The research group recognized that the characteristics of wetlands dictated the approach to the research. Firstly, in both components of the research—the framework and the evaluation—wise use and sustainable management of wetlands depends on the perspective of the stakeholder,

and, therefore, a participatory, interdisciplinary and inter-institutional approach would need to be developed. Secondly, the connection between the two research components posed several methodological problems. For instance, as the economy has moved toward a market-based system, demand for less command and control increased. Thirdly, although comprehensive models for economic valuation of wetland resources exist, they require substantial data. As necessary data are currently unavailable, the economic valuation would need to be regularly updated. Finally, for the policy, legal and institutional framework research component, it would be necessary to extend the study beyond a mere compilation of current policies and regulations, and explore perceptions and incentives of different stakeholders.

The research outcome can be regarded as an opening statement for a dialogue on Mekong Delta wetlands management, and the research is regarded as an aid to the generation of policy and institutional options for their sustainable management.

The project is expected to contribute towards an integrated view of wetland development and best practices for decision and policy-makers at different levels. While the district was perceived as a suitable level for a study of policy implementation and legal enforcement issues, in-depth case studies were done at the community level due to resource constraints.

Members of the research group are listed in Appendix 1.

Geographic scope of research and selection of case study sites

Given the limited resources available for the research, and considering the objectives and activities of the research project, the group selected two case study sites in the Mekong Delta—the Thanh Phu district of Ben Tre Province and the Tan Hung district of Long An Province.

Thanh Phu district was selected as representative of a coastal and estuarine wetland ecosystem. It is located at the mouth of the Mekong River where the river meets the sea. It has high value in terms of economy, ecology, history, culture, and environment. Tan Hung district, a portion of the Plain of Reeds, was selected as representative of an inland seasonal-flooded wetland area. The case study site in Thanh Phu was regarded as a pilot, with the lessons from that experience subsequently applied to the study at Tan Hung.

The site selection process included an exploratory visit and consultation with relevant stakeholders at local and national levels at a national workshop. The criteria for site selection were:

- The existence of diverse ecosystems
- The existence of diversified and conflicting uses of wetlands and wetland resources
- The existence of problems relating to the management of wetlands and wetland resources
- Extensive recent land use changes
- Interest expressed by the local authority
- A willingness of the local community to support and cooperate with the research team
- The proximity and easy accessibility of the site.

Methods used

Research activities

Research involved the selection of the study area, formation of a working group, collection of available information on production and optional uses of wetland resources and wetlands, preliminary site survey, review and selection of methods for economic valuation of wetlands and wetland resources, training of people from participating institutions, and initial valuation of wetland resources in one of the selected study sites.

At each site, a workshop was held at the provincial level. The specific objectives of the workshops were to introduce the project, and to discuss both the logical framework and exploration of issues relating to wetland management and information sources. Local collaborators were identified and involved in the process.

Data collection methods

Secondary data collection involved the exploration of data, reports, and documents relating to wetland and wetland resources use and

management from the central government and from provincial, district, and commune level agencies.

The economic valuation working group explored the following information:

- Socio economic data on wetland management, for the purpose of assessing types and levels of production in wetlands. These data are usually dispersed in various sectoral agencies, including agencies responsible for agriculture, aquaculture and forestry. Other livelihood activities based on wetland resources, including living aquatic resources such as fish, frogs, snails, eels, crabs, shrimps, edible water bugs, clams, cockles, corals, and aquatic plants etc. Usually, this is a missing component in statistics, and the working group obtained these data through field observations.

- Water based transportation and communication.

- Scenic areas, tourism and recreation, wild life conservation areas, bio-diversity, etc.

- Flood protection, erosion and sediment stabilization.

After a preliminary assessment of the secondary data, a reconnaissance survey was conducted to collect preliminary information on the socioeconomic status of the study areas and to identify existing problems faced by local communities in connection with the use and conservation of wetland resources. The field survey on wetland resources use and management was done through focus group discussions, interviews with key informants, and other participatory assessment tools. The survey questionnaire was prepared after the exploratory visit to the study sites, and was pre-tested and revised before being used in the field. Local staff were also trained prior to fieldwork.

The working group also conducted an exploratory assessment of 100 households in the Thanh Phu district of Ben Tre Province. Participatory resource mapping, map analysis, trend analysis, network analysis, and review of available data with local staff were used to gather the information needed to design economic valuation models. The reconnaissance survey and secondary data collection were also conducted in Tan Hung district of Long An Province.

The information collected included:

- Documents from various institutions, including circulars, decisions and decrees (issued by the government, relevant ministries and provincial agencies), project proposals, reports, statistics and maps from the district and communal authorities.

- Profiles of 100 households in five communes (Binh Thanh, An Nhon, Giao Thanh, Thanh Phong, Thanh Hai) in three sub-regions (fresh, brackish, and saline water) of Thanh Phu district, Ben Tre Province, along with a participatory rural appraisal report at the commune level.

- Profiles of 60 households in three communes of Tan Hung district (Vinh Loi, Vinh Chau, Vinh Thanh) and Long An Province, along with a participatory rural appraisal report at the commune level.

- Consultation workshops, papers and proceedings highlighting perspectives of relevant government agencies at central, provincial and district levels.

Research findings

Pressures on the Mekong Delta

Wetlands in the Mekong River Delta have been affected by various pressures that have arisen both on-site and off-site. The lack of an effective holistic, delta-wide perspective in the planning and management processes has resulted in numerous off-site impacts not being taken into account. On-site affects have arisen mainly from rapid human population growth, which has brought intensive development of the delta for agricultural and aquaculture activities, and declining and degrading natural wetland ecosystems.

Driven by economic restructuring and population pressure, especially in coastal areas, much government and private investment has gone into infrastructure development and production intensification. This poses a major threat to the natural wetland ecosystems. Much of the proposed and implemented development work in the lower Mekong River conflicts with the conservation of wildlife and the safeguarding of fisheries in the delta. Such work includes large irrigation projects, industrial development, aquaculture, and flood control projects.

As irrigation enabled agriculture and resettlement to expand onto marginal land, local people in the region suffered floods. As a result, the government promoted a strategy of "living with the flood." Subsidies were provided to resettle local people and develop infrastructure. While water management constructions have had positive impacts for local crop production, the water regime and water quality in the lower Mekong has been affected.

The increase in human settlement and the intensification of agriculture has also resulted in increasing amounts of domestic and agricultural wastes, including pesticides and fertilizers. Aquaculture in coastal areas, rivers and ponds has also intensified. In some cases, overuse of feed and antibiotics in these intensive farms has been reported. Although at present the situation is localized, problems such as eutrophication and toxic algal blooms are expected to increase with agricultural and aquaculture intensification.

Industrial activities are expected to increase within the delta. Industrial parks have been established in Can Tho, and a large state-sponsored gas and nitrogen fertilizer production project has been implemented in Ca Mau. Further industrial expansion, together with increased waste and oil spills from shipping, are likely to create serious industrial pollution problems in the future.

Off-site activities can have regional impacts. For instance, water management projects in upstream countries of the Mekong Basin can alter the hydrology of the delta, reducing seasonal flow peaks and the extent of flooding. This is likely to have a disastrous impact, not only on waterfowl populations but also on fish species that utilize the floodplain wetlands for spawning. Changes in water quality and the timing of peak flows are likely to have adverse effects on fish migrations and spawning, and dams will create obvious problems for long distance longitudinal migrant species.

The legal and institutional framework

Clarifying some terminology

To understand the policy, legal and institutional framework for wetland management in Vietnam, it is necessary to clarify some terminologies, and to highlight several characteristics of the national institutional arrangements relating to environmental and natural resource management in general, and wetlands management in particular.

Policy

It was observed that although the word 'policy' has often been used in the national media, actual debate on policies has, so far, been limited. 'Policy' in the Vietnamese language, *chinh sach*, has different meanings within different organizations, and can also mean different things to different stakeholders. In the Vietnamese language, the word policy can mean visions, strategies, instructions, and even an investment program. There is a continuum in the meaning of the word, from high-level development objectives set by the Party and the Central Government (economic development, national security, poverty alleviation, etc.) through strategies and management guidelines at sectoral level, to the general development of objectives and principles in a specific practice. Furthermore, it was found that policy, legal and institutional aspects are usually combined in official documents. For instance, documents relating to the extension system relate not only to the organizational structure, but also to the national extension program and extension support. To avoid misunderstanding, the project team agreed that for operational purposes, policy would be defined as "something emerging at the national level, which governs implementation at all administrative levels: national, provincial, district and commune."

Legal framework

Noting that the term 'legal framework' is often confined to government laws and regulations, the research group attempted to explore its meaning from the demand side. Any natural resource management system requires a set of rules to regulate its activities. To ensure effectiveness, these rules need to be based on stakeholders being willing to be regulated. However, there are absent stakeholders that need to be considered. For example, people living outside a project area but who may be indirectly affected by a management activity, and future generations who may be affected by irreversible changes in the environment. Their interests need to be taken into account. This operational definition may help to avoid the debate on the inclusion of customary laws or informal regulation at the grassroots level.

Institution

The word 'institution' in the Vietnamese language, *'the che'*, includes organizational and institutional arrangements, regulations and management guidelines, and anything that relates to the methods of policy realization. To avoid possible confusion, the project team proposed the use of the Vietnamese term *'dinh che'* as equivalent to *'institution'*. *'Dinh che'* is a more narrowly defined term that roughly means 'the rules of the game'.

Management

The word 'management' was described in Vietnamese as *'quan ly'*, which includes both technical and institutional aspects of management. In Vietnamese, the institutional aspects of management are usually understood as *'quan ly nha nuoc'* or 'state management'. To emphasize the involvement of civil society, the term 'governance' was also used.

Wetlands

In general, the term 'wetlands' is not used consistently in the various official documents. Even policy-makers and staff in government agencies regard the term differently. Development-oriented agencies that encourage production intensification have never limited its definition to the direct use value of wetlands. In the ordinance of the Ministry of Fisheries, the term was understood to mean 'lands with water surfaces used for the purpose of aquaculture'. Although the term is better understood by conservation-oriented agencies, these agencies are often too busy with identifying 'hot-spots' and developing proposals to establish protected areas, and rarely have time to provide inputs for the development of a legal and institutional framework that can effectively govern behaviors of resource users across the wetlands landscape—most of which lies outside protected areas. The conventional classification of land, as defined in the Land Law (1992), does not define the term wetlands. Furthermore, while it does describe some forms of land use, land use rarely refers to the use of land to maintain ecological functions. As indicated earlier, this report defines wetland using the Ramsar definition.

As earlier indicated, Vietnam is in a transitional period; environmental and natural resource management in general, and wetland management in particular, have changed rapidly, with market operators becoming more influential in natural resource management systems, and management institutions still adopting the command and control approaches. The recent revision of the Land Law reflects this change, one outcome of which was that market-driven expansion of shrimp farming in the coastal provinces raised the opportunity cost of mangrove conservation. In some cases, conflicts were observed between zoning and planning at the macro-level, and demands to change land use in response to new market opportunities.

A stakeholder analysis for wetland management

The need for a stakeholder analysis

Because perceptions of wetlands values were found to vary among stakeholders, and because it is clear that perceptions govern choice and action, a need for stakeholder analysis was identified. For rice farmers, who adapt their production to the flood regime of the Mekong River, the concern is an adequate supply of freshwater in the dry season. On the other hand, aquaculture farmers, who adapt their production to the tidal and saline water regime, are primarily concerned about water quality. In the case of poor people, who rely on small and low quality fish as a source of protein, the increasingly widespread use of these fish as feed in intensive aquaculture systems poses a growing threat to their food security. Foresters, in turn, hold the view that mangrove and inland wetland forests need to be protected as much as possible; asserting that protected areas need to be established and regulations need to be effectively enforced to control damage caused by local people, especially forest dwellers who depend on wetland forest resources. Last but not least, to small boat operators, the river and canal network in the delta is the arterial system of the Mekong Delta economy.

Wetland management issues are clearly complex, and effective wetland management depends on the choices and actions of its various stakeholders. Government agencies regulate these choices and actions so that the functions of wetlands are maintained for the long-term benefit of the people.

National level institutional arrangement

The 1992 Constitution is the principal law of Vietnam. It defines the National Assembly as the highest legislative body, and the Government as

the highest executive body of the state. Representatives of the National Assembly are directly elected by those with full citizenship rights. The National Assembly elects the Government. The Constitution also states the leading role of the Communist Party in the policy-making process. Proposed laws are discussed at National Assembly sessions, and can only be promulgated though its resolutions. The President of the state signs the order to promulgate laws, while ordinances, decrees and decisions are promulgated by the Prime Minister, ministers and province chairpersons, respectively.

The ministries are headed by a minister and several vice (deputy) ministers. These people direct the work of central level and provincial departments and offices. The functions of the ministries are assigned by the Prime Minister, through the Law of Government Organization and relevant sector laws. In recent years, the number of ministries has been reduced as part of administrative reforms, but new ministries have been established to cope with new state management responsibilities. In the case of wetland management, the former Ministry of Forestry and Ministry of Water Resources were incorporated into the Ministry of Agriculture and Rural Development (MARD) in 1995, while a new Ministry of Natural Resources and Environment was established in 2002. Several other ministries also have direct influence on wetland management. They are the Ministry of Fisheries, the Ministry of Planning and Investment, and the Ministry of Science and Technology. The Ministry of Science and Technology was formerly known as the Ministry of Science, Technology and Environment. However, environmental management functions have been transferred to the newly established Ministry of Natural Resources and Environment.

The Vietnam National Mekong Committee, which is equivalent to a ministry, is currently chaired by the Minister of Agriculture and Rural Development. With this arrangement, MARD is the strongest stakeholder at the central government level in issues relating to state management of wetlands. The newly established Ministry of Natural Resources and Environment has been mandated to undertake state management of land and water.

Although a detailed description of the mandates of relevant ministries on wetlands was not available, an overlap in functions has been observed. For example, water management for agricultural purpose is under the authorization of institutions belonging to MARD, while the Ministry of Natural Resources and Environment maintains a network of water monitoring stations under the direction of the Department of Meteorology and Hydrology. There is also a separate network of water monitoring stations belonging to the Mekong River Commission. At the central level, one of the strongest stakeholders in water resource management is the Agency of Water Resources and Hydraulic Works Management of the MARD. It is useful to note that this was originally formed as a separate ministry and was later combined with MARD at the beginning of the *Doi Moi* policy. This historical development has influenced water research, planning, and management systems. The Department of Meteorology and Hydrology has its own research institution conducting research and planning projects for the whole country. The Department also has a system of education at the university level and directly manages important hydrological work. The placement of responsibility for management for water resource in a ministry that is mainly a resource user has sometimes created debate, especially since the Ministry of Natural Resources and Environment was established. As described later, responsibility for irrigation water management is assumed mainly by state-run water management companies.

Each ministry has its own research and planning bodies, mandated to provide information for policy-makers. This approach can create constraints in the development of the holistic perspective that is crucial to address multi-sectoral issues. In this context, agreement on a general procedure involving various institutions and covering interdisciplinary management issues has been slowly established. In the case of wetland management, the following separate research and management areas were identified: land management, under the Ministry of Natural Resources and Environment; agriculture projection and planning, under MARD; forest inventory and planning, under MARD; water resource management, under MARD; meteorology and hydrology, under the Ministry of Natural Resources and Environment; and aquaculture research, under the Ministry of Fisheries.

International commitments and support

Although no specific laws and regulations for wetlands management have so far been

promulgated in Vietnam, international shifts in how natural resources are managed, valued and perceived have had a strong influence on wetland management in the country. Some of the influence has come from Vietnam's commitments to various international or regional conventions, and from international support received through technical assistance and development projects.

Several environment-oriented wetland management documents reflecting the government's commitment to international agreements and conventions, such as the Ramsar Convention, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (FCCC), have been published. In addition, Vietnam has been actively involved in the MRC, ASEAN and GMS. Important documents generated under these banners include the Vietnam Forestry Sector Review - Tropical Forestry Action Program, the National Plan for Environment and Sustainable Development and the National Biodiversity Conservation Strategy.

Levels of government

There are three levels of local government below the central government level. These operate at the province level (including main cities), the district level and the commune level (including wards in urban areas). The structure of local governments is similar to that of the central level; the elected People's Council appoints a People's Committee, with a chairperson taking the highest position. The People's Committee is thus responsible to both the electors and the higher administrative level; however, upward accountability is more apparent than downward accountability.

At present, a separate unit for the management and use of wetlands does not exist. The issue was discussed in Ben Tre and Long An, the two provinces in which the study sites were located. The need for a legal document for wetlands management and the establishment of a specialized agency for wetlands management was suggested. However, it was also noted that different aspects of state management of wetlands are shared by various agencies.

The Provincial People's Committee represents an important administrative level, especially in the establishment and implementation of development strategies. On a national level, development strategies are developed and implemented by different departments and committees, in a structure similar to that of the central government. However, district level government has a smaller structure, whereby several tasks or functions are combined and carried out through one office or work team. For instance, the provincial Departments of Fisheries exist only in the coastal province, and the extension and management of aquaculture production is under the mandate of the Department of Agriculture and Rural Development.

State-run enterprises in natural resource sectors

State-run enterprises form specific institutions in the Vietnamese economy. Enterprises relevant to wetlands management in the Mekong Delta include forestry enterprises that manage production forests, and fishery/aquaculture enterprises that manage aquatic production. These enterprises are managed by various government agencies, from central to district level, depending on their size and importance. However, recent policy changes require that business management be distinguished from state management. In response to these changes, the management issues of state-run enterprises have been reconsidered. Changes have been made to the means of regulating forestry enterprises to ensure more effective management, and the privatization process for some state-run enterprises in aquaculture and aquatic product processing has been accelerated. The arrangement of state management functions among government agencies is summarized in Table 2.

Provinces and districts are in positions to promulgate decisions under the general framework provided by the central government. This indicates a degree of decentralization—and the trend toward decentralization is increasing. The superior level of government provides the general guidelines, and lower level governments have some rights to adapt these guidelines to fit with the local situation. With this arrangement, staff of local level departments have a dual responsibility in terms of accountability. They need to report to department superiors on technical matters, and to the People's Committee on administrative matters and matters concerning the implementation of development plans.

Table 2 shows the dominant role of the Department of Agriculture and Rural Development (DARD) in the planning, management and monitoring of

Table 2. Agencies and their roles in state management of wetlands

Agencies	Finance	Research	Policy formulation	Planning	Monitoring	Implementation	Enforcement	Supplement
1. Department of Agriculture and Rural Development (DARD)								
• Department Office			X	X				
• Protection and Special Use Forest Management Board		X				X		
• Extension Center								X
• Resettlement Division								X
• Plant Protection Division		X					X	X
• Agricultural Hydrological Construction Company						X		
• Ben Tre Forest Company								X
2. Department of Fisheries								
• Department Office			X	X				
• Aquatic Resource Protection Sub-department							X	
• Fishery Extension Center								X
• Aquaculture Enterprises (state-run)						X		X
3. Department of Science and Technology								
• Standard - Measurement and Quality Department							X	
• Applied Research Center of Science, Technology and Environment		X						X
• Science and Technology Unit					X			X
• Environmental Inspection Unit					X		X	
4. Department of Natural Resources and Environment								
• Department Office			X					
• Cadastral and Map Storage Center					X			X
• Land Use Planning Unit				X				
5. Defense Provincial Board								
• Defense Units							X	X
6. Department of Finance								
• Department Office								
• Bank Units	X							
• Treasury	X				X		X	
7. Department of Planning and Investment								
• Department Office								
8. Tax Department			X					
• Tax Collection Units							X	
9. Tourism								
• Tourism Companies	X							
10. Department of Communication & Transport								
• Department Office								
• Companies Involved								

land and water resources for agricultural use, and in the enforcement of water use regulations. DARD carries out state management functions at the provincial level, and dominates sub-units or state enterprises working in water resources, agriculture, forestry and rural development.

The study found that there has been some transfer of management responsibilities from DARD to the newly established Department of Natural Resources and Environment. Mandated to perform state management of land and water resources, this new Department:

- Determines land allocation, and issues land use right certificates
- Provides guidance on the implementation of development strategies and plans, including basin planning, short-term planning, protection policies and exploitation, and use and development of surface and ground water resources
- Regulates and monitors construction and exploitation of irrigation schemes, and flood control measures
- Organizes enforcement of laws, and implementation of regulations, norms and standards on water resources
- Checks and supervises enforcement of laws, and engages in resolutions and negotiations related to law violations
- Settles conflicts and resolves complaints about exploitation and use of land and water resources.

In both study sites, it was noted that authorities at the district and commune levels had limited roles; in some cases they had no authority over the wetland environment and resource management. The roles of these levels of government were limited to implementing provincial projects and enforcing provincial regulations.

The District Office of Agriculture and Rural Development is a professional body working as an assistant body to the District People's Committee in state level management of agriculture and rural development in the study area.

Decentralization, civil society involvement, and participation in wetland management

The policy of enhancement of local democracy has been implemented with the slogan: "The people know, the people discuss, the people implement and the people supervise." With this policy in place, the role of the people and mass organizations in environmental and natural resource management is becoming increasingly recognized. The Vietnam Fatherland Front, the Women's Union, the Farmers' Association and the Young League, all of which are usually found operating in rural areas, have their respective hierarchies from the central to the commune level, and have been involved in supporting policy implementation. Mass organizations are considered a political instrument with the aim of realizing policies. With the new demands arising in the transitional period, these organizations have shifted their mandates to effectively address the needs of their members. For instance, many Farmers' Associations at the commune level are actively involved in ensuring businesses help local farmers procure agricultural inputs and market their products, while Women's Unions at the commune level provide support for their members by facilitating access to formal credit, or by establishing savings funds. Their role in agriculture and aquaculture extension has been substantial. With decentralization, the participation of local villagers in wetlands management has been increased, and local people now accept the need to establish some form of collaboration. Examples of such collaboration, where local people have come together to manage resources for their own benefit, include the development of cooperatives in Ben Tre and the establishment of Water User Associations (WUA) in irrigated areas.

In recent years, the need for some form of co-management has been discussed in several institutions. However, the development of the system has seen slow progress. Initiatives in developing cooperatives would be the starting point in promoting grassroots governance of wetland environments and natural resource management, especially in cases where local civil society organizations are still weak. However, it should be noted that there are some concerns about possible negative impacts arising from domination by elite groups in grassroots initiatives. This poses a challenge to the establishment of co-management systems. Table 3 presents the output of an assessment exercise on opportunities in developing co-management systems.

Wetland resource tenure

Land tenure and land law

According to the Constitution, land, water, forest and other resources including wetlands are owned by the state. In the period of central planning,

Table 3. Potential for developing co-management systems for wetlands in the Mekong Delta

Opportunities	Concerns	Strategies
Policies on enhancement of democracy at the grassroots level have been promulgated	· Dominated by elite people	· Support community organizations; consolidate mass organizations at the commune and village level.
New policy on cooperatives	· Local farmers are concerned about effectiveness as they have had negative experiences with an earlier form of cooperative.	· Promote transparency in cooperative management. · Support business management.
Privatization of state enterprises	· Equity	· Promote transparency in privatization process.
Land allocation and land use rights certification	· Equity in the privatization of common land · Capacity of local staff	· Promote participatory land use planning with an input on wetland functions. · Advocate for common properties management. · Provide on-the-job training.
Policies relating to sharing of management responsibilities between the state agencies and local communities	· Effectiveness of various forms of responsibility sharing, such as contractual forest management and forest land allocation.	· Develop a participatory monitoring and evaluation method.

state-run enterprises and cooperatives were mandated to manage these resources. Since *Doi Moi* in 1986, the most important policy change in rural Vietnam in general was the promulgation of the Land Law in 1988 and its revision in 1993. A new revision of this law is currently being discussed in the National Assembly. The law has taken a step forward by recognizing private land-use rights. This policy contributes more than any other policy in the Mekong Delta to the acceleration of agricultural production and income. The security gained from land-use rights over the assets stimulates commercial farmers to allocate capital and other factors of production to the most efficient uses. When farmers are given the rights over land that was previously under the control of people's committees or state forest enterprises, they have added incentives to ensure higher benefit for themselves and for society as a whole.

The allocation of private land-use rights has, however, some negative impacts. These are summarized below.

The accumulation of agricultural land benefits commercial farmers

This is a problem that has caused the most concern in the Mekong River Delta. In some cases, the situation had been so extreme that local governments have had to support poor families in re-procuring land from the rich commercial farmers. The reasons that cause poor farmers to lose their lands in the first place include poor management and the uncertainty of their production systems.

Inequitable reallocation of public lands

Inequality in the allocation of public land arises when preference is given to a particular form of land-use management. In Vietnam, policies to strengthen and expand land-use rights for productive purposes in agricultural and forestry lands have been promulgated to ensure better use of land by rural households and enterprises; the preference has been toward exploitation rather than conservation. The issue of inequitable allocation is more complicated when it involves the allocation of both common land and large waterbodies. Wealthier farmers have a strong say in decision-making, while traditional tenure arrangements that can benefit poorer farmers are not well recognized by the local government.

Conflicts between farmers and management agencies

Conflicts between farmers and management agencies emerged as a result of the Land Law, which required government agencies to relax restrictions on production decisions. This policy allows farmers to change from producing food to producing other crops in order to increase efficiency of land use. These policies give farmers greater opportunities for maximizing the income from their limited land resources. Nevertheless, several cases of conflict have emerged as a result of the conversion of rice land to shrimp farming.

For instance, to capitalize on shrimp farming, farmers in the saline-affected areas have destroyed dikes that were built with national funds to prevent salt intrusion and to support rice production. It is anticipated that, in the long-run, agricultural development agencies in the Mekong Delta will increase their focus on assisting a shift toward higher value export agricultural products, thereby reducing the country's exposure to fluctuations in world prices. Much rice land has already been converted to the production of export and high value commodities in order to meet growing urban demand. However, along with this direction, other policy tools need to be improved, particularly those used in land-use management and zoning.

The study explored the impact of land-use policy at both study sites in terms of its rationality and its ability to satisfy local needs for productive land. The results are summarized in Table 4.

Resource tenure arrangement

In the case of wetlands, resource tenure includes access to and control over land, water, plants and animals, and the environmental services that they provide. Local authorities realize that clear rights and responsibilities are important in ensuring efficient agricultural and fishery productivity and natural resources management.

Realizing that land tenure security provides long-term incentives for the sustainable management and improvement of the resource base, a process of land allocation has been implemented. Land allocation is expected to trigger the emergence of a market for land, which is not only crucial for achieving efficient production, but also allows for the use of land-use rights as collateral in credit transactions. However, the use rights of other resources, such as water, have been overlooked.

Table 4. Land-use policy implementation and production land needs

Items	Households (%)
Rationality of land-use policy implementation:	
Reasonable	20 - 40
Not reasonable	5 - 35
No comment or lack of information	40 - 65[1]
Land area per household:	
Enough	40 - 75
Need more land for production	35 - 40[2]

Notes: [1]In some communes (Binh Thanh, Ben Tre Province), it was up to 78.9%.

[2]This group requested a distribution of land to households based on the number of people per household. Another idea was to allow 30–50% of the wetland within the strictly protected zone of the Thanh Phu Wetlands Nature Reserve to be used for aquaculture activities.

One positive outcome of land-use privatization is that it drastically increases agricultural production. In the case of forest land, however, private incentives for reforestation are weak, because benefits only come in the long-run and are not fully internalized by the investors. It should be noted, however, that in Long An Province, farmers had successfully made a profit from plantations of melaleuca, and in the coastal provinces in the Mekong Delta, farmers willingly planted rhizophora in the mangrove area in order to secure rights to use a portion of the land for shrimp cultivation.

In addition to the wetlands that have already been converted into land for agriculture or aquaculture, several portions of common wetlands in the communes remain open to local communities (de facto users). Unfortunately, customary laws to manage these common properties have been eroded, while newly established institutional arrangements have not been effectively enforced. This has left a situation of unregulated access to common wetlands. The existence of protected areas that restrict illegal encroachment by local users is one cause of conflict between the interests of de facto users and regulation enforcement.

Privatization of land use and the emergence of a land market do not automatically lead to sustainable land use; instead, it often leads to shortsightedness and an inability to bear the investment costs of conservation. This is a critical issue for wetlands management. Because wetlands are open systems, their management requires a stronger collaboration between the various users, who may be shrimp farmers sharing the same source of saline water, rice farmers sharing the same irrigation infrastructure, or landless people who depend on wetlands as a common property in order to make a living by capturing aquatic products.

Considering these points, resource tenure issues need to be further analyzed in the legal framework. By nature, tenure systems cover not only private use rights, but also different degrees of access to and control over resources. This generic definition can help in the understanding of several systems

of collective management that exist in the wetlands area.

The Water Resource Law 1998

The issuance of the Water Resource Law in 1998 marked a shift in the water resource management mechanism. However, the lack of effective enforcement has created new problems for all state management agencies involved in the water sector. The Water Resource Law clearly indicates that water needs to be considered as a common good, and that water management needs to change from the focus on irrigation schemes and subsidiary hydraulic work operations and maintenance to a more integrated approach to watershed management that involves the active participation of local villagers.

The ultimate aim of water use regulations is to encourage efficient, rational and sustainable water uses and to avoid abuse of the resource. However, to achieve this aim, a clearer prioritization scheme that puts the basic needs of the local people first and economic objectives second is required.

A wetlands approach acknowledges the fact that wetlands are not static biophysical entities. They are dynamic, and their values are socially embedded in the context of multiple users. This reality poses a challenge to research and management institutions. While wetland concepts must be broadened to develop a natural resource governance system that includes both local informal arrangements and social networks, both individual wetland user and sectoral approaches have failed to consider this reality.

Recognizing the natural, economic, and governance dimensions of resources management is critical in developing appropriate wetlands management systems.

Environmental and natural resource management issues

An analysis of existing documents and field consultations shows that there are several issues and drivers relating to the sustainable management of wetland resources. Some of these are discussed below.

Environmental and natural resource problems and the regulation approach

In the early 1900s, perceptions of environmental problems led to national investment in environmental protection and natural resource management. The national program on barren land development (under decision 327/CT) in 1992, for example, saw the implementation of the national program for the planting of five million hectares of forests and the establishment of new national parks and protected areas, particularly in wetlands. The Law on Environmental Protection was promulgated in 1993. Although degradation was a serious problem in some areas, the perception of environmental crisis and the subsequent, indiscriminate 'crisis management' of all areas created a situation whereby other, possibly more efficient, ways of using and managing such areas were obscured.

The 1993 Environmental Protection Law defined the management rights and responsibilities related to the exploitation and use of natural resources, including wetlands. The management arrangement was also clearly defined to include management agencies, environmental protection agencies and local administration agencies. One of the most important parts of this law was the use of environmental impact assessment in the formulation and implementation of the projects.

Biological resources are currently managed by different institutions. The Ordinance on Aquatic Resources Protection and Development, 1999, is implemented by the Ministry of Fisheries, while the Ministry of Agriculture and Rural Development (MARD) deals with plant resources and wildlife. The Forest Inspectorate (under MARD) is involved in the implementation of CITES. The overlap in functions can be observed at the local level, where the forest control sub-department focuses on wildlife, and an aquatic resource protection sub-department focuses on aquatic resources in the same area.

In general, although there is no specific document on wetlands management, different regulatory aspects can be found in various legal and regulatory documents. In some cases, an overlap in management function was observed.

Limited management capability

The existence of functional overlaps is partly due to the limited capacity of various bodies to efficiently manage wetlands, and the resulting sharing of management responsibilities between the state agencies and local communities. As Vietnam is in a transition phase, several natural resource management institutions at the local level are facing budget and staffing difficulties.

New mechanisms have been implemented in wetland areas, including contractual forest protection and forest land allocation. However, implementation is usually based on a simplistic understanding of ecological and social dynamics. For example, through recent interviews, it was noted that local staff do not pay sufficient attention to community activities, even though this was a problem for newly established villages of immigrants in the protected areas.

Central government intervention in development

Local government agencies often strive to receive financial support from the central government for development projects, including the establishment of national parks and protected areas. This has often resulted in an upward type of accountability rather than a downward type, and in bureaucracy rather than participation. Prospects for a successful, sustainable, wetlands management depends on creating a more positive decentralization and participation dynamic.

Access to information and extension services

Information is critical for sound management of wetland resources and the environment. All phases of wetlands management—planning, implementation, monitoring, and decision-making—are information-intensive. Several national planning institutions (especially NIAPP, sub-FIPI and the Water Resource Management Institute) are equipped with powerful information tools, such as remote sensing and geographic information systems. However, available information and data seem to remain confined within these institutions. In many cases, information is dispersed among various agencies, and not sufficiently consolidated or made available to local managers, especially at the commune level. New information management methods and tools relating to wetlands would increase the effectiveness and efficiency of sustainable wetlands management.

Local people's awareness of and access to information on government policies and on regulations related to wetlands and the status of law enforcement were assessed during the project. In general, local people were well aware of government policies and regulations. However, there was some indication that dissemination of information about government laws and policies in coastal communes was less than that in inland communes. About 60% of surveyed households indicated that law enforcement was quite good, although dissemination of information about laws and policies to people in remote areas needs to be improved.

Along with the dissemination of laws and regulations, access to technical support was also evaluated. In general, fishery and agricultural extension services have reached farmers, and the work of the services was assessed as effective. However, poor people who rely on capture fishing do not currently have access to this form of support. Extension has been focused on production technologies rather than on environmental protection and biological resource conservation.

Access to credit

The local authority at the commune level has facilitated access to formal credit by providing moral credit guarantees. More than 50% of interviewed households have received this kind of support. Other forms of support are mortgages based on land-use rights certificates. The ratio of farmers receiving reputation guarantees from local government and mass organizations varied from 5% to 15.8% of the interviewed households. Interviewees considered credit procedures to be quicker, more convenient, and more effective than guarantees. However, loan durations are too short and amounts too small to help local farmers effectively develop production.

Conservation and development: A reconciliation in Mekong Delta wetlands

As shown in Table 5, a number of different agencies are involved in various aspects of wetland management. However, the number and variety of institutions involved has led to confusion, with mechanisms for cooperation between these various agencies being neither well-defined nor well-understood.

An analysis of documents, and discussions with institutions and local farmers on issues relating to wetland resource management revealed that a sectoral approach dominated wetland resource management. For example, a planning institution for water resource management focuses on water issues, such as salinity invasion and flood control, while fisheries agencies focus on aquaculture development. This sectoral approach fails to consider the multiple dimensions of wetland resources and their uses.

Economic valuation

The valuation framework and methods used

There is a growing body of research that attempts to measure the total economic value of natural resources. Approaches differ slightly in terms of value taxonomy and measurement techniques. The valuation framework used for this research project was the Total Economic Value (TEV) approach described in the Ramsar Manual of Economic Valuation of Wetlands. The framework is based on the assumption that the total value of a natural resource can be broken down into various components, which can then be estimated independently using different methods and later aggregated to estimate the total value. The TEV is the sum of the use and non-use values. Use value is subdivided into direct use values, indirect use values, and option values. The non-use value is subdivided into existence and bequest values (see Figure 2). In the first stage of the valuation exercise, some time was invested in a workshop to discuss these different terminologies and explore how the values were perceived by local stakeholders.

Because of the general lack of secondary data and the limited availability of human and financial resources for the economic valuation exercise, the working group decided to:

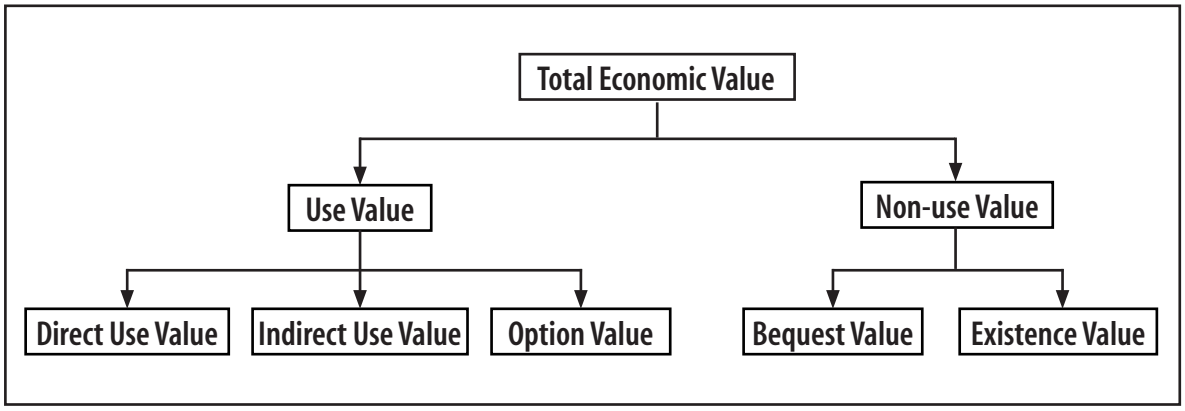
- Keep the economic valuation as simple as possible
- Identify the appropriate valuation approach
- Use available time series data for the analysis
- Where possible, use maps as guides for site selection
- Avoid unreliable official statistics
- Conduct case studies in specific sites
- Undertake system and stakeholder studies
- Estimate values using a ranking method.

For the economic valuation of mangrove forest resources, the team conducted a household survey of 100 households in five villages in Thanh Phu

Table 5. Jurisdiction of local agencies over various wetland uses

Wetland use	Relevant agencies
Agriculture in fresh water	Agriculture, Land administration, Irrigation, Transport, Environment, Banking, Tax.
Agriculture and aquaculture in brackish water	Aquaculture, Agriculture, Land administration, Irrigation, Transport, Environment, Banking, Tax; under the provincial, district, and commune people's committee leadership.
Shrimp farming and forestry in saline water	Forestry, Aquaculture, Land administration, Irrigation, Transport, Environment; under the provincial, district, and commune people's committee leadership.
Forest protection and aquaculture in saline water	Forestry, Aquaculture, Environment, (Project management board); under the provincial, district, commune people's committee leadership.
Strictly protected area in saline water	Forestry, Environment, (Project management board); under the provincial, district, commune people's committee leadership.

Figure 2. Taxonomy of Total Economic Value



district. The survey was designed to gather information on the socioeconomic conditions of villages that depend on mangrove forest resources and use of wetland resources. The villages included in the survey were Thanh Hai, An Nhon, Thanh Phong, Binh Thanh, and Giao Thanh. The survey provided the information needed to quantify the importance of the mangrove area for traditional uses.

Because of the lack of secondary data for economic valuation of wetland resources, the economic working group conducted a case study in the Thanh Phu district of Ben Tre, with the aim of evaluating the TEV of the mangrove ecosystem and understanding its economic importance.

A case study in economic valuation: Mangrove forests in Thanh Phu, Ben Tre Province

Identification of important wetland types for economic valuation

A review of secondary data collected from the Thanh Phu district provided an overview of current resource use in the district. The secondary data also assisted in the selection of important wetland resources for economic evaluation. In recent years, shrimp farms have been proliferating rapidly in Thanh Phu district; large areas of natural wetlands, particularly mangrove forests, have been converted into shrimp ponds. The condition of the mangrove forests in the coastal areas of Thanh Phu district is an example of how rapid population growth and associated economic development have increased threats to the wetland ecosystem. Various benefits of wetlands are either under-priced or not priced at all, as environmental values are not considered in current management of mangrove forests.

However, environmental costs associated with shrimp farming were not incorporated into the planning process, and conflict is arising between the aquaculture and forestry sectors. The conflict is mainly between local farmers who want to expand areas for shrimp farming and institutions that want to preserve forests for environmental protection and biodiversity conservation, particularly in the saline water sub-region. An inter-sector management strategy could safeguard the important ecological functions of the mangrove forests while supporting sustainable commercial shrimp farming in the area.

Household survey of use of wetland resources

The villages included in the survey were Thanh Hai, An Nhon, Thanh Phong, Binh Thanh, and Giao Thanh. The Thanh Phong commune is a very poor one. Formerly, local farmers depended heavily on agriculture, gaining income mainly from rice cultivation. In recent years, the farmers have shifted to shrimp farming due to its higher profits. The demography of the villages is shown in Table 6.

Characteristics of resource use

Thanh Phong commune

- Improved extensive shrimp farming is the most popular practice among local farmers in Thanh Phong commune because it does not require a large investment. Local farmers cultivate shrimp despite their inadequate knowledge and skills, and in some cases regardless of the government's land use plan.

- Extension services (in aquaculture, forestry, and agriculture) are still insufficient and do not reach all target groups.

- The conflict in the commune is between wetland resource users and non-resource users. Farmers (the resource users) want to expand their shrimp farming areas, while the local authority (Thanh Phu Natural Reserve Management) struggles for its conservation.

- Taxation policies are disorganized. One interviewee explained that he currently pays a small amount of tax for his shrimp farm as his land tenure certificate defines his land as agricultural land. He expressed willingness to pay higher taxes if his land were to be legally regarded as a shrimp farm.

- Government support of industrial (intensive) rather than extensive shrimp farming by way of credit and technical assistance would reduce demand for land.

- Regulations for the management of newly deposited mudflats would decrease the growing problem of illegal occupation of such mudflats in the commune.

Table 6. Demographic characteristics of the surveyed villages

Commune	Total population	Number of households	Total labor (persons)	Female labor (%)
Thanh Phong	8 871	1 871	3 052	37
Thanh Hai	7 167	1 520	3 395	57
An Nhon	5 068	968	2 902	45
Binh Thanh	8 827	1 797	4 394	50
Giao Thanh	5 835	1 285	2 835	50

Thanh Hai commune

- Thanh Hai commune has a total land area of about 4 925 ha. The commune has about 1 520 households with a total population of 7 167 persons. Almost half (3 395) of the population, including 57% of the women, work as laborers.

- Forty-two percent of the local population is involved in aquaculture, the most important livelihood activity. Aquacultural land comprises 42% of the total land area of the commune.

- As in Thanh Phong commune, there has been a rapid expansion in shrimp farming in the commune over the last decade.

An Nhon commune

- The An Nhon commune is located in a sub-section of the Thanh Phu district that is planned for aquaculture development. The total area of the commune is 2 656 ha, of which 420 ha is dedicated to rice cultivation, and 2 236 ha to aquaculture; 746 ha is waterfront.

- The total population of the commune is about 5 000. The natural population growth rate is 1.1% per year. There are 905 households employed in aquaculture, 18 households are employed in the service sector and 11 households are involved in supplying tiger prawn breeds. Annually, 40 million shrimp are raised.

Binh Thanh commune

- Binh Thanh is a commune located in the brackish water sub-region. Rice cultivation is the main livelihood activity of local farmers in this commune. Shrimp farming is less developed in this commune than it is in Thanh Hai and Thanh Phong communes; the two communes are located close to the mangrove area.

Giao Thanh commune

- Giao Thanh is a remote commune in the Thanh Phu district. The total area of the commune is 1 903 ha; it has a population of 5 936 people living within 1 325 households.

- There are 810 households employed in aquaculture (mainly shrimp farming); the industry covers an area of 660 ha. Giao Thanh was selected as a pilot commune for a 1 000 ha Department of Fisheries aquaculture development program. However, the quality of shrimp is poor and the mortality rate is high.

- An improved aquaculture extension service would help farmers avoid unnecessary risks.

- Aquaculture development in the commune is constrained by a lack of capital that is partly caused by the slow issuance of land tenure certificates. This makes it difficult for farmers to obtain credit from the bank.

- Many poor farmers in the commune are unable to provide collateral to the bank in order to obtain credit.

Key values of mangrove forests in the Thanh Phu district

Estimate of the economic value of the mangrove forest resources in Thanh Phu district required identification of the key functions, products, and attributes of its mangrove system. This step helped the team focus its research efforts on components that had high economic value and make the most of the limited time and resources available for the study.

The ranking of the importance of the functions, products, and attributes of Thanh Phu mangrove forest was done by participants at the national workshop held in Ben Tre Province—local officers from various provincial agencies who had good knowledge of the mangrove forest under study. The results are presented in Table 7.

The assessment of the importance of the direct and indirect values of the mangroves of Thanh Phu district clearly shows that local leaders are aware of the various functions, products and attributes provided by wetlands. This assessment provided the initial information that helped the team estimate the economic value and develop a training program[3] on economic valuation methods and the selection of tools for economic valuation.

Importance of functions, products and attributes of mangrove forest resources (ranking by stakeholders)

Information on the total value of the wetlands is important for making decisions about their use and management. However, further detailed information on the importance of wetland resources to the various local stakeholders, especially poorer households, will help the local authority make better decisions and policies regarding the use and management of wetlands, particularly in relation to economic development, poverty alleviation and resource conservation objectives. The initial economic valuation of Thanh Phu mangrove forest did not provide this extra information. Data limitations meant that the economic value was mainly estimated on the basis of aggregated data and mean prices.

The national workshop noted that additional information on the importance of each kind of function, product, and attribute of Thanh Phu wetlands would assist local decision-makers. The team developed a rating method to identify the importance of each function, product, and attribute of Thanh Phu wetland for the various stakeholders; this method involved rapid assessments based on group discussions. The ranking exercise was included in the discussions with the different stakeholder groups, including farmers living in the protected mangrove forest area, farmers living adjacent to the protected area (shrimp farmers, other rural farmer groups), people living in the urban area of Ben Tre Province,

Table 7. Ranking of the importance of the functions, products, and attributes of the mangrove forest of Thanh Phu

Economic value	Direct use value	Indirect use value	Non-use value
Products			
Forest resources	***		
Wildlife resources	*		
Fisheries	***		
Forage resources	**		
Agricultural resources	***		
Water supply	***		
Functions / services			
Groundwater recharge		*	
Flood control		***	
Shoreline stabilization		***	
Sediment retention		***	
Nutrient retention		***	
Water quality maintenance		***	
Storm protection/windbreak		***	
Micro-climate stability		**	
Recreation, tourism		**	
Water transport		***	
Attributes			
Biological diversity	**	*	*
Contribution to culture/heritage			**

Rank: (*) low; (**) medium; (***) high

[3] *Training materials on economic valuation methods are available. For further details on how they can be obtained, please contact Dr Dang Thanh Ha (d.thanh.ha@hcm.vnn.vn).*

and local leaders (district and provincial level). Results of the ranking exercise are presented in Table 8.

Results derived from the ranking exercises show that different stakeholders have different perspectives regarding the relative importance of the protected mangrove forest in terms of the value of its major functions, products, and attributes. Farmers, particularly poorer farmers, within the protected forest area placed more value on direct uses of the mangrove forest, such as aquatic products. Other groups placed a higher value on the ecological functions of the protected mangrove forest. Shrimp farmers placed a high value on the water quality maintenance function of mangrove forest because it supports their commercial shrimp farms. The results also show that assessment of the relative importance of the protected mangrove forest varies among local officials and other stakeholders.

Many farmers living within the protected area expressed their unwillingness to maintain mangrove forests because this means less space for shrimp farming. They believed that the clearing of mangrove forest in their shrimp ponds would increase shrimp yield. This perception indicates a lack of awareness among farmers of the ecological importance of the mangrove forest. It also reflects the fact that, for local farmers living within the protected area, the current level of payment for forest protection activities does not cover the opportunity costs forgone, such as the income from shrimp farming.

Identification of methods to be used for the economic valuation of wetland resources

A training session on the basic concepts and methods of economic valuation of wetland resources was organized in Ben Tre province for local staff and members of the research team. As the economic valuation of mangrove resources includes the valuation of several characteristics of the ecosystem, several economic valuation methods are applicable. Participants worked in groups to identify the methods to be used for the economic valuation and the data to be used for the analysis.

Table 8. Relative importance (perceived % of TEV) of major functions, products, and attributes of Thanh Phu mangrove to different stakeholders

Value	Stakeholder groups				
	Farmers within the protected forest area	Shrimp farmers outside protected forest area	Non-shrimp farmers outside protected forest area	People in urban area of Ben Tre	Officials of provincial offices
Wood and firewood	5	1	1	0	0
Aquatic products (shrimp, fish, crab, mussels)	64	10	10	7	10
Construction material	5	1	1	1	0
Wildlife	3	1	1	1	0
Water transport	10	7	12	5	4
Supporting near-shore fishery	2	3	14	11	11
Tourism, recreation	1	5	8	17	17
Protection against storm, coastal erosion, flooding	2	25	32	31	29
Sedimentation, expanding shore line	6	2	6	5	5
Water quality maintenance for supporting commercial shrimp farming	1	39	4	6	6
Non-use value (historical, cultural, biodiversity)	1	6	11	16	18

Note: Numbers in this table indicate the relative importance of each function, product or attribute expressed in terms of percentages of the total economic value of the wetland as perceived by various stakeholder groups. The numbers are averages computed for each stakeholder group.

The direct use values of mangrove resources and services were measured on the basis of estimated production and market prices. The indirect use value was measured on the basis of estimated differences in production gains when a particular production system is protected or supported by mangrove forests. For example, in the case of a commercial shrimp farm that is supported by functions of the mangrove forest—such as water quality maintenance, storm protection and erosion prevention—the value of these functions was measured by estimating the value of damage costs avoided. The contingent valuation method (CVM) was used to estimate non-use values, such as historical, cultural, and biodiversity values.

Preliminary estimation of the value of mangrove forest in Thanh Phu district

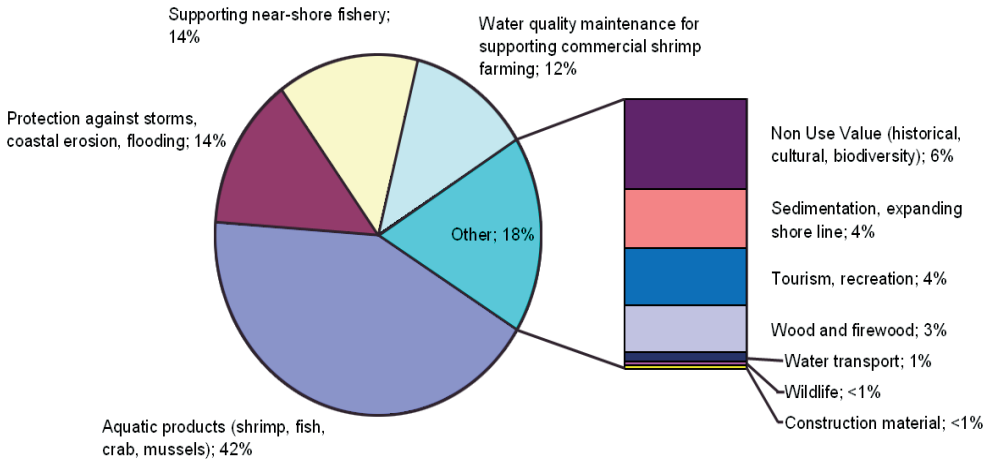
Since detailed data were not available for all the functions, products, and attributes of mangrove forests, aggregate statistics at the district level were used for the evaluation. The preliminary evaluation of mangrove forests in Thanh Phu was done using estimated data and the judgment of experts with good understanding and knowledge of the mangrove forest area. These data were validated through consultation with the villagers. To reflect the uncertainty involved, a range of estimated values was presented. The estimated per hectare economic value of the mangrove forest in Thanh Phu was calculated to be between VND 26.896 million/hectare and VND 35.145 million/hectare (US$1 793-2 343 /ha). The various individual values contributing to these estimates are presented in Figure 3. It should be noted that the result of the preliminary economic valuation exercise only provides a rough estimate due to the lack of reliable data.

Comparison with shrimp farming systems

Given the rapid expansion of shrimp farming in wetlands, with rice farmers and external individual investors attracted to the high profits offered by this industry, an examination of the trade-offs between shrimp farming and the other uses of wetlands is appropriate. Indeed, a simple comparison of current monetary values shows that the estimated partial economic value of wetlands of VND 26.9–35.1 million per hectare is higher than the average annual income estimated from extensive shrimp farming of VND 20.0 million per hectare, but is lower than that of semi-intensive shrimp farming or intensive shrimp farming, which provide annual incomes of VND 54.2 million and VND 256.0 million per hectare respectively. Caution must be exercised, however, when drawing conclusions based on such simplified comparisons.

It should be noted that, in computing the income from shrimp farming, social costs were not included in the analysis. The actual costs of shrimp farming are in reality much higher than computed figures, since data on externalities are usually not available. More importantly, however, the analysis also did not account for the environmental costs associated with shrimp farming, such as the loss of mangrove areas, water pollution, and the associated declines in fish productivity. It should also be noted that intensive shrimp farming is often subject to high risks, especially of disease. Given these factors, and the strain already placed

Figure 3. The elements of economic value of mangrove forest in Thanh Phu district, Ben Tre province, Vietnam



Note: Estimates based on consultations with stakeholders and experts

on wetlands by existing shrimp farms, one may also expect that the income from one hectare of shrimp farm will decline sharply as additional wetlands area are converted for shrimp farming. Future management of the shrimp farming industry requires a focus on sustainable practices and greater involvement of the local community, rather than on short-term profit.

Discussion

During the literature review, the economic working group identified several available approaches for resource valuation. However, the selection of an appropriate method was a challenge. The main constraint that limited the analytical approach was the lack of reliable statistics. The economic valuation was, therefore, based mainly on aggregate data, without detailed information on values of different wetland types and differences in perceived importance of wetlands products and services between various local stakeholders, particularly the poorer farmers. A more detailed economic valuation is therefore needed to provide decision-makers with the information they need in order to make decisions about wetlands use and management. Wetland resource management is complicated by the variations in perceived values, differing levels of understanding of problems and solutions, and incomplete scientific understanding of the hydrological relations between the many wetland components. Moreover, the level of support from community leaders varies and there is a lack of coordination amongst agencies involved in the use and management of wetlands.

From the economic valuation exercise, it was also noted that the lack of reliable statistics on resource use is one of the main constraints limiting the application of available economic valuation methods. Statistical data usually do not cover the bio-resources harvested by subsistence farmers. Statistical data are also usually aggregated at the commune and higher levels. Data are not disaggregated according to wetland types or wetland use.

Field surveys are noted as essential in providing useful information for the analysis. Field surveys can provide information on the multiple uses of resources as well as appropriate methods for participation in resource management. They can also help identify wetland uses that conflict or interact with other uses.

Insufficient awareness of the multiple uses of wetlands at the various decision-making levels was noted. Through discussions with the local authority, it became clear that some improvements in wetlands management could be achieved if the multiple values of wetlands were more widely understood. This would contribute to, for example:

- Better development planning decisions that took into account the multiple uses of wetlands
- Formulation of policies and provision of incentives that lead to improved resource management
- An optimal balance between economic development and wetland conservation.

It is critical to recognize both the inter-linkages within a wetland ecosystem and the benefits that can be obtained if the wetland is managed in an integrated manner and used in a sustainable way. Sustainable wetland management is a challenging task that requires integrated action and cross-sectoral coordination at many levels and among many management institutions. Such an approach must begin with the involvement of all stakeholders in the wetland.

The economic evaluation of wetlands and the analysis of information for decision-making is not a one-off process. It is important to improve the valuation approach and link it to the policy process. Sustainable management of wetlands requires continuous collection and analysis of environmental and economic information, and the communication of such information to decision-makers. This, in turn, requires improving the capability of local staff to collect, process, store, analyze, and report data to policy-makers.

It is also important that researchers identify the losers and winners in situations where wetlands are converted to other uses, and the reasons behind the overexploitation of wetland resources. Such information would be useful for decision-makers in wetland management. The case study in Thanh Phu, for example, showed that some local people could end up bearing the costs of wetland conservation projects. This presents a major economic disincentive to wetlands conservation. When local people are expected to bear the costs, they are likely to be less willing to support

such projects. In such cases, a compensation mechanism could provide economic incentives for local people to protect wetland resources and offset loss of benefits associated with other uses.

Assessment of the value of wetland resources, especially to poorer groups, would require:

- The involvement of local stakeholders, particularly the poorer groups, in the economic valuation process. This could be achieved by use of a Participatory Economic Valuation Approach.

- An assessment of the relative importance of wetland products, functions, and attributes for the various groups of local people, with a special focus on the poorer groups. This could be achieved using a ranking method.

In general, only a few studies have attempted to estimate the economic value of specific wetland types. There is no systematic information available for the economic valuation of various wetland ecosystem types in the country. During the secondary data collection process at both study sites, the research team collected a large number of research reports, government statistics, and project documents. In many cases, aggregate data on wetland resources, production and uses were available, but lacked the detail needed for economic valuation of a specific wetland type.

Official economic data usually provide only partial valuation of some types of wetland use, such as use for rice or aquaculture production. These data are usually estimated on the basis of marketable production value. There is no economic value provided for the whole wetlands system. Data are usually aggregated at the commune level but not disaggregated according to wetland type or wetland use. Production data usually provide estimates of only a subset of the actual production from wetland resources; these data are usually only the marketed quantity. There is usually no detailed data on wetland use for the various income groups, particularly the poorer group. Statistical data do not cover the value of harvested bio-resources by subsistence farmers. In this project, partial economic value was estimated on the basis of average market prices for goods and services sold. Many goods and services important to poorer groups, and others, but not sold in conventional markets, are usually not included in statistical data.

In particular, there is no systematic database for the economic analysis of wetlands. Most critical is the lack of data on biophysical relationships that would allow measurement of the ecological function of wetlands and wetland resources. There is a lack of information on the exact links between different wetland uses, particularly the marginal impact of destruction and conversion of parts of the wetland to other uses such as shrimp farming.

One of the missing elements was the value of water transportation using small boats; this is an important form of local transportation for goods and people that is not captured in the economic value of either the wetlands or the transportation sector. Other missing elements include the values of fertile sediments for rice cultivation in the Mekong Delta; of harvesting wild fish and other aquatic products such as frogs, snakes, shells, crabs, shrimps, insects, and aquatic plants; and of collecting firewood and non-timber products such as wild honey in the melaleuca forests. These products and services are important for local farmers, especially the poor, but their values are not included in statistical data.

The project has initiated an open dialogue on wise use and sustainable management of wetlands in the Mekong Delta with various local communities and stakeholders in Ben Tre and Long An. It is expected that this kind of dialogue would be useful in improving the management competencies of stakeholders.

Conclusions and recommendations

Conclusions

The project was aimed at estimating the economic value of wetlands and wetland resources, and analyzing the legal and institutional frameworks relating to wetlands and the resources found therein. The research was conducted in a participative way, involving various stakeholders in the process, and included awareness-raising and training activities. The main conclusions are summarized below.

Overall, the region is richly endowed with wetland resources, with industrial and service sectors just emerging. However, to some extent, wetlands in the region have not been sustainably managed. The project results suggest that this is caused by a sectoral rather than holistic approach

to management, lack of both quantitative data on wetlands and information on wetland management, and lack of active involvement of stakeholders in wetlands management. Faced with this challenge, the project team incorporated an awareness-raising element into the research process. Participants who were involved in the research now recognize that wetlands are a major source of wealth in the Mekong Delta; they regard them as important natural environments that are key to rural development and social equity.

Natural resources in wetland areas consist not only of ecosystem components, such as land, water, forests, wildlife, aquatic biological resources and waterbodies, but also their environmental functions, such as water distribution, prevention of saltwater invasion, fish migration and sedimentation. To date, these values have not been properly understood or accurately estimated. In this context, this project has demonstrated that accurate valuation could help generate options for wise use and sustainable management of wetlands and their resources. It was noted that natural resources would continue to drive the region's economy for decades to come; therefore, research to support wise use and sustainable management of wetlands is crucial. From a regional perspective, these processes are governed by the entire river system. From a local perspective, these processes are central to the livelihood of the majority of the population, be they farmers, fishers, aquaculturists, mangrove and inland wetland forest dwellers, boat operators on the river and canal network, or a manager of a bird sanctuary welcoming ecotourists.

There have been rapid changes to the environment and natural resource management systems in wetland areas of the Mekong Delta, especially since the *Doi Moi* in 1986. Natural resource management was observed to be moving in two directions. One is exploitation for economic activities—for example, the reclamation of wetlands for agriculture, the expansion of the area dedicated to shrimp ponds in the coastal mangrove forests, the expansion of the canal and dike network, and the development of infrastructure. The other is the natural resource and environmental protection programs, which focus on the establishment of national parks and natural reserves.

A review of the inventory and classification of wetlands shows a wide diversity of wetland types, from inland depressions to coastal areas. However, it is clear that existing terminology has not been consistently applied in official documents. The most recent classification, although comprehensive and based strongly on ecology, has not been very useful in local management because it was not accompanied by appropriate guidelines. Such guidelines would have demonstrated how to develop measures for wise use and sustainable management of different types of wetlands.

In many cases, agricultural development in the Mekong Delta is seen as central to rural development. This perspective emerged in a period when the country faced food security problems, and was continually supported by agricultural development agencies. In the study sites selected for this research project, agriculture, although a dynamic sub-system of natural resource management, was not regarded as the optimal use of land and was not the most important economic sector. Farmers seemed to be more able to operate in the market than were government agricultural agencies; in the Mekong Delta, except for the alluvial and the ridge zone, a large proportion of land with soils classified by government as 'problematic' for agriculture has been converted by local farmers to aquaculture.

An overly sectoral approach to natural resource management has seen two major trends develop in Vietnam. On the one hand, agriculture and aquaculture have been perceived as a response to rural economic growth and poverty alleviation, leading to short-term exploitation of natural resources while ignoring long-term consequences. On the other hand, natural resource management has been confined to protected areas or 'hot spots', resulting in 'islands' of protected areas surrounded and negatively impacted by external development and influences. Natural resource management in Vietnam has not been regarded in the larger context of land use and resource management; this has resulted in separate and contradictory results.

The limitations of the sectoral approaches have been manifested by the failure of government projects. Conflicts relating to resource use have also resulted. For example, conflict has arisen when local villagers, pursuing the economic opportunities of shrimp farming, have destroyed the dikes built for the prevention of salt invasion into agricultural land.

In spite of the potential offered by wetlands and government assistance, many rural communities in the Mekong Delta remain mired in poverty. Resources are often mismanaged and degraded, and new production systems are not well developed. The main assumption made here is that mismanagement is a result of a lack of awareness of wetlands' values. Consideration of the relationship between resources, the economy and the policy and legal framework in wetland management remains a challenge.

Recommendations

1. **Improve data and information use and develop management support tools.**
   Improved links between the generation of data and information, particularly at the district level, and the acquisition of data and information related to end-user needs would assist decision-making. Decision-support tools that improve information capture would also assist decision-making at the district level, and new methods and tools for information management would increase the effectiveness and efficiency of sustainable wetland management practices.

2. **Promote institutional linkages and develop forums and networks for sustainable management practice for wetlands.**
   Wetlands are open systems that are currently managed by various stakeholders. An integrated approach is required to address the issues of multiple stakeholders and resource users in wetland areas. Networking has proven to be a powerful tool to promote this approach. Networking would provide a channel for not only sharing experiences and capitalizing on empirical data, but also for the re-negotiation process among wetland user groups. These user groups are not confined by administrative boundaries (commune, district and even country); therefore, networking should be extended to cover regional trends that can affect the livelihood of local people. A local level forum would enable stakeholders to share perceptions about wetland management issues. Wetland development projects might be more successful if they involved both forum facilitators and networking aimed at sustainable management practices.

3. **Develop local co-management systems.**
   Although a process of land use privatization has been implemented, many wetlands remain as a common resource. Production on private land often relies on common property resources, such as saline water for aquaculture, fresh water for rice production, and dilution and transport of non-point pollution. As a result, access to and control over common property resources becomes a major issue, especially for rural people, since these common resources are often integral to the production of rice and fish. Recent trends however have shown opportunities for co-management. Since wetlands are open systems, co-management can help in the development of good management practices by helping to overcome the current problem where too much emphasis is placed on planning and not enough on monitoring. For wetland development projects, the concerns are not only on monitoring performance of the system but also on the ecological impacts. A set of locally-based criteria and indicators can be used to activate a participatory approach in natural resource management. Such systems, however, require that relevant issues are brought to the fore and clarified, and appropriate approaches to involving local wetland users in the monitoring process are developed and implemented, so that information can be captured with sufficient accuracy and depth.

References

Anh, Nguyen Ngoc. 2001. Water management in the Mekong Delta. Paper presented at the Workshop on Wetland Studies, Hanoi, 5-6 October 2000.

CSA (Canadian Space Agency). 2000. *Remote sensing data of the flood in the Lower Mekong Basin*. Communications Directorate, Canadian Space Agency, 6767 Route de l'Aéroport Saint-Hubert, Québec, J3Y 8Y9, CANADA.

MONRE (Ministry of Natural Resources and Environment). 2004. *Environmental Status Report for 2003*. Ministry of Natural Resources and Environment, Hanoi.

Thinh, Phan Trong. 2002. Wetland classification as a tool for wetland inventory and management in the Mekong Delta. Paper presented at the Workshop on Wetland studies, Hanoi 5-6 October 2000.

UNESCO. 1994. Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, Iran 2.2.1971), as amended by the Protocol on 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 [2001, July 19].

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Appendix 1. The Research Group

The Wetland Management Research Group (WMRG) was established with the participation of various institutions, including faculty members of NLU's Fisheries, Forestry and Economics Department, the Sub-Forest Inventory and Planning Institute (Sub-FIPI), the Sub-Institute for Water Resources Planning and Management (Sub-IWRPM), and the Research Institute for Aquaculture (RIA-2). The WMRG was divided into two sub-groups to implement the two components of the research. The Policy, Legal and Institutional component was led by Ngo An, a researcher of the Sub-FIPI, and the Economic Valuation component was led by Dr Dang Thanh Ha from Nong Lam University. Members of the Economic Valuation working group include researchers from different disciplines. In addition, the economic working group collaborated with local staff from DOSTE, DARD, DOF, and PC of Thanh Phu District.

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The legal and institutional basis for wetlands governance in Thailand and the economic value of wetlands in Surin and Buri Ram provinces, northeast Thailand

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* The official Thai calendar follows the Buddhist Era (B.E.), which begins in 543 B.C. The year 2005 AD is equivalent to the year 2548 B.E.

Introduction

Background

Wetlands are very diverse ecosystems and can mean different things to different people. Perhaps the best definition is the one provided by the Convention on Wetlands of International Importance (Ramsar, Iran 1971), commonly known as the Ramsar Convention –

"area of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters" (UNESCO 1994).

This definition is very broad, and includes coastal zone ecosystems such as coral reef flats, seagrass beds, mudflats and sandy beaches, mangroves, forests, estuaries and rivermouths; freshwater habitats, such as paddy fields, marshes, swamp forests, floodplain and lakes; as well as saline marshes and salt lakes. In this research, coral reefs and other exclusively marine systems have been excluded.

Wetlands are amongst the most complex ecosystems in the world; they also have high biological diversity. Only about 6% of the earth's surface is covered by wetlands but they provide habitats for about 20% of known species – and it is believed that there are many species that have not yet been described. Asian wetlands are important habitats for many animals (including rare and exceptional species of fish, amphibians, reptiles and mammals) and birds. Although wetlands have high fish, mammal and bird biodiversity, their significance can best be measured by their importance for invertebrates. This is because many invertebrate groups are aquatic at some stages of their life history and because, in many cases, the wetland food chain is dependent on invertebrate biomass.

In Asia, apart from hunting, the most important direct cause of biodiversity loss in wetlands is habitat destruction arising from draining and filling, coastal development, and conversion of natural ecosystems into areas for agriculture, industry, energy generation and human settlement. Other reasons for wetland loss include the overexploitation of plants and animals, invasion by introduced species, and air and water pollution. Climate change will also contribute to loss of wetlands. Ultimately, however, the current threat to biodiversity results from a complex variety of underlying social, economic, political, and cultural forces, and from trends operating on local, national, and international scales. These influences are so complex that it is probably not an overstatement to refer to them as being 'rooted in the contemporary human condition'. Economic externalities, adverse government policies, human population growth, and poverty are among the most powerful of these influences, and these factors are themselves strongly interconnected.

Essential to the wise use of wetlands is the development of coordinated wetland policies at the national, regional and local level. This necessitates the planning of wetland policies, conservation policies, or policies with a broader scope (environment, application of water laws, or resource planning), and calls for the establishment of appropriate institutional and administrative arrangements. Of considerable importance in policy development is the involvement of local people in decisions about wetland use, including the provision of information. Various legislative tools can be used to promote and implement wise use policies and practices. The many possible uses of, and benefits from, wetlands and wetland resources form the economic backbone of the country. At the same time it should be stated that little is known about the actual catches or value of inland wild fish, frogs, snails, crabs, etc. There are no real estimates either of the real or potential net earnings of, for example, the floating market or the bird sanctuary.

Wetlands in Thailand today are a mix of public or private resources. When talking about wetlands, most people think about marshes, swamps and the like, which in general are public. But, based on the existing classification, the focus needs to be broader than that. In reality, the largest type of wetland that exists in Thailand is rice fields/fish farms, and these are actually privately owned. Whether wetlands are public or private property directly influences their management.

Thai agricultural society extracts multiple benefits from wetlands, which sustain the staple Thai foods – rice and fish. These two commodities are the most dominant among a wide range of wetland products. The massive contribution of the wetlands to the sustencance of the Thai people underlines the importance of making explicit the value of such benefits in economic terms.

Objectives

The objectives of this study are twofold. The overarching development objective is to provide guidance on improving the legal and institutional operational framework for wetland management, while strengthening the economic rationale for doing so through a better and more comprehensive assessment of wetland values.

The immediate objective of the report, however, is to increase the capacity to manage wetlands in pilot areas (in accordance with the intention for local involvement as stipulated in the 1997 Constitution of Thailand).

Study team

This study was undertaken by a study team that worked in close collaboration with a project advisory group, under the guidance of the Thai Wetland Team. The members of these teams are listed under Appendix 1.

Study period

The study was undertaken during a three-month period from 11 April 2002 to 10 July 2002.

Scope of study

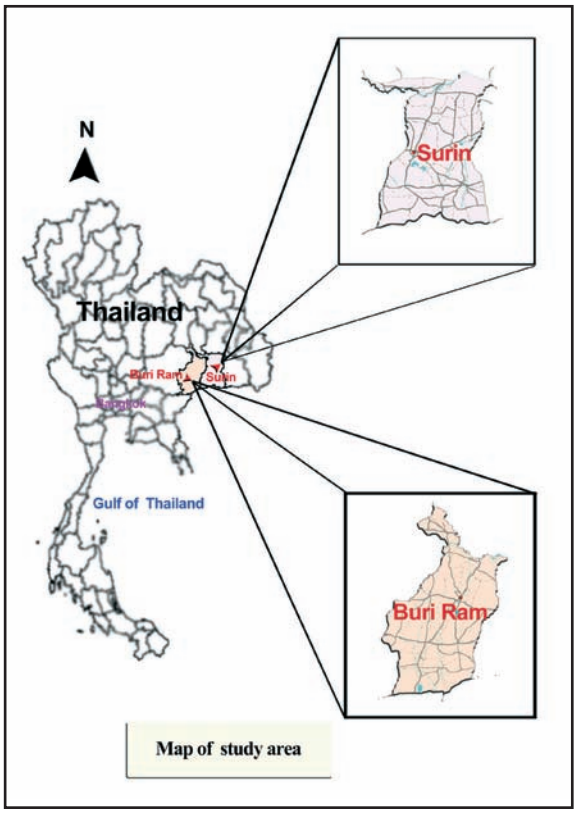
As the target area of the project was the Mekong River Basin, the project – which involved the compilation of data and information – focused (for the purposes of the economic valuation of wetlands) on two provinces in the northeastern region of Thailand that lie within the Mekong River Basin (Surin Province and Buri Ram Province – see Figure 1). Dominated by palustrine wetlands consisting primarily of swamps and ponds (Homchern 1999), these two provinces provided suitable case study sites for testing models for the valuation of wetlands.

In contrast, the work on the legal and institutional framework was conducted at the country level.

Methods used

The study involved a literature review, analysis of statistical information from relevant agencies, and consultation with experts and officers from central and regional agencies, and is divided into four parts. The first part provides an introduction to the research, the terms of reference and the methods used. The second part reports on the legal and institutional aspects of wetland management, while the third part provides the results of a review of the data available for undertaking an economic valuation of wetlands in Surin and Buri Ram provinces. The last part of the report consists of conclusions and some recommendations for wetland management regimes in the northeast of Thailand.

Figure 1. Map of Thailand showing location of Surin and Buri Ram provinces



Legal and institutional framework

This component of the study essentially involved providing an overview and analyses of the legal and institutional data collected. The research involved:

1. Review and analysis of existing policy and legal and institutional frameworks relevant to wetland management.

2. Review of the roles and duties of government agencies involved in wetland management.

3. Review of the division of jurisdiction among government agencies.

4. Compilation of information on local (traditional) practices and on local rights over wetland use.

5. Review of international agreements relevant to wetland conservation.

6. Identification of possible measures to improve legal and institutional arrangements.

7. Development of a meta-database on laws and institutions, and identification of effective and ineffective laws and regulations.

8. Coordination with Coastal Resources Institute (CORIN) to clarify gaps in legal and institutional information, particularly in terms of the comparison of coastal and freshwater areas.

Economic valuation

The study on wetlands economic valuation aimed to document the importance and value of wetlands. Existing secondary information and data were compiled, and a literature review was conducted. Site visits were carried out, and some relevant resource persons were consulted. The wetlands in northeast Thailand were then categorized and their various uses identified. These uses included the direct and indirect use of both public and privately owned wetlands in Surin and Buri Ram provinces.

At a later stage of the study, the economic valuation approach was selected, and information gaps and constraints in data were identified. This study employed the total economic valuation approach as a framework to assess the value of wetlands.

Institutional arrangements and legal aspects

Existing policies and legal framework relevant to wetland management

The National Sub-Committee on Wetlands Management

In 1993, the National Environment Board established the National Sub-Committee on Wetlands Management (NCWM). This Sub-Committee is comprised of Directors-General of various government agencies, such as the Royal Forestry Department, the Department of Fisheries and the Royal Irrigation Department, and representatives of the private sector along with several wetlands experts. The Sub-Committee has the following roles and responsibilities:

- Formulate national policies and plans for wetland management.

- Support, monitor and evaluate the implementation of wetland management pursuant to the national policy.

- Support, supervise and monitor the implementation of wetland management in accordance with the obligations stipulated in the Ramsar Convention.

- Promote the integration of wetland management concepts into the formulation and implementation of other natural resources development and conservation plans.

- Help to increase awareness of and provide education on the value of wetlands and wetland conservation.

- Support research on wetland issues.

- Coordinate with other concerned institutions both at national and international levels.

- Nominate a wetlands working group in accordance with approved work plans.

- Implement other tasks assigned by the National Environmental Board.

Policy, strategic measures and an action plan for wetlands management (1998-2002)

A policy, some strategic measures and an action plan for wetlands management have been formulated by the Sub-Committee on Wetland Management. A brief description of these is provided below.

Policy on wetland management

The overall policy aims are to conserve the wetlands intact and maintain their abundance of ecological functions, and to develop them for sustainable economic and social benefits of Thailand.

Strategic measures for wetland management

Strategic measure 1: Increase awareness of the importance and values of wetlands

- Coordinate the planning and implementation of promotional programs to increase awareness of the importance of wetlands.
- Establish a database and an information center focusing on the importance and values of wetland.
- Make government policies and strategic measures available to the public and facilitate public participation in the evaluation of wetland conservation initiatives.
- Enhance public awareness of wetland conservation through educational programs.
- Conduct regular public relations campaigns on wetland conservation.

Strategic measure 2: Wetlands management and coordination of wetland conservation

- Conduct studies and surveys to classify wetlands in Thailand.
- Formulate wetland management plans for different wetland types, for wetland conservation and for its sustainable utilization.
- Coordinate wetlands management between the public and private sectors, in accordance with policies, strategic measures and action plans, to ensure a constant harmonization towards a similar direction.
- Promote and support cooperation between the public and private sectors in conservation, protection and rehabilitation of wetlands.

Strategic measure 3: Capacity-building for concerned personnel

- Organize seminars, workshops and training programs on wetland conservation, including the legal aspects of wetlands conservation.
- Allocate budgets for training programs and study tours on wetland conservation and management, in order to increase knowledge and experiences of concerned personnel.

Strategic measure 4: Promote and support research and studies to obtain baseline information for wetland management

- Formulate research plans for wetland conservation and management and for sustainable utilization of wetlands.
- Establish a wetlands research network.

Strategic measure 5: Impose conditions on wetland utilization and private ownership of wetlands

- Prevent illegal encroachment on wetlands.
- Strictly monitor and evaluate wetland utilization and ensure conformance to existing laws and regulations.
- Strictly inspect the issuance of land title deeds in public wetland areas.

Strategic measure 6: Promote law enforcement and capacity-building of institutions

- Strictly enforce laws relevant to wetlands; review, revise, amend and supplement existing laws to increase their effectiveness in wetlands conservation.
- Capacity-building for all concerned institutions.

Strategic measure 7: Promote international cooperation for wetlands conservation

- Promote regional and international cooperation such as the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin of April 5, 1995.
- Exchange information and technology on wetland management and study tours.

The Action Plan for Wetland Management (1998 – 2002)

The Action Plan for Wetland Management (1998-2002) approved by the Cabinet involves the implementation of the seven strategic measures provided above. The strategic measures have been incorporated into the development plans of 14 concerned governmental institutions. As a result of this, there are currently 28 plans and 43 programs, with a combined implementation budget of 472.5 million baht.

Strategic measures on the conservation of wetlands of national and international importance

The Office of Environmental Policy and Planning (OEPP) has conducted a survey for an accounting and database system on a National Inventory of Natural Wetlands in Thailand. The Inventory categorizes levels of importance of natural wetlands as follows:

- ***Wetlands of international importance.*** These wetlands have unique regional or international characteristics. They are homes to threatened and endangered species of flora and fauna. There are 61 natural wetlands of this level in Thailand.

- ***Wetlands of national importance.*** These wetlands have national uniqueness. They are habitats for rare, threatened or close-to-extinction flora and fauna. There are 48 natural wetlands of this type in Thailand.

- ***Wetlands of local importance.*** These wetlands play important roles in local cultures, social values, traditions, religions, beliefs, history, folklore and recreation. There are 19 295 natural wetlands of this level in Thailand.

Accordingly, the OEPP formulated 13 strategic measures for the management of wetlands of international and national importance; these were approved by Cabinet on 1 August 2000 (see Table 1).

Cabinet resolution (23 July 1991)

The Cabinet passed the resolution on "the Report on the Present Situation of Mangrove and Coral in Thailand" in July 1991, the details of which are described below:

1. Acknowledge the study report on the present situation of mangrove and coral in Thailand, which was proposed by the Budget Bureau.

2. The National Forest Policy Committee shall formulate strict measures to stop mangrove destruction in Thailand in line with the proposal by the Budget Bureau and shall report to the Cabinet within 30 days.

3. The utilization of mangrove areas shall be completely terminated. The Ministry of the Interior shall direct all the provinces involved in order to set up a provincial committee that would consist of officials in charge of stopping mangrove encroachment and the termination of all applications for permission to use mangrove areas by the government sector.

4. The Central Bank of Thailand shall control loan providence by requesting private banks to stop the provision of loans to any project that might cause mangrove encroachment, mangrove destruction, or mangrove transformation.

National Economic and Social Development Plan No. 9 (2002-2006)

The 9th National Economic and Social Development Plan contains strategies designed to improve the economic and social development framework carried over from the 8th Plan, and simultaneously readjusted activities to improve the quality and the efficiency of use of natural resources and the environment. During the past four decades, the inappropriate and abusive use of natural resources in Thailand has led to severely degraded natural resources. Therefore, the 9th Plan emphasises the sustainable development of natural resources and the environment in order to maintain ecological balance. A participatory approach that involves all stakeholders is regarded as a means of natural resource management. The government is also attempting to improve governance and to introduce transparent practices.

The 9th Plan places wetlands management under the Biological Diversity Management Plan. This latter plan emphasises the maintenance of ecological balance through the establishment of information networks and the provision of financial support for biological diversity research. A legal framework to conserve essential flora and fauna was also formulated. Local people, local communities and other stakeholders are encouraged to participate in natural resource management. In addition, the establishment of protected areas, especially wetland areas, is regarded as high priority.

Legal framework

According to the 1997 Constitution, the environment is to be developed to meet the needs of population growth, but this must be harmonized with the principles of sustainable development. Many laws and acts express concern

Table 1. Strategic measures for the management of wetlands of international and national importance

Strategic measures	Main responsible agencies	Supporting agencies
1. Nomination of wetlands of international importance for listing as Ramsar Sites.	Office of Environmental Policy and Planing (OEPP)	Royal Forest Department (RFD) Department of Fisheries (DOF)
2. Proclamation of wetlands of international and national importance as non-hunting areas, protected areas or conservation areas, etc.	RFD, OEPP	DOF
3. Accelerating the issuance of Royal Gazette for public wetlands of international and national importance, and accelerating demarcation to prevent encroachment.	RFD, Land Department (LD) Department of Local Administration (DOLA)	Local Administrative Organization (LAO)
4. Rehabilitation of degraded internationally and nationally important wetland ecosystems to ensure continuance of their ecological and hydrological functions.	OEPP, RFD, DOF	Navy, LAO, Rapid Rural Department (RRD)
5. Formulation of a master plan for the short-term and long-term management of internationally and nationally important wetlands that provides a zoning system (e.g. conservation zone, development zone and buffer strips) and specifications of permitted and prohibited activities.	OEPP RFD	DOF, Department of Harbors, Education institutes, Land Development Development (LDD)
6. Requirements for the conduct of Environmental Impact Assessments (EIA) prior to the approval of any development projects that have a potential to alter internationally and nationally important wetlands.	OEPP	RFD, Educational institutes, Royal Irrigation Department (RID)
7. Enhancement of awareness and knowledge of the values of wetlands among local communities, and encouragement of local participation in the planning processes for management of internationally and nationally important wetlands.	RFD, Environmental Quality Promotion (EQP), Educationl institutes	Non Government Organization (NGO) LAO
8. Promotion of research and studies on internationally and nationally important wetlands and continued information dissemination to the public.	RFD, DOF, Educational institutes	EQP OEPP
9. Continued monitoring of change in wetland ecosystems with clear factors and indicators.	RFD, DOF, OEP, Pollution Control Department (PCD)	Educational institutes
10. Continued studies and surveys on wetlands and their bio-diversity, to help in the revision of the list of wetlands of international and national importance in conformance with existing guidelines.	Sub-committee on Wetland Management, RFD, OEPP	
11. Control and prevention of pollution from non-point and point sources.	PCD, LAO	Urban Planning Department
12. Control of forest fires in wetlands of international and national importance: 1. Forest fire prevention. • Regulation of water level in the wetland forests. • Wet-line firebreak in accordance with the Royal initiatives. • Proactive public awareness campaigning to discourage open burning 2. Forest fire-extinguishing measures. • Establishing forest fire control stations in important wetlands. • Training staff on forest fire extinguishment • Providing appropriate and effective fire extinguishing equipment.	RFD LAO	RRD
13. Study and plan the landscape in the surrounding wetland areas of international and national importance to conserve and rehabilitate wetland ecosystems in both the short-and long-terms.	Urban Planning Department	LAO, NGO, RFD DOF, LD, RID

for the environment and support the conservation of natural ecosystems and their components, including wetland areas. Acts relevant to wetlands are described in the following sections.

***Constitution, B.E.* 2540* (1997)**

On 27 September 1997, in a combined House and Senate vote of 578 to 16 (with 55 abstentions), Thailand's parliament endorsed a new constitution. Among the main features of the new constitution are additional rights and freedoms for people, and clearer definitions and limitations of the role of the Government. The new constitution is expected to radically change the political landscape of Thailand. It aims to eliminate, or at least minimize, unnecessary political influence on administration, and enhance transparency, accountability, responsibility and fairness. It provides for an independent election commission, citizens' access to an anti-corruption body overseeing politicians elected to office, proportional representation for a portion of seats, a stipulation that senators and provincial village chiefs be elected instead of appointed, and a requirement that Cabinet Ministers resign from their Parliamentary seats. The Constitution also provides a clear stipulation to accelerate the process of administrative decentralization in order to empower people; this would necessitate the establishment of many new Acts. The new constitution pays greater attention to social sectors, and includes an emphasis on education – with a goal to make 12 years of education compulsory. It also obliges the Government to pay sufficient attention to social welfare and environmental conservation.

Chapter 3 of the Constitution stipulates the rights and freedoms of Thai people to participate with government agencies in environmental protection programs aimed at sustainable development. In addition, the Constitution also ensures the right of Thai people to have free choice of occupation, provided they do not cause harm to the environment.

Apart from ensuring the rights and freedom of Thai people, Chapter 5 of the Constitution stipulates the State's fundamental policies that oblige the government to support and promote public participation in natural resource conservation and environmental protection. Article 79 of the Constitution states that "the State shall promote and maintain public participation in conserving, maintaining and utilizing the environmental resources in a balanced and sustainable way, including controlling and eliminating pollutants, which can cause damage to the health, or social well-being of its citizens".

***Fisheries Act, B.E.* 2490* (1947)**

This law was enacted in 1947 and has been revised twice (in 1953 and 1985). This Act is administered by the Minister of Agriculture and Cooperatives through the Director-General of the Department of Fisheries. The text of the Articles referred to in this section can be found in Appendix 2.

In Article 6 of the Act, fisheries are classified into four categories using an area approach. The categories are (1) Preservation fisheries, (2) Concession fisheries, (3) Reserved fisheries, and (4) Public fisheries. Article 7 empowers the Provincial Council, with the approval of the Minister, to designate fisheries within its province as any one of the four above categories. Fisheries that are not designated in the first three categories are to be regarded as public fisheries.

Aquaculture activities can fall under two categories of fisheries – reserved fisheries and public fisheries. The category 'reserved fisheries' can be granted to both freshwater aquaculture and coastal aquaculture (including mariculture). Normally, pond culture is operated on the farmer's properties; pond culture on private land is not subject to fishery tax and does not require a license because farmers have full rights over their property. Only shrimp farming has recently been required to be registered with the DOF. Trapping ponds in private land, however, are subject to fisheries tax. Paragraph 2 of Article 14 permits the digging and building of trapping ponds on private land provided that it does not harm aquatic animals in preservation fisheries.

Other activities, such as the use of stationary fishing gear, cage culture, pen culture and mollusk culture (e.g. oyster culture, mussel culture, blood cockle culture) are usually operated in natural waterbodies, which are public fisheries under the jurisdiction of the *Fisheries Act*. Therefore, farmers operating stationary fishing gears, cage culture and mariculture (mainly shellfish culture) in reserved fisheries must obtain licenses to do so and pay fisheries tax. The licensee has full rights to fish or operate aquaculture activities in reserved fisheries (Article 13). In this regard, reserved fisheries create property rights for licensees. Generally, before granting licenses to reserved

fisheries, the provincial fisheries office will organize a meeting of villagers in the locality to seek their approval. During the meeting a fisheries officer will inform them about the rights of the licensee over reserved fisheries. Normally, access to reserved fisheries will be granted for a period of 5-10 years with an annual fishery tax payable; failure to pay the tax results in license revocation.

Public fisheries are fisheries in which fishing or aquaculture activities are allowed without a license and without the imposition of a fisheries tax. However, these fishing and aquaculture activities have less legal protection than those in reserved fisheries, because access is open to anyone who wants to fish or carry out aquaculture activities within them.

The *Fisheries Act* also prohibits some activities with the potential to degrade water quality. Article 17 prohibits the erection of any structures or the plantation of water plants in all fisheries areas because these may deter water flow. However, permission may be granted for the plantation of water plants, such as lotus, rice, jute, etc., in swamps or wetlands in reserved fisheries areas as local people usually collect these water plants for their living. Article 18 prevents the drainage of water from preservation fisheries, concession fisheries, reserved fisheries and public waters. It also prevents the setting up of trapping ponds or the drying up or diminishing of water in these fisheries areas without a license.

Article 19 prohibits the use or disposal of chemicals or poisonous substances that stupefy aquatic animals. Presently, the Ministerial Regulation specifies only 12 kinds of prohibited chemical or poisonous substances, such as DDT, Dieldrin, Aldrin, etc. Article 20 prohibits the use of explosives or electricity in fisheries because, in addition to endangering the user, both destroy aquatic animals and their habitat over a wide area. However, the use of explosives and electricity in fisheries may be allowed for scientific purposes, if a permit has been obtained from the Minister.

Articles 21 of the Act prohibits the alteration of watercourses in fisheries areas that are not privately owned without a permit, because these activities may affect other users. Article 22 prohibits the erection, setting up or building of structures such as dikes, dams, screen fences and fishing nets that may obstruct the passage of aquatic animals in public fisheries areas, without a permit. Article 22 also allows the addition of fish ladders[3] and other structures that enable aquatic animals to swim upstream and downstream, around dams or water gates.

Chapter 2 of the *Fisheries Act* regulates the cultivation pond. Article 23 of Chaper 2 prohibits construction of cultivation ponds in public areas unless permission is obtained, and Article 24 provides tax exemption for fishing in cultivation ponds.

Chapter 3 of the *Fisheries Act* regulates the registration and application for fishing permits. Article 25 empowers the Minister to proclaim the Royal Decree requiring persons who engage in fisheries to register with the DOF before operating their fishery activities. In 1991, the Royal Decree requiring the registration of shrimp farmers and shrimp hatchery operators with the DOF was proclaimed. Other aquaculturists are not required to register.

Chapter 5 of the *Fisheries Act* controls fishing activities. Article 54 controls the importation of live aquatic animals and related quarantine procedures. Article 55 controls the introduction of exotic aquatic animals. However, only aquatic species listed in the Royal Decree are subject to the Act. These two articles have been used to implement the regulations provided in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It should be noted that these two articles control only *importation* of live aquatic animals; they do not control the *export* of live aquatic animals. The *Fisheries Act* has no mandate to control export of aquatic animals.

Most provisions of the *Fisheries Act* do not regulate discharged wastewater or set standards for water quality. However, in 1994, the notification of the Royal Decree required the registration of shrimp farmers and shrimp hatchery operators, and some conditions were imposed on shrimp farmers to control the quality of waste effluent from their farms. Shrimp farms larger than 50 rai (8 ha) were required to construct a wastewater oxidation pond equal to 10% of the size of the whole water area. A condition was also imposed that that the Biochemical Oxygen Demand (BOD) value of

[3] Fish ladders are a series of ascending pools built to enable fish to swim upstream past a dam.

effluent should not exceed 10 ppm. Legal action would be taken against farmers who discharge bottom clay or residue from ponds. The government would also operate a monitoring program of coastal waters, improve drainage canals and tributaries, and provide technical assistance and advice to farmers.

***Wildlife Reservation and Protection Act, B.E.* 2535* (1992)**

The *Wildlife Reservation and Protection Act, B.E.* 2535* (1992) replaced the old *Wildlife Reservation and Protection Act, B.E.* 2503* (1960). Only the Royal Forestry Department (RFD) was responsible for the old Wildlife Law, but the current *Wildlife Reservation and Protection Act*, is under the jurisdiction of both the RFD and the Department of Fisheries (DOF). This is because the definition of wildlife in the new Act was widened to include aquatic animals. The DOF is responsible for aquatic animals and crocodiles, while the RFD is responsible for terrestrial animals and birds.

This Act provides two lists of endemic endangered species: (i) the list of reserved species notified by Royal Decree, and (ii) the list of protected species notified by Ministerial Regulation. The Act prohibits hunting, possessing, breeding, trading, importing and exporting all species on these two lists. However, for species that can be bred in captivity, the second generation offspring can be traded, possessed, exported or imported pursuant to CITES regulations.

As a result, the Act also provides a list of captive-bred species notified by the Ministerial Regulation. Examples of endangered species bred in captivity include crocodiles, pythons and the Asian bony tongue fish (Arowana). In relation to aquaculture, only the aquatic animal species in the captive breeding list are allowed to be cultured. Other aquatic animals in the two lists of endemic endangered species are not permissible for aquaculture. In addition, captive-breeding operators are required to register, obtain a permit, and pay the due tax to either the RFD or the DOF.

The Act provides a channel for the implementation of the CITES regulations. Article 23 empowers the Minister to proclaim the list of animal species (different from those two lists of endemic endangered species) requiring a permit for exportation or importation (not CITES permits). This provision can help control both the introduction of exotic species and quarantine. Article 24 serves CITES regulations by issuing CITES permits for animal species listed in CITES Appendices. The Act also regulates private and public zoological gardens, which rear wildlife and aquatic animals.

In relation to wetland management, this Act provides a mandate to establish protected areas. Protected areas established under this Act can be divided into two types, (i) Wildlife Sanctuary Areas, and (ii) Non-hunting Areas. A Wildlife Sanctuary Area can be established by Royal Decree, and strictly controlled regulations apply to it. A Non-hunting Area can be established by the Royal Gazette, and is less regulated. The law automatically protects wetlands situated within these protected areas.

***National Environmental Quality Promotion and Preservation Act, B.E.* 2535* (1992)**

This Act is a revised version of the previous 1975 Act. It is the responsibility of the Ministry of Science, Technology and Environment (MOSTE). Upon the enactment of this law in 1992, MOSTE was divided into three agencies: (i) the Office of Environmental Policy and Planning (OEPP), (ii) the Department of Pollution Control (DPC), and (iii) the Department of Environmental Quality Promotion (DEQP). The text of the Articles referred to in this section can be found in Appendix 3.

The Ministerial Regulation of Article 55 of this Act sets quality standards for industrial wastewater, but it does not include wastewater discharged from aquaculture. The Act requires Environmental Impact Assessments (EIAs) for large-scale projects. Furthermore, Articles 43, 44 and 45 of the Act empower the Minister of MOSTE to proclaim the Ministerial Regulation determining "environmentally protected areas" and "pollution control areas", in addition to regulating the activities in these areas. However, because MOSTE has an inadequate number of staff in the provinces, these regulations are inadequately enforced. Normally, enforcement is carried out by provincial police and various provincial government officers.

The Act can serve as a legal instrument to protect a wetland, by designating it as an "environmentally protected area", regardless of whether it is privately or publicly owned. Such "environmentally protected areas" can be established by Ministerial Regulation.

***Navigation in the Thai Waters Act, B.E.* 2456* (1913, revised in 1992)**

This Act was enacted in 1913 but has been revised several times; the most recent version (Number 14) being promulgated in 1992. This Act is the responsibility of the Department of Harbors and the Ministry of Transportation and Communication (MOTC). The main objectives of the Act are to regulate navigation and water transportation in Thai waters and to regulate the construction of, registration and license issuance for all vessels, including fishing vessels. In addition, the Act prohibits the disposal of waste into the watercourse, either from vessels or from land-based sources. The text of the Articles referred to in this section can be found in Appendix 4.

Article 117 of the Act prohibits the construction of anything above or below the water surface unless a permit has been obtained from the Department of Harbors. A permit from this Department is also required for the construction of commercial ports, fishing ports, marinas and piers. Article 119 prohibits the disposal of stones, rocks, sand, soil, mud, wastes, garbage, oils or chemicals into the watercourse without a permit from the Department of Harbors, because such disposal may cause sedimentation, contaminate water used by the public, harm living organisms, or endanger navigation activities.

Article 120 gives the Department of Harbors responsibility for the management of watercourses by the removal of sediment from the bottom of rivers, canals, lakes and internal sea waters in order to make room for navigation, generate water flow, and to maintain healthy watercourses. In addition, Article 120 prohibits activities that may cause alteration of watercourses unless a permit has been obtained from the Department of Harbors.

In relation to aquaculture, the DOF is required to seek approval from the Department of Harbors before granting permits for stationary fishing gears, cage culture, shellfish culture and other similar cultures for reserved fisheries, because this may cause alteration of watercourses.

In relation to wetland management, the Act regulates encroachment of and construction within public freshwater and marine wetlands.

***National Reserved Forest Act, B.E.* 2507* (1964)**

This Act aims to protect reserved forests and natural resources within reserved forests. Previously, intensive surveys were carried out to identify the areas of proposed reserved forests, before these areas could be officially designated as reserved forests. The enactment of the *National Reserved Forest Act* in 1964 aimed to change this slow procedure by making it possible to designate intended reserved forests in advance, by Ministerial Regulation. Any person not satisfied with such a designation is entitled to challenge the decision by submitting a petition to the Head of District Office within 90 days from the effective date of the Ministerial Regulation.

In reality, many villagers occupy and use areas within these reserved forests. The Act only recognizes the occupation and use rights of persons with land title deeds issued by the Department of Lands pursuant to the Land Code, B.E.* 2497. These procedures are also applicable to mangrove reserved forests, which means that there are many villagers within these forests with the rights to legally exploit mangrove forests.

***National Park Act, B.E.* 2504* (1961)**

This Act aims to protect natural resources and the environment within national park areas in a manner similar to that of the *National Reserved Forest Act* in relation to forests. However, in comparison, national parks supposedly have a higher level of protection since the *National Park Act* does not allow any use within national park areas. The main objective of the Act is to maintain natural resources within national parks for educational and aesthetic purposes. Marine national parks and national parks along coasts are automatically protected as mangrove forests under this Act. Presently, there are 26 marine and coastal national parks along the coasts of Thailand (RFD 2002). Although these areas are legally protected, illegal encroachment and use regularly occur within these parks. For example, there are several illegal shrimp farms in Khao Sam Roi Yod National Park, in Prachuap Khirikhan Province.

Wetlands situated within national parks are also automatically protected under the Act, and national parks can be established by Royal Decree. Currently, Thailand has 114 terrestrial national parks covering an area of 39.628 million rai, equivalent to about 12.36% the country's total

land area. The government is preparing to establish another 33 national parks (RFD 2002).

Draft Community-based Forest Management Act, B.E.*

This Act is still draft legislation. Its aims to grant use rights to local people residing close to reserved or protected forest areas. Use rights are granted to the community and not to the individual. Together with use rights, the community takes on the duty to conserve the forest and ensure sustainable use.

At the national level, the Act establishes a Community-based Forest Management Policy Committee chaired by the Minister. At the provincial level, the Act establishes a Provincial Community-based Forest Management Committee chaired by the Governor of the province.

Communities eligible to establish community-based forest management can apply to the Provincial Community-based Forest Management Committee. An eligible community should have a membership of more than 50 people and is required to submit to the Committee a management plan demonstrating conservation measures, rehabilitation measures, development plans, environmental preservation measures, and use plans.

The Act also establishes a Community-based Forest Management Fund to be used for community-based forest management activities.

***Local Administration Act, B.E.* 2457* (1914)**

This Act is administered by the Ministry of the Interior. It has the provision to protect against encroachment on or illegal occupation of wetlands in rural areas, by empowering the provincial committee to monitor the use of water for public interests. However, this Act appears to be inadequately enforced.

***Tambon Administrative Organization Act, B.E.* 2537* (1994)**

This Act is also administered by the Ministry of the Interior. Its main objective is to decentralize resource administration to the level of a sub-district (*Tambon*). Each Tambon Administrative Organization (TAO) is responsible for the conservation of natural resources within its territory. A TAO also has the duty to formulate an annual development plan and issue regulations to direct activities within its territory.

TAOs obtains their funds from two sources – taxes on activities within its territory, and an annual budget provided by the government. The Act stipulates that fisheries taxes and other taxes generated from the use of natural resources within its territory will be given to the TAO. For example, the RFD collects an entrance fee to a national park and these fees are channeled to TAO.

In relation to wetland management, TAOs provide a means of conserving wetlands through the establishment of local committees to manage wetlands located in its territory. TAOs are also able to collect taxes from the use of such wetlands.

***People's Irrigation Act, B.E.* 2482* (1939)**

There is a tradition of separate private and public irrigation development in Thailand, resulting in separate laws governing the two. Water for irrigation purposes may be used in four different systems: private irrigation, people's irrigation, contractual irrigation and state irrigation. Private irrigation is considered to be the oldest system of irrigation practiced in Thailand. This method of irrigation is governed by Articles 7 to 10 of the *People's Irrigation Act, B.E.* 2482* as well as by the relevant provisions in the Civil and Commercial Code.

The people's irrigation system, which refers to "any irrigation system jointly constructed by the people for the benefit of cultivation by the people within that locality," is governed by Articles 11 to 29 of the *People's Irrigation Act*. Article 11 empowers the Provincial Commissioner to determine and declare "the area of any river, stream, creek, swamp, canal, marsh, bog or source of waterway" as belonging to this category, and to monitor and prohibit any action that may obstruct irrigation within an area so designated. Although such a system is placed under government control, the irrigation works can be constructed either by individuals or by the State, or jointly, and have to be approved by the majority of the users benefiting from them (Article 12).

Article 4 of the *People's Irrigation Act* defines "contractual irrigation" as "irrigation works constructed by any person for remuneration, which is to be obtained from those who are desirous of making use of the water from such

irrigation works for purposes of cultivation." This type of undertaking is dealt with in Articles 30 to 37 of the Act, covering the construction of such works, a concession from the Ministry of Agriculture and Cooperatives. The concession establishes all the conditions concerning the extent of the works, the remuneration, the reports to be submitted, and other issues concerning contractual irrigation (Articles 39 to 41).

***Dikes and Ditches Act, B.E.* 2505* (1962)**

The main purpose of this Act, which is under the jurisdiction of The Royal Irrigation Department (RID), is the provision of water for agricultural areas. This Act can be a legal instrument for wetlands conservation in the field. The text of selected sections of this Act related to wetlands can be found in Appendix 5.

Institutional arrangements relevant to wetland management

Constitutionally, the management of wetlands is the responsibility of the government, and should be governed by laws and regulations of various governmental agencies. In general, wetlands within protected areas are protected by laws and managed by government. Wetlands outside protected areas are usually managed by communities or private enterprises.

Roles and duties of government agencies involved in wetland management

The Thai governmental system is organized at two levels – the central government level and the local government level.

Central government agencies

There are numerous central government agencies involved in wetland management in Thailand. However, the core agencies are as follows:

Ministry of Science, Technology and Environment

The Ministry of Science, Technology and Environment is responsible for the coordination of regulations and guidance relating to wetlands management and for the monitoring and evaluation of reports on the implementation of national policies on wetlands management. It is also responsible for conducting training programs on wetland management.

Ministry of Agriculture and Cooperatives

The Royal Forest Department (RFD) is responsible for the production and conservation of forests and their influence on wetlands systems. The Director-General of RFD is responsible for the protection and management of wetlands in protected and conservation areas, the protection of wetland flora and fauna, and the principal training of wetland managers and rangers.

The Department of Fisheries (DOF) is responsibility for the conservation of aquatic species and the protection of wetlands as habitats of fish.

The Department of Land Development (DLD) is responsible for providing technical guidance for the management of wetlands and for the use of soil associated with water use.

The Royal Irrigation Department (RID) is responsible for the regulation of water use, for the provision of water support to farmers and other water users, and for the construction of irrigation infrastructure.

Ministry of the Interior

The Ministry of the Interior is responsible for the coordination and provision of guidance to provincial governments and local governments responsible for wetlands management activities.

The DLD is responsible for directing the allocation of land to each individual according to the national and regional landuse plan and legal requirements.

Office of the Prime Minister

The National Economic and Social Development Board is responsible for the coordination and planning of government programs and the finances for the management of wetlands resources.

The Tourism Authority of Thailand is responsible for tourism in wetlands, including coastal wetlands.

Ministry of Public Health

The Ministry of Public Health is responsible for the standards of public hygiene associated with water quality and waste disposal. The Ministry is

also responsible for raw materials and water usage, and processing and quality control procedures in pharmaceutical production.

Ministry of Industry

The Ministry of Industry is responsible for providing information on quality standards of raw materials and for regulating water discharged by industries into wetland resources.

Ministry of Transportation

The Department of Harbors is responsible for regulating navigation in Thai waters and for protecting the watercourses.

Local government agencies

Provincial Administrative Organization

The Provincial Administrative Organization (PAO) is established by the *Provincial Administrative Organization Act, B.E.* 2540*. Every province has one PAO, which has the responsibility to coordinate with other governmental organizations and other local administrative organization, such as the Tambon Administrative Organization (TAO). PAO also has the responsibility to protect and conserve natural resources and environments within its territory, and this includes the protection and conservation of wetlands.

Tambon Administrative Organization

The Tambon Administrative Organization (TAO) is established by the *Tambon Administrative Organization Act, B.E.* 2537*. TAO is responsible for wetland management within its territory, and is currently playing an essential role in the protection and conservation of wetlands on which people residing in the village depend for their livelihoods.

Division of jurisdiction among governmental agencies

It is the policy of the present government to reform governmental organization. For this purpose, in October 2002, the Cabinet passed two bills – namely, the *Public Organization Act, B.E.* 2545* and the *Restructure Ministry, Bureau, Department Act, B.E.* 2545*. This reorganization resulted in the establishment of 20 Ministries from the previous 15 Ministries, as shown in Table 2.

The structure and arrangement of institutions for wetland management in Thailand is complex. There is often overlapping and duplication of work, overlapping of power, and a lack of coordination and cooperation.

Apart from the duplication of work and power, there are also numerous loopholes in the legislation. Furthermore, there is confusion

Table 2. List of Ministries before and after cabinet reorganization of October 2002

Ministries before October 2002	Ministries after October 2002
1. Office of the Prime Minister	1. Office of the Prime Minister
2. Ministry of Defense	2. Ministry of Defense
3. Ministry of Finance	3. Ministry of Finance
4. Ministry of Foreign Affairs	4. Ministry of Foreign Affairs
5. Ministry of Education	5. Ministry of Education
6. Ministry of Agriculture and Cooperatives	6. Ministry of Culture
7. Ministry of Transportation and Communication	7. Ministry of Tourism and Sports
8. Ministry of Commerce	8. Ministry of Agriculture and Cooperatives
9. Ministry of the Interior	9. Ministry of Transportation
10. Ministry of Justice	10. Ministry of Information and Communication Technology
11. Ministry of Labor and Social Welfare	11. Ministry of Commerce
12. Ministry of Science, Technology and Environment	12. Ministry of the Interior
13. Ministry of Public Health	13. Ministry of Justice
14. Ministry of Industries	14. Ministry of Labor and Social Welfare
15. Office of University Affairs	15. Ministry of Science and Technology
	16. Ministry of Natural Resources and Environment
	17. Ministry of Public Health
	18. Ministry of Industries
	19. Ministry of Energy Development
	20. Ministry of Social Development and Human Security

among the various government agencies when it comes to enforcement of laws; in some instances, new agencies are mandated to enforce the same laws as the old agencies. A transitional period of at least two years before the organizational system became clearly established was anticipated.

International agreements relevant to wetlands conservation

Thailand is a party to many International Agreements relevant to wetlands management, such as the Ramsar Convention, The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the World Heritage Convention.

The Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar, 1971)

The main, legally binding international convention that deals with the management of wetlands in Thailand is the Convention on Wetlands of International Importance, Especially as Waterfowl Habitat 1971, known as the Ramsar Convention. Thailand acceded to the Ramsar Convention in 1998, and is therefore bound to comply with the articles stipulated therein. In relation to legislation and other legal instruments, Thailand has to conform to the objectives and spirit of the convention.

The Ramsar Convention is an intergovernmental agreement, which provides the framework for international cooperation in the conservation of wetlands. One of the obligations under the Convention is to designate wetlands of international importance for inclusion on the list of Ramsar sites. Already, more than 1 230 wetland sites throughout the world are listed under the Convention, covering more than 105.9 million ha of wetland habitat (as of 22 December 2002). The principal obligations of the Contracting Parties under the Convention are:

- Promoting the wise use of wetlands and their resources
- Designating wetlands for inclusion on the list of Wetlands of International Importance
- Cooperating with other countries in implementing wetland conservation activities
- Creating wetland reserves.

The Ramsar Convention provides guidelines for the wise use of wetlands. Wise use promotes the modification of human activities in wetlands so that they are compatible with the protection of the long-term ecological values of wetlands. This use leads to the continuation of benefits for the present and future generations.

Wetlands of International Importance are a focus used by the Convention to demonstrate best-practice management and wise use of wetlands. The Convention has developed certain criteria for management and wise use. The parties are encouraged to nominate specific wetlands, which qualify according to the criteria. The criteria relate to a wetland's values and attributes, its uniqueness, its biodiversity, and its importance as waterfowl habitat. Once a site is listed as a Ramsar Site, Contracting Parties are expected to manage the site to maintain the ecological characteristics for which it was nominated.

Countries that are Parties to the Ramsar Convention promote wetland conservation by:

- Nominating specific sites for inclusion on the list of Wetlands of International Importance, which will then be continually monitored to ensure that they retain their special ecological characteristics
- Promoting the wise use of wetlands within their territory
- Promoting the training of wetland managers
- Consulting with each other, particularly in the case of a shared wetland, water system or resources, such as migratory waterbirds
- Creating and managing wetland reserves.

Thailand nominated Thale Noi Non-hunting Area in Puattalung Province, as a Ramsar Site in 1998. In 2002, Thailand designated the Bung Khong Long Non-hunting Area (Nong Khai Province), Don Hoi Rord (Samut Songkram), Krabi River Estuary (Krabi Province), Nong Bongkai (Chiang Rai Province), Princess Sirindhorn Wildlife Sanctuary (Phru To Daeng Peat Swamp Forest) (Narathiwat Province), Hat Chao Mai Marine National Park-Libong Islands Non-hunting Area-Trang River Estuary (Trang Province), Laemson National Park-Kapoe Estuary-Kra Buri River Estuary (Ranong Province), Ang Thong Islands Marine National Park (Surat Thani

Province), and Phang Nga Marine National Park (Phang Nga Province) as nine additional Ramsar Sites.

The Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972)

The World Heritage Convention requires parties to take steps to identify, protect, conserve, present and transmit to future generations the cultural and natural heritage within their territories. Cultural and natural areas of outstanding universal value are eligible for listing in the World Heritage List. The Convention has established the World Heritage Fund so that the World Heritage Committee can assist countries in establishing and conserving World Heritage Sites.

Thailand has been a signatory to the World Heritage Convention since 1980. Many outstanding cultural and natural areas in Thailand have been designated on the World Heritage List. One of them – Phangnga Bay, located in the southern part of Thailand – is a wetland area.

Economic valuation

Approaches, scope and methods used

Approaches for economic valuation of wetlands

Definition and importance of economic evaluation of wetlands

Wetlands contain a diversity of multifunctional environmental resources. Because of this, development and conservation of wetlands need to be based on their sustainable use. In turn, sustainable use needs to take into account both the limited nature of the resources and the opportunity cost associated with present use of the resources, in such as way that equitability and effectiveness of resource use are thoroughly assessed for current and future generations. This could result in a dynamic management of wetlands that requires determining the actual values of each component resource. The economic representation of environmental value as 'goods and services without a market' may not always be effective in estimating the 'willingness to pay' value for maintenance of ecosystems. Management decisions based on costs and benefits associated with natural resources, and the environment, should instead be considered as a basis for management (Prapamontol 2001).

Isvilanonda (1995) defines an environmental value as the "determination of specific quality of goods on [the] basis of desire and satisfaction." As he further explains, "The greater the satisfaction, the higher the value. The value of a particular good differs in accordance to its specific characteristics and is dependent on the valuators, time of valuation, objectives of valuation and conditions when it is valued." With limited natural resources in wetlands, and an increasing population, the demand for resources and the amount of waste generated would also increase. Therefore, public demand for wetland resources can also be another indicator of environmental value (Isvilanonda 1995).

Inefficient uses of wetland resources can lead to increased pressure on resources and to conflicts over use. Inefficiency may arise from incomplete assessment of all values of wetlands that contribute to the maintenance of underground water, support of plants, animals and microorganisms, and the balancing of the ecosystem. To prevent incomplete assessment and its implications, the concept and practice of estimating total economic value has been introduced. This practice extends the calculation of the value beyond physical resources, and includes functions that yield indirect benefits to humans. This requires assessment of several natural processes, such as hydrological systems, geomorphology and the use of plants in water treatment. Total economic valuation also needs to take into account intrinsic values, such as the role of wetlands as habitat for migratory birds and in preserving biodiversity, in order to ensure that estimates of the value of wetlands reflect *all* their functions, and can be used for developing effective measures for its wise use.

Principles concerning economic values of wetlands

One method for the valuation of wetlands has been proposed by Barbier et al. (1997), where the economic values of wetlands are assessed in fiscal terms. Values are converted into conventional preferences for goods and products. This idea was used as a basis for categorization of economic values for wetlands as shown in Table 3.

Categorization of economic values of wetlands

1. **Use value**, is the value of actual use or the value of product from wetlands that can be directly consumed or used, such as wood from

Table 3. The approach for categorization of economic values of wetlands

Total economic value				
1. Use value			2. Non-use value	
1.1 Direct use value	1.2 Indirect use value	1.3 Option value	2.1 Existence value	2.2 Bequest value
Goods and services that can be directly consumed	Value of benefits from ecological functions	Direct and indirect values in the future	Values that ensure existence of ecosystems	Use and intrinsic value that is left as heritage
For example: • Food • Recreation • Medicines	For example: • Flood protection • Storm protection • Balancing food cycle	For example: • Biodiversity • Conservation • Habitats	For example: • Habitat • Animal genetic resources • Plant genetic resources • Ecosystems	For example: • Habitat • No irreversible change

Source: Barbier et al. (1997)

forests, recreation and fishery. It can be further divided into;

- *Direct use value*, which is the value of natural resources and the environment in the form of products or services that can be used directly, such as fish, wood, herbs and food.

- *Indirect use value*, which is the value of benefits derived from the ecological function of natural resources and the environment, such as flood protection, water retention and sediment retention.

- *Option value*, which is the value that society gives to natural resources and the environment despite the fact that no goods or services are currently derived from the resources, such as biodiversity and the role of habitat for wildlife or spawning area for fishes. The value is the amount of "willingness to pay" for maintaining the value for the future.

2. **Non-use value** can be divided into

- *Existence value*, which is the value derived from knowing that the item or the environment will continue to exist in its original form. Loss of this value because of irreversible damage would result in regret and dissatisfaction. This value includes extinction of rare wildlife species that may result in the loss of uniqueness of an area.

- *Bequest value*, which is the value that the present generation preserves for future generations, by preventing destruction of natural resources and the environment and resulting loss of tradition, culture, livelihoods and traditional knowledge.

Types of economic valuation for wetlands

Impact analysis

Impact analysis is the assessment of the negative impacts of socially accepted activities; it is undertaken in order to develop prevention measures. The value can be determined by assessing the social impacts in the form of the possibility of the impact, or by analyzing projects with risks that carry obligations concerning loans or insurance.

Partial valuation

Partial valuation is a partial assessment of cost and benefits. It is used to develop options for projects where effective allocation and exchange of limited natural resources are required, or where the resources undergo certain change. Partial valuation would be of use, for example, when the development of upstream reservoirs affects the amount of water in downstream wetlands.

Total valuation

Total valuation is the cost-benefit assessment of the entire wetland system. The type of valuation is often used for issues related to restricted or regulated wetlands. It involves calculating both direct use values (such as fishing and hunting practices) and indirect use values (such as recreation and storm protection). Several techniques can be used for this type of valuation, including modeling marginal productivity for fishery resources; employing contingent valuation to estimate recreation value, by determining the willingness to pay for visits, or for participation in sports, hunting of wildlife, fishing and photography; assessment of travel cost; and,

estimation of damage cost (for storm protection value).

Scope of the study

This study focused on the compilation of data necessary to prepare a total economic valuation of the entire wetland system. The scope of the study provided for:

1. An overall picture of wetlands in the northeast of Thailand, with in-depth analysis of wetlands in Surin and Buri Ram provinces.

2. Documentation of the types and numbers of wetlands; estimation of the value of each usage; identification of information required for valuation; and, analysis of different types of data collection systems in order to identify both gaps and overlaps in the information.

Methods used

The study involved collection of data from all available sources, and a literature review of all scientific works that relate to wetlands. The study is divided into three stages (summarized in Figure 2).

Stage 1: Define goals and objectives

At this stage, goals and objectives were defined, and an assessment approach for the study was determined. The total valuation method was selected for the estimation of economic values of wetlands in Surin and Buri Ram provinces.

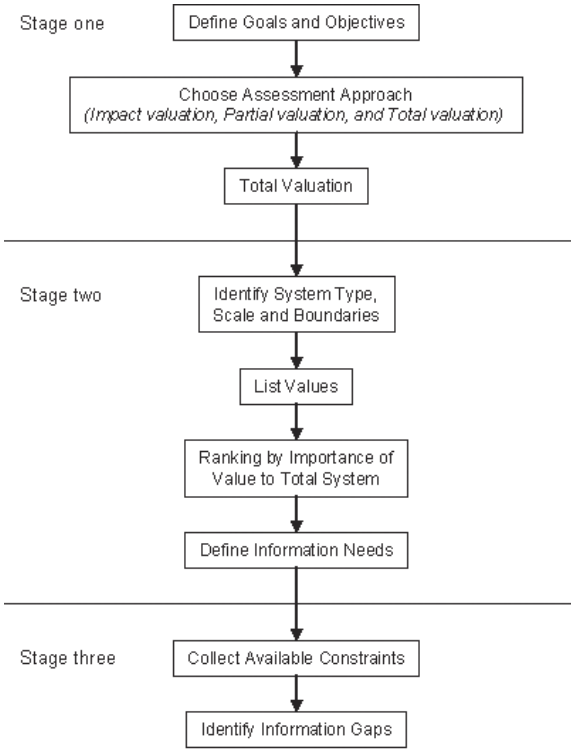
Stage 2: Preliminary data collection for planning

In the second stage, the characteristics of wetlands and the required information were determined. This consisted of the following steps: 1) identify wetland type, characteristics and ecosystems and determine the scope and scale of relationships between ecosystems and natural resource use in wetlands; 2) list and classify values of wetlands (from both direct and indirect use); 3) rank values in accordance to the systems; and 4) identify information needs.

Stage 3: Determine methods for data collection and data processing

This stage consisted of the following steps: 1) collect information and undertake a literature review and identify limitations of available information; and 2) identify overlaps and gaps, assess the accuracy of information that could constrain the economic valuation of wetlands, and recommend guidelines for additional collection of required information.

Figure 2. The assessment framework for economic valuation of wetlands



Wetlands of northeast Thailand

General description

Northeast Thailand is located between latitude 14° and 18° north and longitude 101° and 105° 37′ east (Somintra 1982). The region covers an area of approximately 168 854 km^2, and is bounded by Laos PDR in the north and east, Cambodia in the south, and central and northern Thailand in the west. The northeast region is mainly supported by bedrock of the Jurassic and Cretaceous periods. These rocks are called the Korat Rock Group and are comprised largely of sandstone, with some shale, conglomerate and rock salt (Somintra 1982).

Somintra (1982) reported the topography of northeast Thailand or the Korat Plateau to be mostly undulating. Expanses of flat lands can be found at Thung Sam Rit in Nakhon Ratchasima Province and Thung Kula Ronghai. In general, the region can be characterized as a large basin enclosed by mountain ranges.

The northeast region has three climate types, tropical low-rainfall climate, wet-dry monsoon climate and tropical Savannah-climate. Between November and February, the region is influenced by the northeast monsoon from the mainland, which brings dry and cold weather. The southwest monsoon influences the region between May and September, bringing to the region wet and warm air from the Indian Ocean.

Natural resources

Soil resources

- Levees and floodplains are formed from recent alluvial deposits and are found along major rivers; these account for approximately 5% of the total area of the region.

- Low terraces are mostly used for rice cultivation. Soil in the area, however, has low fertility and poor drainage.

- Middle terraces are often used for crop cultivation. Soil found in this area is coarse, with good drainage but is of low fertility. In addition to crop cultivation, the area has also been converted into rice fields (*Na Don*).[4]

- High terraces are also used for crop cultivation and have some similar characteristics to the middle terraces. Soil in the high terrace, however, has better drainage. The soil here is of low fertility and is mostly a mix of fine soil and sand. The high terraces can be found scattered throughout the region, accounting for approximately 1-2% of the total area.

- The dissected erosion surface is an area with rolling topography, connecting mountainous areas to alluvial plains. The lower part of the area may contain deposited sediments from riverine systems, and soil found in the area varies with the rock units from which it originated (OEPP 1999).

Forest resources

A variety of forest resources and forest types are found in northeast Thailand. Deciduous dipterocarp forest is the dominant plant community here. The forests are often found with mixed deciduous forests in extremely dry areas, such as hills, plains with a large content of sand, and areas with a large number of rocks on the surface. Dry evergreen forests can be found in a number of mountain ranges in several provinces, including the northern part of Nong Khai Province, along the Mekong River. Coniferous forests can be found stretching from the Phetchabun Mountain Range down to Chaiyaphum Province, and hill evergreen forests can be found at higher elevations. Lastly, mixed deciduous forests have been found in restricted and protected areas.

Water resources

There are three major river basins in the northeast – the Mekong River Basin, the Mun River Basin and the Chi River Basin (see Table 4). The largest river basin is the Mun River Basin, which covers 41.66% of the total area of the region, followed by the Chi and Mekong River Basins. The origins of the Pasak River are located in this region.

Table 4. Areas and provinces in river basins of northeast Thailand

River basins	Area		%	Provinces
	(km²)	(million rai)		
Mekong River Basin	57 422	35.9	28.39	Nong Khai, Nakhon Phanom, Mukdahan, Amnat Charoen, Ubon Ratchathani, Udon Thani and Sakon Nakhon
Mun River Basin	69 700	43.6	41.66	Nakhon Ratchasima, Buri Ram, Surin, Srisaket and Ubon Ratchathani
Chi River Basin	49 476	30.9	29.55	Chaiyaphum, Khon Kaen, Maha Sarakham, Roiet, Yasothon and Ubon Ratchathani, Udon Thai, Nong Bualumphu, Kalasin, Chaiyaphum and Luey
Pasak River Basin	675	0.4	0.40	
Total	177 273	110.8	100.00	19 provinces

Source: Modified from OEPP (1999)

[4] *Na Don* is the Thai term for higher-elevation, lowland paddy fields.

Underground water in the northeast is found mostly in the lower plains, at depths of 1-5 m. Approximately 80% of the reservoirs are found in the cracks of shale and sandstone, while the remaining can be found in sand, pebbles, limestone and other metamorphic rocks. Water quality of groundwater in the northeast ranges from highly saline to brackish and freshwater.

Agricultural land use

A large portion of the population in the northeast region depends for its livelihood on rain-fed agriculture. Rice, both the conventional and sticky varieties, is the main crop cultivated in the lower plains, the lower terraces and the lower section of the middle terraces. Cash crops are cultivated in the higher plains and sediment plains that have fertile soil and good drainage. The main cash crops of the northeast are cassava and kenaf, while other notable commercial crops include corn, sugarcane, wheat, castor oil and peanuts. Agricultural production of the region is largely dependent on the quantity and distribution of rainfall and on soil quality. Table 5 shows land use in the northeast of Thailand.

Table 5. Land use in northeast Thailand

Land use	%
Agricultural areas	**71.16**
Paddy fields	44.78
Croplands	25.41
Plantations	0.11
Fruit plantations	0.46
Grasslands	0.34
Forest areas	15.55
Other areas	11.79
Grasslands with shrubs	10.52
Lower plains	1.30
Water reservoirs	1.34
Urban areas	0.16
Total	100.00

Source: Land Development Department (1993)

Irrigation

The population in this region is the poorest in the country. This is largely due to infertile soil conditions, extensive areas affected by high salinity, and the inability of the soil in the higher terraces to retain water, which limits water storage for the dry season. Several projects were initiated by the government to combat these problems, including construction of water reservoirs of various sizes accompanied by interconnected irrigation systems at a regional level. In inaccessible areas, where it was not possible to extend the irrigation system, small reservoirs were built to meet the local water need. The Office of Accelerated Rural Development reported that, since 1965, the office has constructed 1 100 water reservoirs/overflowing dikes and 7 089 ponds to accommodate such local needs. Besides this, since 1981, village fishery projects have been developed by the Department of Fisheries in 9 616 sites across 19 provinces of the region, resulting in the extensive development of reservoirs in the region. The region now has a large number of natural and man-made reservoirs that are of significant importance for fisheries.

Wetland classification in Thailand

Based on the wetland classification system of the Asian Wetland Bureau (AWB), the first 41 wetland sites were classified through a collaborative initiative of AWB and the RFD. The exercise was based on AWB's classification system, in which wetlands are categorized into 22 types. Each wetland was found to include several types identified by this system.

In 1990, the Mekong Secretariat assigned the Land Development Department as the coordinator for the implementation of a study of the management of river plains within a 50 km radius of the banks of the lower Mekong River. Lao PDR, Thailand and Vietnam participated in the study. Each country was assigned to survey, classify and map wetlands in their respective areas, in order to create an overall map of the Lower Mekong Basin. For the first time, the classification system provided by Dugan (1990), which is endorsed by the Ramsar Convention, was adopted in Thailand. The Mekong Secretariat later convened a consultative meeting in Vientiane, Laos PDR, of the country working groups on wetland classification. After this meeting, Thailand decided to develop its own wetland classification system, which is similar to the systems of the Ramsar Convention and the Lower Mekong Basin. The classification system was later finalized at a seminar, and it was decided that wetlands would be divided into two major groups, saltwater and freshwater. This classification is similar to the United States system, which classifies according to type, system, sub-system, class and sub-class (Land Development Department 2000). Appendix 6 provides a detailed description of the Thai

wetland classification system, which lists the classification codes used below.

Classification and characteristics of wetlands in the northeast of Thailand

From the assessment of wetland systems at the reconnaissance level, all wetlands in the northeast region are classified as freshwater (F) types with the following four distinct systems.

Riverine wetlands (FR)

Riverine wetlands have a clearly visible riparian system and include rivers, canals and streams with permanent flow or seasonal flow; floodplains; inundated grasslands/paddy fields; swamp shrub lands; seasonal ponds of over 80 000 km^2 in size; seasonal ponds of less than 80 000 km^2 in size; and inundated plains/flooded riverbanks (Land Development Department 2000).

(i) Rivers (FRR)

There are four major rivers in the northeast:
- the Mekong River,
- the Chi River,
- the Mun River, and
- the Songkram River.

(ii) Floodplains (FRF)

A floodplain is a temporarily inundated area located between a river and a terrestrial area. Most of the floodplains in the country are in the large plains areas of the Central Region. In the northeast, a floodplain is called '*Tam*' and '*Bung*' by locals. A tam is a floodplain along a river or a canal that acts as a transition area between land and water. A tam is normally flooded for a short period (1-2 months each year, normally September-November), and often covered with extensive vegetation. A *bung* is a small basin within a *tam* that may be permanently flooded or be the last area to dry out. A *bung* is covered with bushes or shrubs. *Pa bung pa tam* is the specific local name given to floodplain areas in the northeast.

Pa bung pa tam is thus a community of swamp forest in floodplains on banks of rivers, or large ponds connected to rivers. The area is inundated from overflow or floods in the rainy season for a period of up to several months (Yukong et al. 2000)

Pa bung pa tam can be found in several sites along major rivers, including the Mun River, the Chi River, the Songkram River, and the Mekong River and its tributaries. Swamp forests are of significant importance to the livelihoods of local people living in adjacent areas, especially those who remain rooted in a subsistence level way of life.

Lacustrine wetlands (FL)

Lacustrine wetlands include natural or man-made lakes, swamps, ponds or reservoirs that are over 80 000 km^2 in size, both permanent and seasonal; those that are smaller than 80 000 km^2 with a depth of over 2 m and aquatic vegetation covering less than 30% of the surface area; those with permanent water, such as natural reservoirs, fish ponds, sewage ponds, cooling ponds and abandoned mines; and those with water in some seasons (Land Development Department 2000).

The OEPP reported that there are approximately 6 168 freshwater lakes and ponds in the northeast region. These include 528 permanent reservoirs and 160 seasonal reservoirs larger than 8 km^2, and 2 576 permanent reservoirs and 2 904 seasonal reservoirs smaller than 8 km^2. The total area of freshwater lakes and ponds in the northeast was estimated to be 836 km^2 (OEPP 1999).

Palustrine wetlands (FPS)

Palustrine wetands are inundated grasslands, inundated plains or swamps with an average depth of less than 2 m and aquatic vegetation covering around 30% of the surface area. This type of wetland includes permanently inundated areas, such as inundated shrub and grasslands, reed swamps, and cultivation fields, among others (Land Development Department 2000).

The OEPP reported that there are approximately 368 palustrine wetlands in the northeast region, covering an area of 49.79 km^2 (OEPP 1999).

Other types of wetlands

In addition to the three above-mentioned systems, other types of wetlands found in the northeast include waterfalls, beaches, and dams. The OEPP has reported that there are approximately 161 wetlands of these types, covering an area of 21.8 km^2.

Table 6. Number and area of wetlands of local importance in the northeast of Thailand

Provinces	Number of wetlands	Total area	
	(sites)	(km²)	(rai)
Kalasin	805	141.4	88 352
Khon Kaen	1 049	161.8	101 136
Chaiyaphum	736	109.4	68 346
Nakhon Phanom	837	112.9	70 571
Nakhon Ratchasima	346	37.4	23 385
Buri Ram	951	564.3	352 664
Maha Sarakham	1 241	169.2	105 725
Mukdahan	139	11.5	7 195
Yasothon	592	50.5	31 589
Roiet	865	42.5	26 538
Luey	326	19.5	12 160
Srisaket	697	49.4	30 900
Sakon Nakhon	535	43.1	26 921
Surin	1 393	132.0	82 475
Nong Khai	1 002	96.0	59 992
Nong Bulamphu	497	38.4	23 971
Amat Charoen	175	10.4	6 500
Udonthani	942	113.8	71 115
Ubon Ratchathani	1 622	96.3	60 171
Total	14 750	1 999.8	1 249 706

Source: OEPP (1999)

The total area of all types of wetlands in the northeast region is approximately 2 000 km², covering 1.18% of the total area of the region. Palustrine wetlands are the most common type of wetland in the region. The total number and total area of wetlands in each province is provided in Table 6.

Socioeconomic status of wetlands

Humans are constantly reshaping nature, and the socioeconomic conditions of communities or stakeholders can often serve as good indicators of the current and possible future status of wetlands. The findings of a socioeconomic study conducted in 1999 by Khon Kaen University of 72 sample villages from 12 wetlands in the northeast region are discussed below (KKU 1999).

Social and cultural conditions

Settlement and ethnic groups

Of all the wetlands of international and national importance in Thailand, the most densely populated wetland is the floodplain of the Mun River. Other heavily populated sites include Nong Han swamp in Sakon Nakhon Province, Bung Khong Long Wildlife Non-hunting Area, Lower Mong River Basin and the confluence of the Chi and Mun Rivers.

Among the least populated areas are Nong Hua Ku Wildlife Non-hunting Area, Nong Wang Wildlife Non-hunting Area and Sanambin Wildlife Non-hunting Area. Populations in most wetland areas are either of Thai-Lao or Eastern Thai ethnic descents. Other ethnic groups, such as the Thai Yo are settled in Nong Han Sakon Nakhon, while Suai and Khmer ethnic groups are settled in the floodplains of the Mun River, Sanambin Reservoir and Huai Talat-Huai Chorakhe Mak Reservoir.

Wetland-related culture and traditions

Wetlands have a close link with the traditions, culture and the way of life of local communities. The most common relationship is that wetlands are regarded as ancestral sites or *Pu Ta*. Wetlands also play a role in *Bun Bung Fai* and *Rack Na* (first cultivation) ceremonies, and are regarded as sacred sites. Some unique traditions found only along the Mun River include the building of sand pagodas and the use of wetlands as cemeteries and for rice-storing ceremonies.

Economic conditions

Land status, possession and ownership

The majority of wetlands are public lands of variable sizes and shapes, the area of which depends largely on the seasonal water table. However, wetlands are also privately possessed in a number of ways. The most common type is possession without any certified ownership documents, which accounts for 26.3% of the total wetland area. This is followed by use with a *Phor Bor Tor* 5 document[5] (21.48%). Land holdings with a document of the Office of Land Reform for Agriculture, an actual property document, or a *Nor Sor* 3 document[6] account for 20.5%, 16.1% and 15.6% of the total wetland area, respectively.

Use of wetlands

Use of wetlands can be divided into use of land around wetlands and the use of the waterbody itself.

[5] A *Phor Bor Tor* 5 is the certified document for the payment of local tax.
[6] A *Nor Sor* 3 document defines the specific measurement of the area.

Among the most important landuses are rice cultivation, lotus plantation, livestock rearing and household vegetable cultivation. Other notable landuse activities include crop cultivation, fruit and other large tree plantations, fish farming, fuelwood collection, charcoal burning, frog farming, hunting, and industrial activities.

The most common uses of waterbodies in wetlands are fisheries, agriculture, water supply, aquaculture and cultivation of aquatic plant. Other notable activities include lotus cultivation, reed cultivation (for mat production), operation of restaurant businesses (for tourism), sand collection, and aquatic flora harvesting.

Occupations and income

As several economic activities depend on wetland ecosystems and resources, wetlands are regarded as the main source of income by the surrounding communities. Wetlands can be divided into two groups according to the level of income that they contribute. The Chi-Mun River confluence, Nong Sam Mernt, Nong Han Sakon Nakhon, Bung Keai, Kang Lawa, Huai Sier Ten and Num Mong contribute 50-80% of the total income of surrounding households.

Importance of wetlands according to type of usage

Wetlands have been categorized into three levels, according to the criteria provided by the Ramsar Convention – namely, wetlands of international importance, wetlands of national importance and wetlands of local importance. In the northeast region there are at least 12 wetlands of international importance, 65 wetland sites of national importance and 532 wetland sites of local importance.

Wetlands are complex ecosystems. Their function and values are of significant importance to humans, plants and animals as well as to ecological processes, economies and politics at local, national and international levels. From the inventory of wetlands in the northeast (OEPP 1999) and collection of baseline information from relevant individuals, it was possible to identify wetland values and grade the importance of the usage of 24 notably significant wetlands, including 12 wetlands of international importance and 12 wetlands of national importance. The results of this exercise are provided in Table 7.

Direct use

1. There are several natural resources in wetlands that can be directly harvested. These resources are of considerable importance to the daily life of the local community and, in certain cases, to the national economy. The resources include:

    - Fishery resources: Almost all wetlands are used as fishing sites by locals and communities of the surrounding area. Wetlands that are considered important for fisheries in the northeast are the Mekong River, Songkram River, Mun River and its floodplains, and the Mun-Chi confluence.

    - Agricultural resources: Several wetlands are used for agriculture. These uses include temporary cultivation after flooding (which makes use of available nutrients brought in by the flood) and permanent cultivation, such as rain-fed and irrigated rice farming. Important wetland sites for rice farming include Nong Han Sakon Nakhon and Nong Han Kumpawapi. Other agricultural uses of wetlands are plantations and aquaculture.

    - Animal feed: Wetlands, particularly floodplains, are often extensively covered by grass and other vegetation. This vegetation becomes an important source of food for livestock during the dry season.

    - Forest resources: Wetlands provide edible plants for consumption, herbs for traditional medicine, as well as wood and raw material for construction and production of household goods.

    - Wild plant and wildlife resources: Several aquatic plants are used as food and as animal feed, while a number of animals in wetlands are an important source of protein for the local population.

2. Wetlands provide fuelwood for making charcoal, cooking, heating and smoking fish for preservation.

3. Wetlands also contribute significantly to the local transportation system, as they provide effective and cheap routes for transport. Important transportation routes in the northeast region are the Mekong River, the

Table 7. Values and importance of wetlands in northeast Thailand

	Wetlands	Importance	Description	Area (km²)	Values																				Intrinsic values			Income of household from wetlands (%)
					Direct values								Indirect values								Option and quasi-option values		Bequest values					
					Fishery	Aquaculture	Rice farming	Aquatic plants	Timber & Forest products	Medicines & Herbal plants	Water supply	Transport	Wildlife	Nutrient retention	Flood prevention	Balancing groundwater table	External ecosystem support	Recreation & tourism	Micro-climatic stabilization	Shoreline stabilization	Potential for future use	Future value of information	Biological diversity	Culture, heritage, aesthetic value	Habitats	Ecological processes	
1	Nong Han	I	A natural freshwater pond	1 25.20	**	*	**		*		**	*	*	*	*	*	*	*			*	*	*	*	*	*	65
2	Nong Han Kumpawapi	I	A natural freshwater pond with aquatic plants	45.00	*	*	**	*			**			*	*	*	*	*			*		**	**	*	*	50
3	Bung Lahan	I	A semi-natural pond with aquatic plants	29.10	*	*	*	*	*		*		*	*	*	*	*	*			*		*	**	*	*	60
4	Wetlands in Bung Kong Long WNHA	I	A permanent freshwater pond	12.90	*		*				*		*	*	*	*	*	*	*		**	*	*	*	*	*	38
5	Wetlands in Huai Jorakei Mak Reservoir WNHA	I	A seasonal semi-natural water reservoir	6.20	*	*	*				*		*	*	*	*	*	*			*	*	*	*	*	*	10
6	Wetlands in Huai Talad Reservoir WNHA	I	A permanent semi-natural freshwater reservoir	7.10	*		*				*		*	*	*	*		*			*	*	*		*	*	
7	Wetlands in Sanam Bin Reservoir WNHA	I	A permanent semi-natural freshwater reservoir	5.70	*						*			*	*	*	*	*			*	*	*	*	*	*	
8	Mekong River	I	A large river	60 900.00	**	*	*				*	**		*	*	*	*	**	*		*	*	**	**	*	*	
9	Songkram River	I	A catchment in the river	13 001.00	**		*		*			*		*	*	*	*	*			*	*	**	*	*	*	
10	Lum Plaimarst	I	Waterways and seasonally inundated shrublands	19.00	*	*	*				*	*	*	*	*	*					*	*	*	*	*	*	40
11	Lum Dom Noi & wetlands in Yot Dom Wildlife Sanctuary	I	Rivers, floodplains, canals and streams	225.30	*		*		*				*	*	*	*	*	**	*		*	*	**	*	*	*	10
12	Wetlands in Khao Kaei Wildlife Sanctuary	I	A seasonal floodplain	1 560.00	*					*			*	*	*	*	*	**	*		*	**	**	**	*	*	
13	Dun Lumpan	N	Inundated lands and seasonal ponds	0.50	*		*			*	*			*	*	*	*	*			*	*	*		*	*	

Table 7. Values and importance of wetlands in northeast Thailand (Continued)

	Wetlands	Importance	Description	Area (km²)	Values																	Intrinsic values				Income of household from wetlands (%)
					Direct values									Indirect values							Option and quasi-option values		Bequest values				
					Fishery	Aquaculture	Rice farming	Aquatic plants	Timber & Forest products	Medicines & Herbal plants	Water supply	Transport	Wildlife	Nutrient retention	Flood prevention	Balancing groundwater table	External ecosystem support	Recreation & tourism	Micro-climatic stabilization	Shoreline stabilization	Potential for future use	Future value of information	Biological diversity	Culture, heritage, aesthetic value	Habitats	Ecological processes	
14	Nong Kom Koh	N	A natural freshwater pond with aquatic plants	9.40	*	*	*	*			*			*	*	*	*						*		*	*	50
15	Nong Prakun	N	A natural freshwater pond with aquatic plant and floodplains	0.80	*	*	*	*						*	*	*	*	*					*	*	*	*	40
16	Bung Klier Bo Gair	N	A semi-natural water reservoir with aquatic plants and floodplains	0.75	*	*	*	*			*		*	*	*	*	*	*			*	*	*	*	*	*	69
17	Nong Sam Mernt	N	A permanent freshwater pond with dense aquatic vegetation	5.60	*		*	*			*			*	*	*	*	*			*	*	*	*	*	*	70
18	Kang Lawa	N	A permanent freshwater pond and floodplain	11.20	*		*							*	*	*	*	*			*	*	*	*	*	*	60
19	Huai Seai Ten	N	Streams, floodplains and a water reservoir	10.40	*		*	*	*		*		*	*	*	*	*	*			*	*	*	*	*	*	60
20	Lower Mong Basin	N	Floodplains, streams and freshwater ponds with aquatic plants	2.40	*		*							*	*	*	*	*		*	*	*	*	*	*	*	
21	Wetlands in Nong Huai Ku WNHA	N	A permanent freshwater pond with aquatic plants	0.11	*	*	*									*							*	*			
22	Mun River and its associated swamps	N	A river, streams, forests and floodplains	604.00	**	*	*		*	*	*	*	*	*	*	*	*	**	*	*	*	*	*	**	**	*	
23	Chi/Mun Confluence	N	Rivers, their tributaries and floodplains	97.50	**	*	*	*	*			*		*	*	*	*	*	*	*	*	*	*	*	*	*	50-80
24	Wetlands in Nong Wang WNHA	N	Small permanent freshwater ponds with aquatic plants	0.17										*	*	*		*					*	*	*	*	1

Notes:

** = wetland provides a particular value; ** = wetland significantly provides a particular value; I = wetland of international importance; N = wetland of national importance; WNHA = Wildlife Non-hunting Area*

Songkram River, the Mun River and its floodplains, the Mun-Chi confluence, Nong Han Sakon Nakhon and Lum Plaimat.

4. Wetlands provide fresh water for humans, plants and animals, and can be used for several activities, including waterworks, agriculture, pasture, industry and aquaculture. Almost all wetlands of the northeast can be used for at least one of these purposes.

Indirect use

1. Wetlands enable retention of nutrients, including those discharged from agricultural lands, urban areas, factories and animal farms. These nutrients can be used by plant and animal species of the wetlands, and may eventually be removed from wetlands through the harvest of these species. With appropriate management, proper harvest of plants and animals can balance the level of nutrients in wetlands, resulting in better water quality, mitigation of environmental impacts, and the generation of sustainable revenues for the local economy.

2. Wetlands are natural catchment areas; they enable flood retention and prevent the rapid flow of floodwater downstream. Wetlands thus play an important role in mitigating and preventing flood in adjacent areas, and their removal often results in frequent flooding.

3. Wetlands contribute to the maintenance of the groundwater table by regulating the flow of refilling water and enabling substantive filtration of water into underground reservoirs. If the use of underground water is properly controlled and maintained, underground reservoirs can provide sustainable water supply in the long-term and, in certain cases, water can be released into other reservoirs to be used by adjacent communities during the drought season.

4. Wetlands are transitional areas of nutrients and biomass along waterways or runoff, enriching adjacent ecosystems and nearby areas.

5. Wetlands help prevent and mitigate erosion of riverbanks. Bank vegetation, such as swamp forest, is capable of stabilizing the banks and reducing the impacts of currents and water flow.

6. Wetlands are of significant importance to recreation and tourism as they cater to activities such as water-sports, fishing, bird-watching, nature study and study of wildlife.

7. Wetlands contribute to the balanced maintenance of natural processes, for example, through their roles as carbon sinks and in maintaining microclimate.

Non-use value

1. Wetlands are often habitats for many endemic plants and animal species. Some of these species may have critical importance in the development of new varieties in the future, or have other commercial purposes.

2. Wetlands in the northeast region have historical, social, cultural and traditional importance, as they are closely associated with the historical background, religion and the beliefs of the local communities. Evidence of this can be found in local traditions such as *Don Puta*, *Rak Na*, the building of sand pagodas and rice storage ceremonies.

Specific values of wetlands

Values of *Pa Bung Pa Tam* (inundated forests) contributing to the community's way of life

1. Value in agricultural practices: Locals often use swamp forests for cultivation, using crop rotation methods where crops are not planted twice in the same area, or where the cultivated area is left for one to two years before replanting. Cultivation in inundated forest includes:

    - Rice
    - Crops such as corn and melons
    - Vegetables used in the household, such as chilli, beans and green vegetables
    - Lotus plantation
    - Eucalyptus plantation

2. Use of wood products

    - Fuelwood and charcoal: Inundated forests are an important source of fuelwood, as the softwood from these forests burns

easily. Popular fuelwood from the forests includes Huling, Siao, Nao Nam, and Cheese wood.

- Timber and wood for construction: Trees found in inundated forests, such as Malabar ironwood, Yang and Chat can be used for the construction of houses and buildings. Smaller wood is used for making household products such as baskets, chicken cages and boat paddles; vines provide raw material for producing handicrafts, and reeds are also used for weaving mats.

3. Collection of forest goods: Several plant species in inundated forests can be consumed in daily diets or as supplements, or used as herbs. These plants include Kluai Noi, Namchoi, Pee Puan, Huling, Muo, Black Poum, Ma Kok Nam, Madan and Phlap. In actual fact, almost all plant species are edible, including aquatic plants such as the Indian oak, Asiatic pennywort, Neem, lotus, wild potato, bamboo shoots and mushrooms, such as the Royal agaric and Red and Black russula. In addition, there are over 80 plant species in inundated forests that can be used as herbal medicine.

4. Animal farming (husbandry): Inundated forests are suitable for various forms of animal farming, including pasture for livestock (during the dry season), duck farming, fish farming and frog farming. Some inundated forests, such as the one in Tatum District in Surin Province, are also used for raising elephants. Plant species in swamp forests that are commonly used as animal feed are Kamphi, Fueinam and Khanghung.

5. Fishing and hunting: Fishing is a dominant form of direct harvest in inundated forests (see Box 1). Inundated forests themselves are comprised of various types of reservoirs. The

Box 1. Case study of fishery values of inundated forests: Songkram River Basin

Inundated forests in the Songkram River Basin provide good spawning and nursing grounds as well as shelter for aquatic organisms. During the flooding period, in the earlier part of the rainy season (May-June), high precipitation in the headwaters of the river releases sediment into the river, causing the river to appear reddish in color. High concentrations of suspended sediment can also be found in floodplains and associated swamp forests along the rivers, providing valuable nutrients for plankton and benthic life. This results in a rapid increase in the number of these organisms, attracting larger consumers such as fish into the inundated forest area, where they come to breed. A study conducted by Suntornratana et al. (2002) on migration of fish into inundated forests of the Songkram River Basin found that 145 out of the 194 fish species of the Mekong River migrate into the Songkram River Basin in the early part of the rainy season. Approximately 64% of the fish were found in areas between the estuary of the Songkram River and the Tabo District. A total of 37 species use the inundated forests as a spawning ground, while another 32 species use other reservoirs. Obviously, inundated forests are important spawning grounds for river fish.

Inundated forests are also an important source of food for local and adjacent communities, and can be regarded as natural markets or supermarkets for villagers. Fish are the most valuable products of these forests, providing cheap sources of protein for the local population. A study evaluating the status of fisheries in the Mekong River reported that the average catch of each household in inundated forests of the Songkram River Basin is approximately 117.44 kg/yr, and accounts for 8.9% of the total catch in the basin. In comparison, average catch from lakes is 168.67 kg/yr and average catch from rivers is 125.11 kg/yr.

There are more than 30 traditional fishing tools used by locals in fishing activities in inundated forests. Among the most popular tools are hooks, bottom long-line and gillnet.

Thus, inundated forests are of significant importance to the livelihoods of the local and adjacent communities. Many inundated forests are, however, in a state of decline due to causes, such as the building of dams, logging and encroachment. Measures to regulate the use of these forests and their resources, and to enable cooperation in their conservation and rehabilitation are crucial if their existence for future generations is to be assured.

larger reservoirs are often densely covered with water plants, providing a fertile feeding ground for fish species. The reservoirs in swamp forests are interconnected, enabling uninterrupted water flow between the reservoirs, and replenishing the reservoirs with oxygen in the process. Oxygen replenishment and the protection offered by the dense vegetation means that these wetlands are good spawning and nursing grounds for fish, enabling year-round harvest of fish and other aquatic species.

6. Salt production: Extensive floodplains, particularly in *Pa Tam* (inundated forests), are used by locals as salt flats in the dry season. Traditional salt harvesting is an important tradition for several local communities, as it also gives rise to specific customs and rituals.

7. Community traditions: Several traditional customs are associated with inundated forests, such as *Don Ho*, *Don Puta*, *Bun Bang Fai*, boat races and *Lai Rua Fai*.

8. Recreation: Floodplains often have several areas that can be used for tourism and recreation by visitors and locals.

Value of wetlands in sediment retention

Agricultural landuse and logging often result in extensive removal of vegetation, and the consequent release of sediment into rivers through runoff. During the rainy season, the larger tributaries are reddish in color because of the high concentration of sediment. Wetlands, particularly palustrine wetlands with their dense vegetation, play an important role in trapping these sediments, by reducing water flow. As fine sediments are moved further downstream than are larger particles, the larger the wetlands, the more effective they are in trapping sediments.

The proportion of organic and inorganic suspended sediment depends largely on the sediment source. Sediment from mines is mostly inorganic, while that from urban areas consisted of mainly organic material.

Accumulation of sediment can result in decreased depth of waters, reduction in a reservoir's storage capacity, alteration of ecosystems, and problems for maritime transportation. The soil in the Songkram River Basin is mostly derived from downstream sedimentation. In some areas, soil originates from land-based sediment from higher elevations, and becomes highly concentrated with sand and salt. (Department of Energy Development and Promotion 1995).

Values of wetlands in nutrient accumulation

Nutrient retention can be clearly observed in swamps, ponds or some water reservoirs that are connected to riparian systems. Nutrients from areas where there is intensive fertilizer use and decomposition of organic materials attach to sediment and accumulate in wetlands. Wetlands also receive nutrients from untreated wastewater from communities along rivers, as observed in Nong Han in Sakon Nakhon Province, Lum Takong Reservoir in Nakhon Ratchasima Province and Lam Pak Bai in Phetburi Province.

Nutrients from agriculture are mostly released into wetlands during the rainy season, while those from households are discharged into wetlands throughout the year. In several urban areas, water quality is poor and coliform bacteria contamination is common (Pollution Control Department 1996). The quality of water gradually improves with distance away from urban areas. For example, the water quality of the Lum Takong Reservoir is notably better than that of the catchment around the city area of Nakhon Ratchasima (Ingthamjitr et al. 1999).

Biodiversity values of wetlands

Ecosystem diversity of wetlands in the northeast region is lower than that of other regions, such as the central and eastern regions, as all wetlands in the northeast region are freshwater ecosystems. However, diversity of wetland inhabitants is similar to other regions, as reported in inventories of plants and animal species in wetlands of the northeast prepared by Homchern (1999) and the OEPP (2000). Biodiversity of Wetlands of International and National Importance are provided in Tables 8 and 9 respectively.

Plant diversity

Aquatic plant species found in wetlands of the northeast can be divided into four major groups:

1. Important plant species found in open ponds and other lacustrine wetlands are Hydrilla, Common coontail, Common bladderwort, Pond weed, Bushy pond weed, Floating water fern, Water hyacinth, Nam Chap, Buakinsai,

Table 8. Biodiversity in Wetlands of International Importance in northeast Thailand

Wetlands	Provinces	No. of species		
		Bird	Fish	Plant
Nong Han	Sakon Nakhon	32	31	42
Nong Han Kumphawapi	Udon Thani	74	39	15
Bung Lahan	Chaiyaphum	56	25	12
Bung Khong Long WNHA	Nong Khai	29	25	10
Huai Chorakhe Mak WNHA	Buri Ram	11	18	7
Huai Talat WNHA	Buri Ram	30	18	9
Sanambin WNHA	Buri Ram	23	14	9
Songkram River	Sakon Nakhon, Udon Thani, Nong Khai	-	183	-
Lam Plaimat	Buri Ram	5	37	16
Lam Dom Yai and Pa Yot Dom Wildlife Sanctuary	Ubon Ratchathani	188	36	-
Phu Khieo Wildlife Sanctuary	Chaiyaphum	223	26	-
Mekong River	Chiang Rai, Nong Khai, Nakhon Phanom, Mukdahan, Amnat Charoen, Ubon Ratchathani	-	289	-

Source: OEPP (1999)
Note: WNHA = Wildlife Non-hunting Area

Table 9. Biodiversity in Wetlands of National Importance in northeast Thailand

Wetlands	Provinces	No. of species		
		Bird	Fish	Plant
Dun Lampun	Maha Sarakham	21	9	50
Nong Komkoh	Nong Khai	20	27	10
Nong Plakun	Roiet	15	51	14
Bung Kleir Bo Gair	Roiet	28	54	11
Nong Sam Mernt	Chaiyaphum	31	22	9
Kang Lawa	Khon Kaen	36	43	17
Huai Sier Ten	Khon Kaen	35	24	-
Lower Mong River Basin	Nong Khai	4	47	7
Nong Hua Ku WNHA	Udon Thani	6	28	8
Mun River and its floodplains	Buri Ram, Surin, Srisaket	53	109	7
Mun/Chi River confluence	Srisaket, Ubon Ratchathani	3	39	14
Nong Wang WNHA	Chaiyaphum	50	5	8

Source: OEPP (1999)
Note: WNHA = Wildlife Non-hunting Area

Waterlily, Lotus, Water lettuce, Lesser duckweed, Water morning glory and Water primrose.

2. Important plant species found in flooded grasslands or areas around ponds and other lacustrine wetlands are Water chestnut, Lesser reedmace, Bulrush, Ricefield bulrush, Common reed, Wild cane, Giant reed, Ya Wai, Ya Plong and Southern cutgrass.

3. Important plant species found along waterways (inundated forests) are Nao Nam, Bennam, Huling, Black Poum, Siao, Indian oak and Sakae.

4. Plant species found in wetlands with unique characteristics, such as Dun Lampun in Maha Sarakham Province, differ from those found in other areas both in terms of their abundance and diversity.

Fish diversity

There are many fish species found in wetlands of the northeast region. There are at least 289 species found in the Mekong River, including the endemic Giant catfish. Other rivers with significant number of species are the Songkham River (with at least 183 species) and the Mun River (with at least 109 species). Lacustrine and palustrine wetlands with a high level of fish diversity include Bung Keir Bo Gair in Roiet Province (54 species), Nong Plakun in Roiet Province (51 species), Lower Mong River Basin in Nong Khai Province (47 species), Kang Lawa in Khon Kaen Province (43 species) and Nong Han Kumphawapi in Udon Thani Province (39 species).

The most common family of fish in the wetlands of the northeast is *Cyprinidae*, which can be found in every reservoir, especially in large riverine systems. Commercially important species found in the wetlands include Grey featherback, Eye-spot barb, Mud carp, Hasselt's bonylip barb, River barb, Common silver barb, Catfish, Yellow mystus, Striped tiger nandid, Nile tilapia and Striped snakehead fish.

Other animal species

In addition to their role as habitats for waterfowl and shorebird species (see Table 10), the wetlands in the northeast are also habitats for other important animal species. For example, Dun Lampun, Nachuak District, Maha Sarakham Province is the only habitat in the world for the rice field crab (*Thaipotamon chulabhorn*).

Threats to wetlands and their conservation

Intense use of wetlands in the northeast has had serious negative impacts on their ecosystems. Such threats, whether from adjacent areas, surrounding areas or within the wetlands, have induced water pollution, eutrophication, siltation and reduction of water quantity, a decrease in numbers of aquatic animals, birds and other wildlife species, reduction of wetland size, and destruction of vegetation. Effected wetlands need to be conserved, protected and managed to ensure their sustainable use.

Threats to wetlands from adjacent and surrounding areas

- Discharge of industrial and urban wastewater into the waterbodies, which kills large numbers of aquatic animals through reduction in dissolved oxygen.
- Increased soil salinity, which alters wetland ecosystems.
- Encroachment of agriculture and settlement.
- Development projects that alter wetland ecosystems including, road construction, irrigation for cultivation, and construction of water treatment systems that use wetlands as discharge reservoirs.
- Urban and industrial expansion.

Threats from within the wetland areas themselves

- Contradicting views among stakeholders concerning the use of wetlands, competition for land possession, and demand for land-holding permits for areas surrounding wetlands, all of which reduce the size of wetlands.
- Waste from restaurants in reservoirs, and degradation caused by too many tourists.
- Wildlife hunting, bird shooting, collection of birds' eggs and inappropriate fishing methods, which contribute to a reduction in the number of birds and aquatic animals.
- Inappropriate water allocation, causing lack of water in the dry season and flooding in the rainy season.
- Discharge of untreated wastewater and solid waste from chicken, duck and pig farms, as well as cage fish farming, all of which contribute to water pollution.
- Overgrowth of weeds and aquatic plants, such as water hyacinth, due to excessive nutrients.
- Invasion of non-indigenous species such as the golden apple snail and giant mimosa.

Loss of wetlands

A large number of wetlands in the northeast region have been either lost or degraded. Some degradation is clearly visible while some is not. Degradation is sometimes rapid and sometimes progressive over a period of time.

Quantitative loss of wetlands

A quantitative loss of wetlands is measured in changes in both the area and volume of wetlands. Such loss includes permanent loss, where altered areas no longer have wetland characteristics, the loss associated with a change from natural to semi-natural or unnatural wetlands, and the loss associated with the conversion of natural wetlands into man-made wetlands. Examples of quantitative loss of wetlands are:

- Destruction of natural forest for plantation of species that are non-indigenous to the existing

Table 10. Diversity of threatened and near-threatened bird species found in the wetlands of northeast Thailand

Status / *Species*	Common name	Nong Han	Nong Han Kumphawapi	Bung Lahan	Bung Khong Long Wildlife Non-hunting Area	Nong Wang Wildlife Non-hunting Area	Huai Chorakhe Mak Wildlife Non-hunting Area	Huai Talat Wildlife Non-hunting Area	Sanambin Wildlife Non-hunting Area	Mekong River	Songkham River	Lam Plaimat	Lam Dom Yai and Pa Yot Dom Wildlife Sanctuary	Phu Khieo Wildlife Sanctuary
Extinct in the wild														
Grus antigone	Sarus Crane											*		
Critically endangered														
Esacus recurvirostris	Great Thick-knee			*										
Cairina scutulata	White-winged Duck								*				*	*
Leptoptilos javanicus	Lesser Adjutant												*	
Anhinga melanogaster	Oriental Darter													*
Gyps bengalensis	White-rumped Vulture													*
Endangered														
Ardea cinerea	Grey Heron		*	*					*					
Ardea purpurea	Purple Heron		*	*	*	*	*	*	*					
Vanellus duvaucelii	River Lapwing			*										
Egretta garzetta	Little Egret					*								
Sarkidiornis melanotos	Comb Duck								*			*		
Milvus migrans	Black Kite	*	*						*					
Mycteria leucocephala	Painted Stork								*					
Psittacula eupatria	Alexadrine Parakeet												*	
Pavo muticus	Green Peafowl												*	*
Aquila clanga	Greater Spotted Eagle													*
Vulnerable														
Aythya baeri	Baer's Pochard	*			*	*	*		*					
Aythya nyroca	Ferruginous Pochard				*									
Lophura diardi	Siamese Fireback												*	*
Dryocopus javensis	White-bellied Woodpecker													*
Polihierax insignis	White-rumped Falcon													*
Carpococcyx renauldi	Coral-billed Ground-Cuckoo													*
Near threatened														
Haliastur indus	Brahminy Kite	*	*			*								
Nettapus coromandelianus	Cotton Pygmy-Goose		*		*	*			*					
Vanellus cinereus	Grey-headed Lapwing				*									
Emberiza aureola	Yellow-breasted Bunting											*		
Buceros bicornis	Great Hornbill												*	
Ptilolaemus tickelli	Brown Hornbill													*
Rhyticeros undulatus	Wreathed Hornbill													*
Muelleripicus pulverulentus	Great Slaty Woodpecker													*
Spizaetus nipalensis	Mountain Hawk-Eagle													*
Porzana paykullii	Band-bellied Crake													*
Gallicrex cinerea	Watercock													*
Treron pompadora	Pompadour Pigeon													*
Pycnonotus eutilotus	Puff-backed Bulbul													*

Source: OEPP 1999

ecosystems, such as the creation of eucalyptus plantations in swamps which eventually results in the loss of the wetland.

- 'Bung' areas, the lower plains on Mun River, although being public lands, have been entirely certified for use.

- Construction of dikes around wetlands, for example at Nong Plakun, has enabled the use of surrounding areas for agriculture, and reduced the extent of wetlands.

- A decrease in the amount of water in the dry season, and construction of canals and roads around Nong Hua Ku have reduced the wetland area and opened opportunities for private possession of some parts of the area.

Qualitative loss of wetlands

Qualitative loss of wetland can result in the loss of biodiversity as well as the loss of the wetland's hydrological and ecological functions. Although the slow and progressive degradation of wetlands can be a natural phenomenon, the degradation induced intentionally or unintentionally by human activities is far more rapid and serious. Examples of wetland degradation are:

- Ecological alteration from the construction of dams, such as in Nong Han Kumphawapi, from dredging, as found in Bung Lahan, or from construction of dikes, as seen in Nong Plakun.

- Water pollution caused by discharge of waste from restaurants, such as those found in Bung Kleir in Roi-et Province and Nong Komkoh in Nong Kai Province. At Bung Kleir in particular, there are over 100 restaurants in and around the wetland area.

- Wastewater discharged from paper mills into Huai Sier Ten Reservoir in Khon Kaen Province has polluted water in the reservoir, while wastewater from flour processing plants has polluted water in Nong Komkoh, and resulted in the loss of mollusk species.

- Invasion of alien species, such as the giant sensitive plant, the golden apple snail and hybrid catfish has resulted in the removal of certain indigenous species.

Protected and conserved wetlands

Some wetlands are protected by legislation. These protected wetlands can be divided into the following groups:

- Wetlands in legally protected areas, such as national parks and wildlife sanctuaries, where wetlands are protected as habitats, feeding areas and breeding sites for wildlife. There are also wetlands in the legally protected wildlife non-hunting areas. However, only the listed species and not the wetlands are protected in the wildlife non-hunting areas. There are 23 national parks, 7 wildlife sanctuaries and 8 wildlife non-hunting areas in the northeast region (as of June 1999).

- Wetlands in legally conserved areas, such as fisheries and plant preservation areas, where use of fishing tools are regulated. Although this does not provide specific protection for wetlands, they are indirectly protected because of their importance as habitats for fish and the large number of plants they contain.

- Wetlands in lands belonging to government agencies. These wetlands have been well protected, but not properly maintained.

Case study: Surin Province

General description

Surin Province is located in the southern part of the northeast region and covers a total area of approximately 8 124 km^2. The province consists mostly of high plains, with dense forests and complex mountain ranges in the areas bordering Cambodia. There are five important natural rivers in Surin Province: The Mun River, the Chi River, the Lum Plub Pla, the Huai Rawee, and the Huai Tub Tan.

In addition, there are thousands of waterways and swamps throughout the province. Most are dried out in the dry season. These wetlands can be classified as follows:

- 18 small reservoirs

- 227 medium reservoirs

- 330 ponds, swamps and streams

Homchern (1999) indicates that palustrine wetlands (FPS)[7] are the most common type of wetlands in Surin Province, accounting for 74.36% of the total area of the province. This may be due to the inclusion of some parts of Thung Kula Ronghai in the estimation. Details of each type of wetlands in Surin Province, excluding riverine systems, are provided in Table 11.

Table 11. Types of wetlands in Surin Province

Types	Proportion	Area	
	(% of the province)	(km²)	(rai)
FRR	*	*	*
FRF1/FRF2	4.38	355.8	222 395
FRF3/FRF4	0.12	9.8	6 093
FLL	1.07	86.9	54 329
FLP	0.41	33.3	20 818
FPS	74.36	6 041.0	3 775 629

Source: Homchern, (1999)
*Note: 1. * = Area data not applicable as this wetland type refers to rivers*
2. Total area of Surin Province is about 8 124 km2 (~ 5.08 million rai)
3. See Appendix 6 for description of wetland classification codes

Gross provincial product

The gross provincial product (GPP) of Surin Province in 1999 was estimated to be 26 235 million baht (USD640 million) (Table 12). The agricultural sector contributed the most to the GPP, approximately 6 453 million baht or 24.6% of the total GPP. This was followed by the retail-wholesale sector that contributed approximately 6 202 million baht or 23.6% of the total GPP. The remaining 51.8% came from minerals, industry, construction, electricity and waterworks, transport and communication, banking and insurance, ownership of dwellings, the public service and the service sector.

The agricultural sector can be further divided into five sub-sectors – crops, livestock, fisheries, forestry, and the agricultural services/post harvest sector for agricultural products. Most agricultural products are related in one way or another to wetlands, being either a direct product of wetlands or a product of processes supported by wetlands. The total GPP of the agricultural sector increased from 5 282 million baht in 1995 to 7 018 million baht in 1997, dropping to 6 453 million baht in 1999.

Table 12. Gross provincial product of Surin Province in 1995-1999 (million baht)

Sectors	1995	1996	1997	1998	1999
Agriculture	5 282	5 801	7 018	6 931	6 453
Cropping	3 468	3 744	5 128	5 305	4 364
Livestock	772	713	719	517	756
Fishery	111	227	130	132	151
Forestry	12	58	18	1	38
Agricultural services	443	446	481	476	507
Preliminary processing	476	613	542	500	637
Mineral	63	84	108	58	199
Industry	1 058	898	920	1 000	1 016
Construction	2 288	2 602	1 469	939	843
Electricity & waterwork	316	370	364	416	429
Transport & communication	858	986	1 060	1 012	1 041
Retail & wholesale	5 802	6 153	6 432	6 193	6 202
Banking & insurance	1 008	1 225	1 248	1 485	901
Ownership of dwellings	1 147	1 190	1 248	1 320	1 389
Public service	1 827	1 899	2 009	2 126	2 423
Service	3 817	4 084	4 601	5 061	5 339
Total	23 466	25 292	26 477	26 541	26 235

Source: Office of the National Economic and Social Development Board
Note: 1981 based values

[7] Seasonal palustrine wetlands (freshwater), based on the wetlands classification system of Thailand (see Section 2.2.1 and Appendix 6).

Rivers

Fishery

Information on the fisheries of the Mun River is mostly derived from reports of scientific research. This includes a study conducted by Duangsawasdi and Duangsawasdi (1992) on fishery resources and status in the Mun River. The study covers the entire river ranging from Nakhon Ratchasima, Buri Ram, Surin, Sri Saket to Ubon Ratchathani Province, where the river discharges into the Mekong River. The study found that, in most cases, fishery remains a subsistence practice using traditional fishing gears such as purse seines, gill nets, long lines, cast nets and traps. Approximately 70 fish species of 23 families were found, with Cyprinidae being the most common type. Fishery productivity in 1992 was estimated to be 14 kg/rai. The study also found that the water pollution crisis in Pong, Chi and Mun rivers resulted in the deaths of up to 20 tonnes of 83 species of aquatic animals.

Over the period 1990-1991, Duangsawasdi and Chookajorn conducted a study on the fishery status and fish species distribution in the Mun River. The study found 68 species distributed throughout the river and its floodplains. The study also found that most fishers are in fact farmers who take up fishing to earn an extra income. Only six types of fishing gear are used in traditional fishing, with nets as the most popular (Duangsawasdi and Chookajorn 1991). Prasit Kunurattana et al. (1998) found 45 fish species in the swamp forests of the Mun and Chi river confluence, and estimated fishery productivity in the area to be 3.5-5.7 kg/rai.

Transport

There is no report on the use of wetlands in Surin Province for transport. This may be due to well-developed land transportation infrastructure, with 101 roads connecting districts, sub-districts and villages in the province, as well as roads connecting to other provinces. The province is also serviced by the Bangkok-Ubon Ratchathani train route (Surin Provincial Office 2002).

Floodplains

Paddy fields

Most of the reservoirs in the northeast experience a significant decline during the dry season, with the exception of the Mun River, which is able to supply water for agriculture throughout the year. The Huai Saneng Irrigation Project and a number of reservoirs also supply water for agricultural activities and consumption, particularly during the drought. Paddy fields that receive water from these reservoirs have been used for the activities discussed below.

Rice production

Approximately 49.32% of Surin Province has been classified as suitable for rice farming (Land Development Department 1990). Rice productivity in the province is mainly limited by the soil's limited ability to retain water. Nevertheless, the area used for rice cultivation is expanding, reaching as much as 86% of the province at one point. Seasonal cultivation takes place between April and September, while harvesting usually occurs between October and January.

There is little off-season rice farming in irrigation areas. The area cultivated for such rice in each year fluctuates according to the availability of water from irrigation systems. Off-season rice farming peaked in 1997/1998, with an area of 5 145 rai, and bottomed out in 1994/95 with a cultivated area of only 400 rai. Highest productivity and value for off-season farming was experienced in 1996/97 with production of 1 505 tonnes and a value of 6.05 million baht, while the lowest was experienced in 1994/95, with production of only 54 tonnes and a value of 0.41 million baht.

Production of vegetable and other crops

Vegetables are cultivated mostly in the lower plains and river plains that are supplied by irrigation systems and natural water sources. The area cultivated is often the same area as that used for rice farming, as vegetables are usually grown after the rice is harvested. Popular species for cultivation include cucumber, red onion, peas, cauliflower, ma khuea, chilli, and basil.

Significant fluctuations in the area used for cultivation of vegetables have been observed over the last decade, with the influencing factors being water supply and the market. Production and value during this period reflected the area cultivated, with a peak production/value (49 262 tonnes/338 million baht) in 1999/2000 and the lowest production/value (10 417 tonnes/56 million baht) in 1998/99.

Livestock grazing

The geographical conditions and natural vegetation of wetlands make it suitable for livestock grazing. Wetlands, particularly floodplains, are often rich in vegetation, providing abundant animal feed for livestock and other domesticated species. Domesticated species that are commonly found in wetlands of the province are cows, buffaloes and ducks.

Herds of livestock are usually brought into floodplains and swamp forests for most of the year, except for the rainy season (June-September), when they are mostly kept at home.

Major factors influencing changes in the number of livestock include:

1. Rice farming and other cultivation have gradually switched back to traditional tillage practices since 1985. The practice became common in all areas in 1995.

2. Labor shortages in households, due to migration to other areas, as well as better education services, which resulted in more children in schools, resulted in a switch from buffaloes to cows, which are easier to maintain.

3. An increase in the number of dikes and dams, causing expansion of permanently inundated areas and a reduction in the area available for grazing.

Aquaculture

Aquatic animals are an important source of protein for the rural population of the northeast region. In the past, most aquatic animals were harvested from natural waterbodies. It was estimated that the catch from major rivers during the period 1967-1969 was approximately 14 kg/rai. At present, fish production from natural waterbodies is unable to meet the demand for local consumption, and aquaculture has been introduced to fill the gap. The cultured area accounts for only 16% of the area used for aquaculture nationwide (Boonchuwong and Sithimonga 1997) and in general aquaculture in the northeast is still not fully developed. Most aquaculture operations are integrated farming systems in irrigation zones, and popular fish species cultured include the Thai silver barb, the Nile tilapia and the common carp.

Aquaculture has expanded under the Northeast Fishery Development Project, which aimed to provide a source of protein and extra income for poor people in remote areas by way of subsistence aquaculture, village fisheries and schools fisheries. Between 1982 and 1992, aquaculture production in the northeast increased by 189%. However, yield increased by only 10%, and this reflects the fact that most production came from subsistence aquaculture. Indeed, most aquaculture in Surin Province involves small-scale subsistence practices using ponds, paddy fields, ditchs or cages. Pond culture is the most popular type, accounting for 65% of the total aquaculture area in 1999.

Trap ponds

Pak-Uthai and Kan-On-Sri (1986) surveyed 40 farm households from seven villages in four provinces – namely, Roiet, Surin, Srisaket and Yasothon provinces. The study found that there were 1.38 trap ponds per household. The study also found that trap ponds accounted for 84% of the average annual catch per household. Trap ponds are thus important methods of fish production for Thung Kula Ronghai, with an approximate productivity of 2.947 kg/km^2.

Inundated forests

Economic valuation of inundated forest resources was assessed for 366 households in 11 villages of Surin Province by the Department of Environmental Quality Promotion in 2000. By taking into account the values of all products harvested from inundated forests along the bank of Mun River in 1995 as part of the Tam Mun Project, the study found that the economic value of inundated forest resources per household was an average of 38 906 baht per year as detailed in Table 13.

Reservoirs

Fishery

Fishery in the province is still underdeveloped due to both a lack of substantive stock and shallow waterbodies. Most fishers are skilled in collecting fish from shallow floodplains with simple fishing methods.

Table 13. Economic values of inundated forest resources

Types	Resources from inundated forests	Value (baht/year)
From cultivation	Rice, kenaf, melons, peanuts and corn	6 445 477
From plants (food and other products)	Fuelwood/charcoal, wild potatoes, mushrooms, bamboo shoots, wild vegetables, fruit, wood and vines	3 033 815
From animals	Fish, mollusks, frogs and animal wastes (as fertilizer)	4 760 285
	Total	14 239 637
	Average per household	38 906

Sources: Department of Environmental Quality Promotion (2000)

There are only medium and small reservoirs in Surin Province. Annual fishery production from these reservoirs in the years 1995-1999 was estimated to vary between 264 and 499 tonnes, as detailed in Table 14.

Table 14. Fishery production from reservoirs of Surin Province, 1995-1999

Year	Area (rai)	Production (tonnes)	Value (million baht)
1995	41 451	345	10 880.21
1996	39 813	459	15 747.94
1997	39 713	264	11 277.16
1998	55 344	388	14 070.22
1999	68 267	499	15 416.00

Sources: Department of Fisheries (1999)

Water for consumption

Reservoirs under irrigation projects are generally divided into large, medium and small reservoirs. Water in these reservoirs is mostly used for agricultural purposes, although six reservoirs that are located near densely populated communities have been used to supply water for human consumption. The use of reservoirs for this purpose is likely to increase with urban expansion and the growth of economic activities in the province; during a period of 5 years (1995-1999), demand for water rose from 5.9 million m^3 in 1995 to 7.5 million m^3 in 1999 (see Table 15).

Table 15. Storage volume of reservoirs under irrigation projects and the volume used for human consumption in Surin Province, 1997-2001

Year	Storage volume (million m^3)	Volume for human consumption (million m^3)
1997	1 354.9	5.9
1998	1 031.3	6.8
1999	1 870.7	7.4
2000	4 903.1	7.4
2001	4 750.1	7.5

Source: Office of Provincial Irrigation Project, Surin Province (2002)
Note: Only six reservoirs supplied waterworks services in the province.

Tourism and recreation

Wetlands are of significant importance to recreation and tourism. Common recreational activities found in wetlands include water sports, fishing, bird watching, and nature study. Tourist sites in wetlands in Surin Province accommodated less than 1 000 local visitors a year, with the exception of Huai Saneng where the visitors numbered 625 909 in 2001 and accounted for 76.83% of all visitors to the province. The average spending of each tourist was estimated to be 425.72 baht per day (Tourism Authority of Thailand 2002).

Swamps and marshes

Swamps and marshes include both natural and semi-natural swamps that have been developed to increase production from "community fish ponds". Fish production from natural waterbodies between 1995 and 1999 fluctuated between 743.55 and 1 058.90 tonnes. The production from community fish ponds in the same period ranged from 53.87 to 239.76 tonnes, as detailed in Table 16.

Case study: Buri Ram Province

General description

Buri Ram Province is located in the southern part of the northeast region, covering a total area of approximately 10 394 km^2. Forested lands cover 5.11% or 527 km^2 of this area. Buri Ram Province is divided into 23 districts, 189 sub-districts and 2 501 villages. The population density is ranked

Table 16. Fish production in public swamps and marshes of Surin Province, 1995-1999

Year	Natural waterbodies			Community fish ponds		
	Area (rai)	Production (tonne)	Value ('000 baht)	Area (rai)	Production (tonne)	Value ('000 baht)
1995	18 204	775	2 245	2 117	240	554
1996	17 021	744	24 796			
1997	16 485	813	28 376	2 078	54	1925
1998	30 086	1 059	35 558	7 574	155	5658
1999	55 634	759	26 554	9 514	95	3480

Sources: Department of Fisheries (1999)

as the 8th highest at the national level and as the 5th highest in the northeast region (as of 31 March 2001). Approximately 89% of the people are farmers and 60.04% of the province is used for cultivation, particularly rice, sugarcane and cassava.

The province is administered by a provincial administration, 24 municipalities and 189 sub-district administrations.

Six important rivers flow through Buri Ram Province: The Mun River, the Chi River, the Lum Plaimat, the Lum Nang Rong, the Lum Pa Tia, and the Lum Pung Chu.

Buri Ram province has 18 large reservoirs, with a total storage capacity of 299.57 million m^3. The most important reservoir in the province is Lum Nang Rong reservoir. Irrigation areas of the province cover an area of 173 510 rai. A total of 204 medium-sized reservoirs provide additional support to these areas.

Homchern (1999) found that the most common type of wetland in Buri Ram Province is palustrine wetlands (FPS),[8] which accounts for 63.81% of the total area of the province. Again, this may be due to the inclusion of some parts of Thung Kula Ronghai in the estimation. Details of each type of wetlands in Buri Ram Province, excluding riverine systems, are provided in Table 17.

Table 17. Types of wetlands in Buri Ram

Types	Proportion	Area	
	(% of the province)	(km^2)	(rai)
FRR	*	*	*
FRF1/FRF2	3.73	387.70	242 310
FRF3/FRF4	0.21	21.83	13 642
FLL	1.20	124.73	77 955
FLP	0.36	37.42	23 387
FPS	63.81	6 632.41	4 145 257

Source: Homchern (1999)

*Note: 1. * = Area data not applicable as this wetland type refers to rivers*
2. Total area of Buri Ram Province is about 10 394 km^2 (~ 6.45 million rai)
3. See Appendix 6 for description of wetland classification codes

Gross provincial product

The GPP of Buri Ram Province in 1999 was estimated to be 32 935 million baht (USD803 million) (Table 18). The retail-wholesale sector contributed the most to the GPP, with an approximate value of 7 788 million baht, or 23.6% of the total GPP. This is followed by the agricultural sector, valued at approximately 7 098 million baht, or 21.6%. The remaining 54.8% came from minerals, industry, construction, electricity and waterworks, transport and communication, banking and insurance, ownership of dwellings, the public service and the service sectors.

The agricultural sector can be divided into five sectors – namely, crops, livestock, fisheries, forestry, and the agricultural services/post harvest sector for agricultural products. Most agricultural products are related to wetlands either as direct products of wetlands or as products from processes supported by wetlands. The total productivity of the agricultural sector increased from 6 598 million baht in 1995 to 8 056 million baht in 1998, dropping to 7 098 million baht in 1999.

Rivers

Fisheries in Buri Ram Province are similar to those in Surin province, as both provinces rely mostly on the Mun River. Researches into fisheries in the provinces have often been conducted as overview

[8] Seasonal palustrine wetlands (freshwater) based on the wetlands classification system of Thailand (see Section 2.2.1 and Appendix 6).

Table 18. Gross provincial product of Buri Ram Province in 1995-1999 (million baht)

Sectors	1995	1996	1997	1998	1999
Agriculture	6 598	7 544	7 978	8 056	7 098
Cropping	*4 524*	*5 136*	*5 658*	*5 980*	*4 565*
Livestock	816	830	927	807	*1 084*
Fishery	137	243	137	175	202
Forestry	153	217	164	7	3
Agricultural services	473	481	504	553	549
Preliminary processing	495	637	588	534	695
Mineral	217	290	440	219	282
Industry	3 337	2952	3 309	3 528	4 113
Construction	2 876	3293	2 011	1 339	1 121
Electricity & waterwork	342	413	423	482	495
Transport & communication	885	940	1 038	1 029	1050
Retail & wholesale	6 936	7 424	7 874	7 669	7 788
Banking & insurance	1 137	1 332	1 481	1 816	1 088
Ownership of dwellings	1 243	1 301	1 385	1 471	1 556
Public service	2 432	2 223	2 230	2 382	2 613
Service	4 157	4 334	4 875	5 339	5 731
Total	**30 160**	**32 046**	**33 044**	**33 330**	**32 935**

Source: Office of the National Economic and Social Development Board
Note: 1981 based value

surveys, and not as in-depth investigations. The transport value of wetlands in the province is also similar to that of Surin Province, with water transportation being far less important compared with land-based transport.

Floodplains

Paddy fields

Important waterbodies of Buri Ram Province include the Mun River, the Chi River, Lum Plaimat, Lum Nang Rong and Lum Pa Tia (Buri Ram Provincial Agricultural Office 2000). In addition to these natural waterbodies, agricultural areas of about 88 080 rai in the province are also supported by another 18 irrigation reservoirs. The largely sandy soil of Buri Ram Province contains little nutrient and is more erodible than other types of soil. Paddy fields are used for the agricultural activities discussed below.

Rice production

Approximately 4.3 million rai or 66.15% of Buri Ram Province, mostly in lower plains and plains around water sources, has been identified as suitable for rice farming (Buri Ram Provincial Agricultural Office 2000). Varieties of rice grown in the province and the cultivation and harvest patterns closely reflect that of Surin Province. Off-season rice farming in irrigation areas is relatively small, and the area used for such farming in each year fluctuates with the availability of water from irrigation systems.

Production of vegetables and other crops

Similar to Surin Province, vegetables are mostly cultivated in the low plains and riverplains in Buri Ram Province, using water from both irrigation systems and natural water sources. The cultivated plots are usually the same areas as those used for rice farming because vegetables are usually grown after the rice is harvested. Popular vegetables cultivated include cucumber, watermelons, red onion, peas, cauliflower, chilli, basil and sweet potato. Other crops, such as peanuts and sweet corn are also grown in these areas.

Between 1994/95 and 1999/2000, there were significant changes in the area used for cultivation of vegetables, due largely to the same factors as in Surin Province (see above). The area cultivated was between 18 292 and 56 330 rai, peaking in 1996/97 and dropping to its lowest in 1999/2000. Production and value during this period followed

the same pattern as the cultivation area, with maximum production of 96 884 tonnes at a value of 779 million baht in 1996/97 and the lowest production, 38 044 tonnes at a value of 241 million baht, in 1999/2000.

Livestock grazing

Livestock grazing in Buri Ram Province operates in a similar way to that in Surin Province. Livestock are usually brought into floodplains and swamp forests during the dry season (October-May). The animals are mostly kept at home during the rainy season (June-September).

Aquaculture

Fish farming in Buri Ram Province is similar to that in Surin Province. Most operations are small-scale subsistence farms using ponds, paddy fields and ditchs. Pond culture is the most common type, in 1999 accounting for 83% of all aquaculture areas. The area dedicated to aquaculture increased at a much lower rate in Buri Ram Province than it did in Surin Province between 1994 and 1999, rising from 4 194 rai in 1994 to 9 040 rai in 1999. As in Surin Province, production from fish farming in Buri Ram Province fluctuates with droughts and floods. The highest production was recorded in 1996, when 3 124 tonnes with a value of approximately 93 million baht was produced.

Trap ponds

Statistics of fishery production by the Department of Fisheries indicate that there were 25 trap ponds in Sa Tuk and Kan Dong District, with a total area of 1.87 rai in 1999. Of these, only seven ponds were found to be capable of producing up to 80 kg of fish. Common species harvested from these ponds are Walking catfish, Snakehead and other miscellaneous species (Department of Fisheries 2000).

Inundated forests

Aajchariyachewin (2000) studied the natural resource use in inundated forests of 175 village households in Kok Nong Ta Krong, Nong Kaman Sub-district, Ku Muang District, Buri Ram Province.

Table 19. Use of inundated forest resources in Nong Kaman Sub-district, Ku Muang District, Buri Ram Province, 2000 (175 households interviewed)

Types of resources	Purposes					
	For household use only		For household use and for sale		For sale only	
	Households	%	Households	%	Households	%
Wild plants						
Mushrooms	121	69.1	9	5.1	-	
Kra Chio	69	39.4	8	4.6		
Wild vegetables and fruits	16	9.1	3	1.7	-	
Herbs	1	0.6	-		-	
Wildlife						
Mice	6	3.4	-		-	
Birds	3	1.7	-		-	
Wood						
Fuelwood	151	86.3	1	0.6	-	
Charcoal	92	52.6	-		-	
For repairing houses	4	2.3	3	1.7	-	
For making equipment	4	2.3	-		-	
For making fences	3	1.7	-		-	
For animal pens	5	2.9	3	1.7	-	
For handicrafts	4	2.3	-		-	

Source: Aajchariyachewin (2000)

The most common resource extracted by the villagers was found to be mushrooms, followed by Kra Chio and wild vegetables and fruits. These plants were collected mainly for local consumption, with a small proportion being sold in the market. Wood was mainly collected for fuel and production of charcoal. Table 19 provides the percentage of inundated forest resources used in households and sold.

The study also revealed that most villagers (56%) acquire these resources by harvesting them themselves, 34.9% both harvest or buy the resources, while 14.9% buy the resources they need. Table 20 provides further details on the percentage of items harvested and percentage purchased for use.

Table 20. Means of acquiring resources in Nong Kaman Sub-district, Ku Muang District, Buri Ram Province, 2000 (175 households interviewed)

Means	Households	%
Harvested	98	56.0
Wild plants	38	21.7
Wildlife	1	0.6
Wood	78	44.6
Kok Nong Ta Krong Forest	39	22.3
Around cultivated plots	35	20.0
From neighbors	6	3.4
Planted by themselves	18	10.3
Purchased	26	14.9
Wild plants	2	1.2
Wood	21	12.0
Charcoal	3	1.7
Harvested and purchased	61	34.9

Source: Aajchariyachewin (2000)

Table 21. Fish production in reservoirs in Buri Ram Province, 1995-1999

Year	Area (rai)	Production (tonnes)	Value (million baht)
1995	86 276	704	22 798.59
1996	86 291	1 088	26 321.13
1997	69 223	977	29 454.90
1998	73 046	972	31 721.34
1999	86 296	1 849	52 981.31

Sources: Department of Fisheries (1999)

Reservoirs

Fishery

Man-made and natural reservoirs, particularly in the Mun River, contribute significantly to fish production in Buri Ram Province. Fish production from reservoirs in the province in the years 1995-1999 fluctuated between 704 and 1 849 tonnes, as detailed in Table 21.

Water for human consumption

There are 329 reservoirs under irrigation projects in Buri Ram province (Office of Buri Ram Provincial Irrigation Project 2002). Three medium-sized reservoirs located near densely populated communities have been used as public utilities providing water for local consumption. During the period 1998 to 2000, demand for water from these reservoirs increased from 4.8 to 5.8 million m^3 (see Table 22).

Tourism and recreation

Notable tourist sites in Buri Ram Province are Lum Plaimat and Huai Chorakhe Mak Wildlife Non-hunting Area. Generally, tourist sites receive less than 1 000 visitors a year.

Biodiversity

There are several wetlands of international importance in Buri Ram Province. These include Huai Chorakhe Mak Wildlife Non-hunting Area, Huai Talat Wildlife Non-hunting Area, Sanambin Wildlife Non-hunting Area and Lum Plaimat. The Mun River and its floodplain are regarded as wetlands of national importance. These wetlands have significant importance for agriculture, livestock and fisheries, with some wetlands, such as the Huai Talat Wildlife Non-hunting Area

Table 22. Amount of water used for human consumption from reservoirs under irrigation projects in Buri Ram Province, 1998-2000

Year	Amount used for human consumption (million m^3)
1998	4.8
1999	5.0
2000	5.8

Source: Office of Provincial Irrigation Project, Buri Ram (2002)

acting as a permanent natural reservoir. They are also host to a number of important terrestrial and aquatic plant species, as well as numerous migratory and non-migratory animal and bird species. These include economically important species such as the Grey featherback (*Notopterus notopterus*) and Eye-spot barb (*Cyclocheicthys apogon*). A number of ecologically important species are also found in this area, such as the endangered Chao Phraya giant catfish (*Pangasius sanitwongsei*), the vulnerable Batrachian walking catfish (*Clarias batrachus*), and the globally threatened Baer's pochard (*Aythya baeri*) and White-winged duck (*Cairina scutulata*).

Swamps and Marshes

Swamps and marshes include both natural and semi-natural swamps that have been developed to increase production from "community fish ponds." Between 1995 and 1999, production from natural waterbodies fluctuated between 1 042 and 5 097 tonnes. The production from community fish ponds in the same period varied between 227 and 1 580 tonnes, as detailed in Table 23.

Conclusion of economic valuation

From a literature review of publications, research reports and statistical records and from consultation with various stakeholders, it can be concluded that the currently available information relating to Surin and Buri Ram provinces would only allow for the evaluation of values derived from the direct use of wetlands (Table 24). These include values from fisheries (capture and aquaculture), agriculture (rice farming, cropping and livestock grazing), inundated forest products (fuelwood, aquatic plants and herbal plants), wildlife, water for human consumption, tourism and recreation (Table 25). It was not possible to value the indirect use of wetlands due to a lack of relevant studies and information. As for non-use values, existing biodiversity information revealed only the data listing existing species and number of plants, birds and aquatic animals.

Nevertheless, this study has classified values of the three dominant wetland systems, riverine systems (including floodplains, paddy fields and inundated forests), lacustrine systems and palustrine systems. The assessment of economic values of wetlands mostly relies on information and data from direct use, such as fishery, agriculture and consumption. It was possible to partially quantify other values such as for tourism and recreation; however, producing economic values from available biodiversity information was not possible within the scope of the research. A summary of the available data is presented in Table 26.

Limitations of data used in wetland valuation assessment

The information presented in the previous section is based on data related to wetlands in Surin and Buri Ram provinces, which were obtained from various information systems. The diversity of information sources results in several constraints on how the data can be used. These are discussed in this section.

Table 27 provides the characteristics and limitations of all collected data, according to sector. It can be observed that most of the data collected were on direct uses such as fishery, agriculture, livestock farming and aquaculture. Most of the data were on floodplains, although data were also collected on inundated forests, trap ponds, reservoirs, swamps, marshes and community fish ponds.

Missions of agencies

The agencies that collect data on wetlands are mostly government agencies. These include the Department of Fisheries, the Office of Agricultural Economics, the Office of Livestock, the Royal Irrigation Department, the Ministry of Interior, the Provincial Agriculture Office and academic institutions such as Khonkaen University. However, some data were also obtained from NGO-led initiatives, such as the Tarm-Mun Project.

Although these agencies compile information on wetlands, information is collected in accordance with the particular duties and interests of each of these agencies, and, in most cases, such information cannot be used to reflect overall economic values of wetlands. In some cases, the collected information either overlaps or is incompatible. For example, a reservoir may be recorded under different names and sizes by different agencies, making it difficult to identify overlaps, and to assess its values.

Method of data collection

Wetlands-related data were derived from three sources – namely, random statistical survey, compilation of available information, and literature review.

Table 23. Fish production in swamps and ponds of Buri Ram Province

Year	Public waterbodies			Community fish ponds		
	Area (rai)	Production (tonnes)	Value ('000 baht)	Area (rai)	Production (tonnes)	Value ('000 baht)
1995	41 950	2780	74 482	5 739	1 580	44 047
1996	42 058	5098	142 170	-	-	-
1997	42 052	2620	78 322	5 859	370	10 117
1998	41 975	1042	31 692	5 859	227	7 402
1999	41 975	2032	85 436	5 758	637	26 829

Sources: Department of Fisheries (1999)

Table 24. Availability of information on the values of various wetland types in Surin and Buri Ram provinces

Types of wetlands	Use																					Non use			
	Direct												Indirect							Option and quasi-option value				Bequest value	
	Fishing	Fish culture	Rice	Vegetables	Livestock	Aquatic plant	Fuelwood, timber & byproducts	Herbal medicine	Water supply	Transportation	Wildlife	Peat/ energy	Nutrient retention	Flood control	Groundwater recharge	External ecosystem support	Recreation/tourism	Micro-climatic stabiliza- tion	Shoreline stabilization	Potential future use	Future value of information	Biodiversity	Culture, heritage, aesthetic value	Habitats	Ecological process
Surin Province																									
1. Rivers	*																								
2. Floodplains																									
2.1. Paddy fields	*	*	*	*	*																				
2.2. Swamp forests	*		*	*		*	*	*			*														
3. Reservoirs	*								*								*								
4. Swamps and marshes	*																								
Buri Ram Province																									
1. Rivers	*																								
2. Floodplains																									
2.1. Paddy fields	*	*	*	*	*																				
2.2. Swamp forests				*			*	*			*														
3. Reservoirs	*					*			*								*					*			
4. Swamps and marshes	*																								

*Note: * = information available*

Table 25. Values of each type of wetland in Surin and Buri Ram provinces

Types	Values from direct use										Intrinsic values
	Fishery	Aquaculture	Rice farming	Cropping	Livestock	Fuelwood, timbers, forest products and water plants	Medicines & herbs	Water supply	Wildlife	Tourism & recreation	Biodiversity
Surin Province											
1. Rivers	*										
2. Floodplains											
2.1. Paddy fields	*	*	*	*	*						
2.2. Freshwater swamps	*		*	*		*	*		*		
3. Reservoirs	*							*		*	
4. Swamps and marshes	*										
Buri Ram Province											
1. Rivers	*										
2. Floodplains											
2.1. Paddy fields	*	*	*	*	*						
2.2. Swamp forests				*		*	*		*		
3. Reservoirs	*					*		*		*	*
4. Swamps and marshes	*										

Random statistical survey

Random statistical survey is a systematic and continuous form of data collection. The effectiveness of this method is often limited by the small sampling size, itself usually due to a lack of funding and human resources. Information from such a survey may not best represent actual conditions, and must be treated carefully in the evaluation of wetlands. The method also has numerous steps and can be more time-consuming than other methods. For this research, information derived from this type of survey included results of a survey on aquatic animal catch and farming by the Department of Fisheries, and a survey of production from cultivation by the 5th Office of Agricultural Economy.

Compilation of all available data

Local officers or volunteers at village level often compile data. This method is labor-intensive, produces less organized data, and takes a considerable amount of time. Furthermore, the quality of the collected data is highly dependent on the collector, who may need to be provided with continuous training to ensure good quality data. For this research, information derived by this method came from livestock surveys undertaken by provincial livestock development offices, and from surveys of production from cultivation undertaken by staff of provincial agricultural offices.

Literature review

Literature reviews on wetlands are often limited by the fact that most available scientific reports are in-depth studies of particular areas and are often incompatible with each other. These reports are often focused on a particular interest area of individual researchers, and, in many case, this makes it impossible to use these reports for overall evaluation of wetland values.

Table 26. Area, production and value of each type of usage of wetlands in Surin and Buri Ram provinces

		Values from direct use										Intrinsic values
Types		**Fishery**	**Aquaculture**	**Rice farming**	**Cropping**	**Livestock**	**Timber, fuelwood, forest products and aquatic plants**	**Medicines & herbs**	**Water supply**	**Wildlife**	**Tourism & recreation**	**Biodiversity**
Surin Province												
1. Rivers	Length (km.)	500.4										
	Productivity (kg/rai)	3.5-5.7										
	Value (baht)	N.A.										
2. Floodplains												
2.1. Paddy fields	Area (x10^6 rai)	N.A.	0.004-0.012	2.50-2.92[1]	0.015-0.025	N.A.						
	Productivity (x10^3 tonnes)	4 715.2 kg/rai[2]	11.324	613.5-847.7[1]	10.4-49.3	271 677-601 114						
	Value (x10^6 baht)	88 221.393	315	1 729-4 632[1]	56-338	N.A.						
2.2. Swamp forests	Area (rai)	N.A.		N.A.			N.A.	N.A.		N.A.		
	Productivity (……)	N.A.		N.A.			N.A.	N.A.		N.A.		
	Value (x10^6 baht/year)	4.7		6.4-4			3.03	N.A.		N.A.		
3. Reservoirs	Area (x10^3 rai)	41.5-68.3				348.9248			6 site		1 sites	
	Productivity (tonnes)	344-499							5.9-7.5 x10^6 m^3		N.A.	
	Values (x10^6 baht)	10.9-15.4							N.A.		N.A.	
4. Swamps and marshes[5]	Area (rai)	16 485-55 634										
	Productivity (tonnes)	743.5-1 058.9										
	Values (x10^6 baht)	2.24-26.50										

Table 26 (continued)

		Values from direct use										Intrinsic values
Types		**Fishery**	**Aquaculture**	**Rice farming**	**Cropping**	**Livestock**	**Timber, fuelwood, forest products and aquatic plants**	**Medicines & herbs**	**Water supply**	**Wildlife**	**Tourism & recreation**	**Biodiversity**
Buri Ram Province												
1. Rivers	Length (km.)	449.6										
	Productivity (kg./rai)	3.5-5.7										
	Value (baht)	N.A.										
2. Floodplains												
2.1. Paddy fields	Area (mil.rai)	N.A.	0.0042-0.009	2.72-3.02	0.018-0.056	N.A.						
	Productivity (x10^3 tonnes)	11.4 kg/ pond	3	585-734	38-97	260 962-587 148						
	Value (x10^6 baht)		93	2 245-4 168	241-770	N.A.						
2.2. Swamp forests	Area (rai)				N.A.[6]		N.A.[6]	N.A.[6]		N.A.[6]		
	Productivity (……)				N.A.		N.A.	N.A.		N.A.		
	Value (x10^6 baht/year)				N.A.		N.A.	N.A.		N.A.		
3. Reservoirs	Area (x10^3 rai)	0.069-0.086							3 sites		2 sites	6 sites
	Productivity (tonnes)	0.7-1.8							4.8-5.8 x10^6 m^3		N.A.	N.A.
	Values (x10^6 baht)	22.8-53.0							N.A.		N.A.	N.A.
4. Swamps and marshes	Area (rai)	41.9-42.1										
	Productivity (tonnes)	1 042-5 098										
	Values (x10^6 baht)	31.7-142.2										

Notes:

[1] *Seasonal crops*

[2] *In trapping ponds*

[3] *Production from trapping pond x price*

[4] *Rice and other crops*

[5] *Excludes community fish ponds*

[6] *Percentage of households that use wetlands*

Table 27. Characteristics and limitations of data on wetland valuation

Sector	Types of wetlands	Characteristics of the data					Limitations	Comments / references
		Collecting agencies	Collection method	Type of information	Frequency of collection	Latest record		
Fisheries	Rivers (Mun River)	Department of Fisheries	Researchrs	Species and production	Uncertain	1991, 1992	Ad-hoc	Santana and Tawan 1991; Mitree and Sunthana 1992
	Inundated forests (Rasi Salai)	Khon Kaen University	Researches	Species and catch	Uncertain	1993, 1997	Ad-hoc	Prasit et al. 1993; Prasit et al. 1997
	Trapping ponds	Department of Fisheries	Statistical surveys	No. of ponds, areas, species, production, values	Annually	1999	Non-comprehensive collection	Trapping pond statistic
	Water reservoirs	Department of Fisheries	Statistical surveys	Number, areas, production and values	Annually	1999	Annual change in size of surface reservoirs	Statistical data of fish production in public freshwater reservoirs
		Department of Fisheries	Reporting	Number and species of released fishes	Annually	2001	Lacking information on catch	Annual reports
	Swamps and ponds	Department of Fisheries	Statistical surveys	Number, area, production and values	Annually	1999	Collected only from swamps, ponds and dikes No data on amphibians and other aquatic animals	Statistical data of fishproduction in public freshwater reservoirs
		Department of Fisheries	Reporting	Number, area and production	Uncertain		Collected only at dikes	Annual reports
Agriculture (Rice)	Floodplains	The 5th Office of Agricultural Economic	Statistical surveys	Types of paddy fields, cultivated and harvested areas, production and values	Annually	1999	Small sampling size due to the lack of budget	Agricultural statistic of the 5th region
		Provincial agricultural offices	Collected by sub-district agricultural officers	Types of paddy fields, cultivated and harvested areas, production and values (district level)	Annually	2001	Collected and distributed only within respected provinces	Reports on agricultural production of each province
	Inundated forests (Rasi Salai)	Khon Kaen University	Researchers	Types of paddy fields and production	Uncertain	1993	Ad-hoc	Prasit et al. 1993
		NGOs	Researchers	Production	Uncertain	2001	Ad-hoc	Sanan 2001

Table 27. Characteristics and limitations of data on wetland valuation (continued)

Sector	Types of wetlands	Characteristics of the data					Limitations	Comments / references
		Collecting agencies	Collection methods	Type of information	Frequency of collection	Latest record		
Agriculture (Vegetables and other crops)	Floodplains	The 5th Office of Agricultural Economic	Statistical surveys	Types of paddy fields, cultivated and harvested areas, production and values	Annually	1999	Small sampling size due to the lack of budget	Agricultural statistic of the 5th region
		Provincial agricultural offices	Collected by sub-district agricultural offices	Types of paddy fields, cultivated and harvested areas, production and values (district level)	Annually	2001	Collected and distributed only within certain provinces	Reports on agricultural production of each provinces
Agriculture (Livestock)	Floodplains	The 5thOffice of Agricultural Economic	Statistical surveys	Species, number and value	Annually	1999	Low sampling size due to the lack of budget	Agricultural statistic of the 5th region
		Provincial livestock development offices	Collected by volunteers	Species and number	Annually	2001	Collected and distributed only within certain provinces	Reports on livestock development of each province
	Inundated forests (Rasi Salai)	Khon Kaen University	Researchers	% used and plant species used as feed	Uncertain	1993	Ad-hoc	Prasit et al. 1993
		NGOs	Researchers	Number and characteristic of practices	Uncertain	2001	Ad-hoc	Sanan 2001
Aquaculture	Floodplains	Department of Fisheries	Statistical surveys (by provincial fishery officers)	Areas, species, production and values	Annually	1999	Small sampling size due to the lack of human resources and funding	Statistical data on freshwater aquaculture

Frequency of data collection

During this project it was found that the frequency of data collection often differed between the various information systems. Data from research projects were usually collected at irregular intervals or for relatively short durations, while data collected for the purpose of periodic statistical reports were of a more regular frequency and covered longer periods.

Conclusions and Recommendations

Conclusions from the study

This report reviews and documents the legal and institutional framework related to wetland management in Thailand. In doing so it also examines the policy framework and international agreements. The legal framework and the institutional arrangements are important factors that often contribute to the success or failure of wetland management. Thailand has many pieces of legislation protecting wetlands; they are enforced by various government agencies, such as the Royal Forest Department and the Department of Fisheries. Legal constraints, however, arise from the fragmentation of laws, the overlapping of power, ineffective law enforcement, lack of compliance, and centralization of power. Although wetlands within the protected area system are considered well protected and remain in good condition, the government should establish many more protected areas, implement a program to enhance compliance, allocate sufficient funds for law enforcement, and increase public participation in wetland management and conservation. In the case of wetlands outside protected areas, which are normally managed by communities or private enterprises, local organizations such as Tambon Administrative Organizations (TAO) can play an essential role in strengthening the role of the local community in wetland managment and conservation. Moreover, the establishment of community-based management can also contribute to more effective wetland management in Thailand.

In terms of economic valuation, it can be concluded that wetlands have a considerable number of values. At present, however, only information on values arising from the direct use of wetlands is available. This is largely due to the fact that most wetlands-related agencies have not been exposed to the idea of indirect and intrinsic values of wetlands.

Because of the lack of information on indirect and non-use values, accurate and comprehensive evaluation of the total value of wetlands was not possible within the scope of this research. It is this incompleteness in the valuation of wetlands that has prevented the recognition of their importances, and has led to the adoption of laws and regulations that are ineffective in protecting the real value of wetlands. This has led to inappropriate uses of wetlands.

Recommendations for conservation and wise use of wetlands

In the light of the problems associated with the intensive use of wetlands, such as degradation of habitats and loss of biodiversity, there is an obvious need for conservation and wise use of the wetlands in the northeast of Thailand. This can be achieved by implementing the recommendations summarized below.

Measures for wetland conservation

- Formulate precise plans for the conservation, restoration and management of important wetlands, and establish agencies that will be directly responsible for this.
- Promote research on biological resources and effective wetland management processes.
- Ensure good coordination between relevant agencies and communities in wetland conservation, restoration and management, to ensure effective management and to minimize adverse impacts.

Wetland protection and management

- Demarcate conservation zones, multiple use zones for development and tourism, and the buffer zone for each wetland site.
- Provide more protection for wetlands by assigning wetlands the appropriate legal status.
- Implement strategies whereby local communities are at the center of enforcement of conservation rules, or where local communities formulate their own rules. Provide a channel for joint responsibilities between villages, and strengthen awareness and public relation activities.

- Promote the establishment of community organizations and networks on wetland management.

Formulate policies and plans on wetland management

- Formulate a masterplan and guiding principles for the development of specific wetlands that allows for public participation.
- Formulate action plans with the participation of communities.
- Plan and designate conservation zones, multiple use zones and buffer zones with the participation of communities in every wetland site.

Promote study and research on wetlands

- Study wetlands at the basin level, from the headwaters to the estuary, by analyzing the overall features of each basin.
- Conduct studies on biodiversity in wetlands, and continuously monitor species' diversity and populations of bird and fish species.
- Conduct action-oriented research by providing opportunities for participation by communities.

References

Aajchariyachewin, N. 2000. Citizen participation in conservation of forest resources of Kok Nong Ta Klong forest, Nong Kaman Sub-district, Ku Muang District, Buri Ram Province. Masters degree thesis, Kasetsart University, Bangkok. 98 p. (in Thai).

Barbier, E.B., M.C. Acreman, and D. Knowler. 1997. *Economic Valuation of Wetlands: A Guide for Policy Makers and Planners.* Ramsar Convention Bureau, Gland Switzerland. xi+127 p.

Boonchuwong, P. and C. Sithimonga. 1997. *Socioeconomic condition on genetic diversity: A case study of* Puntius Gonionotius *culture in Khon Kaen province.* Technical paper No.11/1997, Fisheries Economics Division, Department of Fisheries, Bangkok

Buri Ram Provincial Agricultural Office. 2000. *Agricultural Promotion Zones in Buri Ram Province.* Work Plan Section, Buri Ram Provincial Agricultural Office. (in Thai).

Department of Energy Development and Promotion. 1995. *Reassessment of the Appropriateness of Songkhram River Project.* Principal Report by EPDC International Limited. (in Thai).

Department of Environmental Quality Promotion. 2000. *Pa Bum Pa Tam.* Technical Document for Appropriate Natural Resources Management. Ministry of Science Technology and Environment, Bangkok. 155 p. (in Thai).

Department of Fisheries 1999. *Statistic of the Freshwater Fisheries Product from Natural Reservoir in 1999.* Fisheries Economics Division, Department of Fisheries, Bangkok. (in Thai).

Department of Fisheries. 2002. *Statistics of the Freshwater Fisheries Product from Trap Pond in 1999*. Fisheries Economics Division, Department of Fisheries, Bangkok. (in Thai).

Duangsawasdi, M. and S. Duangsawasdi. 1992. *Fisheries resources and fisheries activities in Mun River.* Technical Paper No. 136, National Inland Fisheries Institute, Department of Fisheries. (in Thai).

Duangsawasdi, S. and T. Chookajorn. 1991. *Fisheries characteristic, species and distribution of fishes in the Mun River.* Technical Paper No. 125, National Inland Fisheries Institute, Department of Fisheries. (in Thai).

Dugan, Parick, J. (ed.). 1990. *Wetland Conservation: A Review of Current Issues and Required Action*. IUCN, Gland, Switzerland.

Homchern S. 1999. *Final Report of Inventory of Wetlands in Northeastern Region.* Faculty of Science, Khon Kaen University. 431 p. (in Thai).

Ingthamjitr, S., W. Niyomthai and C. Somsiri. 1999. *Water quality study for impact assessment on fisheries environment of the pumped storage electricity generating system in the Lamtakong Reservoir.* Technical Paper No. 15/1999. Fisheries Environment Division, Department of Fisheries, Bangkok. (in Thai).

Isvilanonda, S. 1995. *Economics of Natural Resources and the Environment: Principles and Theories.* Kasetsart University Publisher, Bangkok. 219 p. (in Thai).

KKU (Khon Kaen University). 1999. *The Study on Conservation and Protection on Bung Kong Long Wildlife Non-hunting Area in Nong Khai.* Khon Kaen University. 102 p. (in Thai).

Kunurattana, P. et al. 1998. *Seminar on guidelines for formulation of management plan for critical wetlands: Rasisali Swamp Forest, Srisaket Province (swamp forest of Central Mun River Basin)*, Khon Kaen University. (in Thai).

Land Development Department. 1990. *Land Use Plan for Surin Province.* Land Use Planning Division, Land Development Department, Ministry of Agriculture and Cooperatives, Bangkok. (in Thai).

Land Development Department. 1993. *Land Use Plan for Northeastern Region*. Technical Document No. 05/06/3. Ministry of Agriculture and Cooperatives,. Bangkok. (in Thai).

Land Development Department. 2000. Wetlands Classification of Thailand. Accompanying document for *National Workshop on Wetlands Classification System in Thailand*, 17-18 October 2000, Hotel Sofitel Raja Orchid, Khon Kaen. (in Thai).

Office of Provincial Irrigation Project, Buri Ram. 2002. *Completed Reservoir Development Projects in 2000 of Buri Ram Province.* Royal Irrigation Department. (in Thai).

Office of Provincial Irrigation Project, Surin. 2002. *Storage in medium reservoirs in 10 years period (1993-2002).* Water Allocation and Irrigation Improvement Division. Royal Irrigation Department. (in Thai).

OEPP (Office of Environmental Policy and Planning). 1999. *Wetlands in Northeastern Region.* Ministry of Science Technology and Environment, Bangkok. 142 p. (in Thai).

OEPP (Office of Environmental Policy and Planning). 2000. *Biological Resources Values in Mae Hong Son Province.* Ministry of Science, Technology and Environment, Bangkok. 92p. (in Thai).

Pak-Uthai, W. and D. Kan-On-Sri. 1986. *Effect of fishery system on Kula Ronghai Field's socioeconomic conditions 1985/1986.* Farming System Research Project, Khon Kaen University (in Thai).

Pollution Control Department. 1996. *The Brown Report: Pollution Situation in Thailand in 1996.* Ministry of Science, Technology and Environment. (in Thai).

Prapamontol, N. 2001. *The contingent valuation method applied to conservation of fisheries resources in Bun Lahan Wetland, Chaiyaphum*. M.Sc. Thesis, Mahidol University. 222 p. (in Thai).

Royal Forest Department. 2002. *Annual Report 2001*. Royal Forest Department. Ministry of Agriculture and Cooperatives. 132 p. (in Thai).

Somintra, A. 1982. *Geography of Northeastern Region.* Pornsak and Associates Print, Bangkok. 401 p. (in Thai).

Suntornratana, U., A. Poulsen, T. Visser, S. Nakkeaw, and T. Talerkkeatleela. 2002. *Migration onto the floodplain of the Songkhram River Basin.* In Proceedings of the 4th Technical Symposium on Mekong Fisheries, MRC Conference Series No. 2. Mekong Fisheries Commission, Phnom Penh, Cambodia. pp 270-282. (in Thai).

Surin Provincial Office. 2002. *Provincial Development Plan for 2003.* Policy and Plan Division, Surin Provincial Office. (in Thai).

Surin Provincial Agricultural Office. 2001. *Document for briefing to Director-General of Department of Agricultural Extension.* Ministry of Agriculture and Cooperatives. Surin Province. 31 p. (in Thai).

TDRI (Thailand Development Research Institute). 1988. *List of Natural Resources and Environments in Thailand.* Office of National Research Council, Department of Technical and Economic Cooperation. 317 p. (in Thai).

Tourism Authority of Thailand. 2002. *Tourism statistics of each Province.* Tourism Statistic Division. (in Thai).

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.

Yukong W., P. Sithongarn and W. Chunchot. 2000. *Study of Swamp Forest and Community's Livelihoods: A Case Study of Lum Seibai.* Ubon Ratchathani Provincial Forest Office. (in Thai).

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Appendix 1
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Appendix 2
Text of selected articles of the *Fisheries Act, B.E.* 2490* (1947) related to wetlands

Article 7

"The Provincial Council with the approval of the Minister, is empowered to make notification determining fisheries within their province to be in the category of preservation fisheries, concession fisheries, reserved fisheries and public fisheries. Fisheries which are not included in the notification under the preceding paragraph shall be regarded as public fisheries."

Article 12

"Reserved fisheries are fisheries in which a person has been permitted to fish or to culture aquatic animals, include trapping ponds."

Article 13

"No person other than the licensee shall fish aquatic animals in reserved fisheries. The licensee must comply with the conditions imposed by the Director-General."

Article 14

"No person shall dig or build trapping ponds in land which is public domain of State, unless permission has been obtained from the competent official. In privately owned land, the digging or building of trapping ponds is permissible, provided that the aquatic animals in preservation fisheries are not injured."

Article 16

"Public fisheries are fisheries in which every person has the right to fish and to cultivate aquatic animals. Any person fishing or cultivating aquatic animals in the public fisheries must comply with the conditions imposed by the Minister and which is published in the Government Gazette.

Article 17

"No person shall erect anything in preservation fisheries, concession fisheries, reserved fisheries which are not owned by a person, and in public waters, or grow therein lotus, rice, jute, such other crops or water plants as named in the Royal Decree, unless permission has been obtained from the competent official. The licensee must comply with the conditions imposed by the Minister."

Article 18

"No person shall drain water out of the preservation fisheries, concession fisheries, reserved fisheries which are not owned by a person, and out of public waters or trapping ponds, or dry up or diminish water in the said fisheries for the purpose of fishing, unless permission has been obtained from the competent official. The licensee must comply with the conditions imposed by the competent official."

Article 19

"No person shall do any act stupefying the aquatic animals in fisheries, or lay therein poison or any substance dangerous to aquatic animals."

Article 20

"No person shall use explosive or electricity in fisheries except for the scientific purposes and permission has been obtained from the Minister. The licensee must comply with the conditions imposed by the Minister."

Article 21

"No person shall make any alternation to the fisheries not lying within the land owned by a person affecting its former condition, unless permission has been obtained from the competent official. The licensee must comply with the conditions imposed by the competent official."

Article 22

"No person shall erect, set up or build dike, dam, screen fence, fishing nets or other fishing implement in fisheries obstructing the passage of aquatic animals, unless permission has been obtained from the competent official or it is for the agricultural purposes in the land owned by a person. The licensee must comply with the conditions imposed by the competent official such as those relating to the fish-ladders or other implements enabling aquatic animals to swim up and down."

Article 23

"No person shall dig or build cultivation pond in the public areas, unless permission has been obtained from the competent official. The licensee must comply with the conditions prescribed in the permit."

Article 24

"Fishing in cultivation pond requires no permission and is exempted from fishery tax under this Act."

Article 25

"The Minister is empowered to notify any persons in any locality engaged in fishing, trading in aquatic animals, fishery products or fishery industry as may be specified in the Royal Decree, to be registered and to apply for permission before engaging in such an occupation, with or without the license fee charged under this Act."

Article 54

"No person shall, without permission from the competent official, bring into the kingdom such kind of aquatic animals as specified by a Royal Decree."

Article 55

"No person shall introduce in any fisheries any kind of aquatic animals as specified by a Royal Decree, unless permission has been obtained from the competent official."

Appendix 3
Text of selected articles of the *National Environmental Quality Promotion and Preservation Act, B.E.* 2535* (1992) related to wetlands

Article 43

"In case it appears that any area is characterized as watershed area, or characterized by unique natural ecosystems which are different from other areas in general, or naturally composed of fragile ecosystems which are sensitive and vulnerable to destruction or impacts of human activities, or worthy of being conserved due to its natural or aesthetic values or amenities, and such area is yet to be designated as a conservation area, the Minister shall, with the advice of the National Environment Board, be empowered to issue ministerial regulation designating such area as an environmentally protected area."

Article 44

"In issuing the ministerial regulation pursuant to section 43, any one or more of the following protective measure shall be prescribed thereunder:

1. Land use prescriptions for preserving the natural conditions of such area or for preventing its natural ecosystems or its aesthetic values or amenities from being adversely impacted.
2. Prohibition of any acts or preserving that may be harmful or adversely affect or change the pristine state of the ecosystems of such area.
3. Specifying types and sizes of projects or activities undertaken by government agencies, state enterprises or private entities, to be constructed or operated in such area, which shall have the legal duty to submit reports of environment impact assessment.
4. Determination of management approach and method specific to the management of such area including the scope of functions and responsibilities of relevant government agencies for the purpose of co-operation and co-ordination that are conducive to efficient performance of work towards the preservation of natural conditions or ecosystems or aesthetic values and amenities in such area.
5. Prescriptions of any other protective measures which are deemed proper and suitable to the conditions of such area."

Article 45

"In any area, despite having been designated as a conservation area, a master town and country plan area, a specific town and country plan area, a building control area, an industrial estate area pursuant to the governing laws related thereto, or designated as a pollution control area pursuant to this Act, but which nevertheless appears to have been adversely affected by environmental problems which assume a critical proportion to such an extent that an immediate action has become imperative and yet no action is taken by government agencies concerned to rectify the situation due to lack of clear legal authorization or otherwise failure to do so, the Minister shall, with the approval of the National Environment Board, propose for a cabinet authorization to take any one or several protective measures provided by section 44, as necessary and appropriate, in order to control and solve the problems in such area.

When cabinet authorization is obtained as provided in the fist paragraph, the Minister shall, by notification published in the Government Gazette, determine the limits of such area and prescribe in detail the protective measures and the duration for which such measures shall be effectively taken therein.

With the approval of the National Environment Board and the Cabinet, the duration of effectiveness specified according to the second paragraph may be extended by notification published in the Government Gazette."

Appendix 4
Text of selected articles of the *Navigation in the Thai Waters Act, B.E.* 2456* (1913 revised in 1992) related to wetlands

Article 117

"No person shall construct a building or any other structure that encroaches onto, into, or under the water of a river, canal, swamp, reservoir, or lake that is used by people for navigation, either individually or jointly, or the sea within Thai waters or on the beach of the said sea without the permission of the Harbor Master."

Article 119

"No person shall release oil or chemicals into rivers, canals, swamps, reservoirs or lakes that is used for public transportation or that is commonly used by people for other purposes. Any persons offending against the provisions of this clause shall be punished with imprisonment not exceeding three years or with a fine not exceeding sixty thousand Baht or both, and shall pay any expenses incurred in the cleaning process or pay compensation for the damages caused."

Article 120

"The Harbor Master shall have responsibility for the supervision, maintenance and dredging of channels, fairways, rivers, canals, lakes and the sea within Thai waters. No person shall dredge, improve or do anything that shall change the navigation channel, river, canal, lake or the sea within Thai waters without the permission of the Harbor Master. Any person infringing this clause shall be punished with a fine from five thousand to fifty thousand Baht."

Appendix 5
Text of selected Sections of the *Dikes and Ditches Act, B.E.* 2505* (1962) related to wetlands

Section 5. "The field dyke must be secured and able to store water not lower than twenty centimeters and not higher than thirty centimeters above ground level."

Section 6. "Upon the issuance of the Royal Decree under Section 2, the owner of the land shall, within two years from the date this Act comes into force for that locality, complete the construction of a field dyke surrounding the land, to which he has ownership or possessor right inside the boundary of the map appendiced to the Royal Decree.

In the case where the construction of the field dyke surrounding the land under the preceding paragraph is inadequate, the owners of the land must construct dividing field dykes in order to store water as specified in Section 5.

In the case where several owners of the land ask permission to jointly construct the field dyke which is at variance with the boundary of each plot of land, the competent official may, if he deems it appropriate, issue a written permission to such owners of the land."

Section 7.
"Upon the publication of the Royal Decree under Section 2 and after one year enforcement of this Act in any locality, if the Director-General is of the opinion that the owner of the land will not be able to complete the construction of any field dyke within the period of two years or the construction of any field dyke has not been completed after the lapse of two years, the Director-General shall have the power to order the competent official to complete its construction and the cost thereof shall be charged to the owner of the land."

Section 8.
"Upon the publication of the Royal Decree under Section 2, the competent official shall have the power to survey the land inside the boundary of the map appendiced to the Royal Decree for the purpose of planning and specifying description of ditches.
After the competent official has already surveyed the entire part of the land, the Director-General shall determine the plan and description of ditches for the surveyed land and have them published at the Office of Kamnan in that locality.

The plan and description of ditches published under paragraph two may be amended by reasons of necessity and expediency."

Appendix 6 System of classification for Thai wetlands

The wetlands classification of Thailand is modified from classifications of AWB, IUCN, and the US Department of the Interior. The drafting of the classification scheme was guided by several basic principles, as follows:

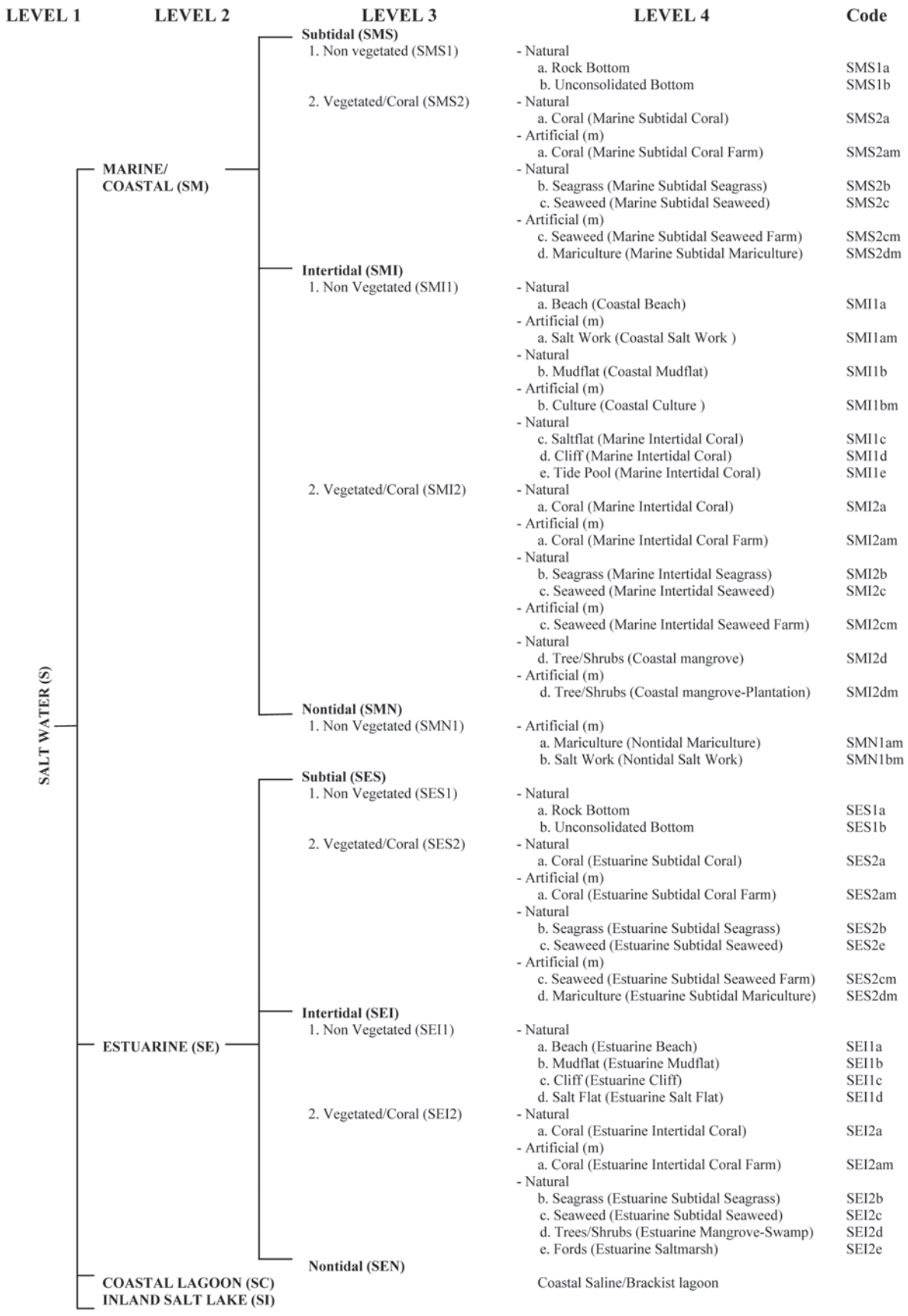
The approach used should:

- be logical;
- be flexible (able to be used for a number of purposes);
- be simple, so that it can be used and understood by workers at the local level;
- use terms and criteria which are meaningful in the national language;
- use terms which are clearly defined;
- in general, allow most wetlands to be allocated to only one class, though some large wetlands may need to be subdivided into two or three classes; and
- be useful at a regional and national level, but be able to be further sub-divided to produce units which can be used at the local management scale.

The following table shows the wetland classification of Thailand:

WETLANDS CLASSIFICATION OF THAILAND (1994)

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	Code
FRESH WATER (F)	RIVERINE (FR)	**River (FRR)**	- Natural	
		1. Perennial River (FRR1)	a. Pool (Pool in Perennial River)	FRR1a
			b. Channel (Channel in Perennial River)	FRR1b
			- Artificial (m)	
			b. Channel (Perennial Canal)	FRR1bm
			- Natural	
			c. Rapid (Perennial Rapid)	FRR1c
			d. Waterfall (Perennial Waterfall	FRR1d
		2. Seasonal River (FRR2)	- Natural	
			a. Pool (Pool Seasonal River)	FRR2a
			b. Channel (Channel Seasonal River)	FRR2b
			- Artificial (m)	
			b. Channel (Seasonal Canal)	FRR2bm
			- Natural	
			c. Rapid (Seasonal Rapid)	FRR2c
			d. Waterfall (Seasonal Waterfall)	FRR2d
		River Bank/Beach/Bars (FRB)		
		River Floodplain (FRF)		
		1. Floodplain Grassland	- Natural	
			a. Grassland (Floodplain Grassland)	FRF1a
			- Artificial (m)	
			a. Rice (Floodplain Wet Rice)	FRF1am
			b. Other Crops (Floodplain Other Crops)	FRF1bm
		2. Floodplain Trees/Shrubs	- Natural	
			a. Trees/Shrubs (Seasonally Flooded-Trees/Shrubs)	FRF2a
			- Artificial (m)	
			a. Plantation/Orchards (Seasonally-lantation/rchards)	FRF2am
		3. Seasonal Foodplain Lake		FRF3
		4. Seasonal Floodplain Pond		FRF4
		5. Seasonal Backswamp/Marsh	- Natural	
			a. Seasonal Backswamp/Marsh	FRF5a
			- Artificial (m)	
			a. Rice (Wet in Seasonal)	FRF5am
			b.Other Crops (Other Crops in Seasonal)	FRF5bm
	LACUSTRINE (FL)	**Lake (>8 ha) (FLL)**	- Natural	
		1. Permanent	a. Permanent Freshwater Lake	FLL1a
			- Artificial (m)	
			a. Permanent Freshwater Lake	FLL1am
		2. Seasonal	- Natural	
			a. Seasonal Freshwater Lake	FLL2a
			- Artificial (m)	
			a. Seasonal Freshwater Lake	FLL2am
		Pond (< 8 ha) (FLP)		
		1. Permanent	- Natural	
			a. Permanent Freshwater Pond	FLP1a
			- Artificial (m)	
			a. Permanent Aquaculture Pond	FLP1am
			b. Sewage Treatment Ponde	FLP1bm
			c. Farm Pond	FLP1cm
			d. Freshwater Cooling Pond	FLP1dm
			e. Borrow Pit, Excavation	FLP1em
			f. Other Permanent Freshwater Pond	FLP1fm
		2. Seasonal	- Natural	
			a. Permanent Freshwater Pond	FLP2a
	PALUSTRINE (FP)	**Permanent Palustrine (FPP)**		
		- Permanent Flooded/Wet	- Natural	
			a. Grasses (Permanent Flood Grassland)	FPPa
			b. Sedge (Permanent Freshwater Marsh)	FPPb
			c. Trees/Shrubs (Permanent Swamp)	FPPc
		Seasonal Palustrine (FPS)		
		- Seasonal Flood/Wet	- Natural	
			a. Grasses (Seasonal Flood Grassland)	FPSa
			- Artificial (m)	
			a. Grasses (Seasonal Flood Plantation)	FPSam
			- Natural	
			b. Sedges(Seasonal Flood Plantation)	FPSb
			c. Trees/Shrubs (Seasonal Flood Swamp)	FPSc
			- Artificial (m)	
			c. Trees/Shrubs (Seasonal Flood Plantation)	FPScm


LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 4
Code
SALT WATER (S)
MARINE/ COASTAL (SM)
Subtidal (SMS)
1. Non vegetated (SMS1)
- Natural
a. Rock Bottom SMS1a
b. Unconsolidated Bottom SMS1b
2. Vegetated/Coral (SMS2)
- Natural
a. Coral (Marine Subtidal Coral) SMS2a
- Artificial (m)
a. Coral (Marine Subtidal Coral Farm) SMS2am
- Natural
b. Seagrass (Marine Subtidal Seagrass) SMS2b
c. Seaweed (Marine Subtidal Seaweed) SMS2c
- Artificial (m)
c. Seaweed (Marine Subtidal Seaweed Farm) SMS2cm
d. Mariculture (Marine Subtidal Mariculture) SMS2dm
Intertidal (SMI)
1. Non Vegetated (SMI1)
- Natural
a. Beach (Coastal Beach) SMI1a
- Artificial (m)
a. Salt Work (Coastal Salt Work) SMI1am
- Natural
b. Mudflat (Coastal Mudflat) SMI1b
- Artificial (m)
b. Culture (Coastal Culture) SMI1bm
- Natural
c. Saltflat (Marine Intertidal Coral) SMI1c
d. Cliff (Marine Intertidal Coral) SMI1d
e. Tide Pool (Marine Intertidal Coral) SMI1e
2. Vegetated/Coral (SMI2)
- Natural
a. Coral (Marine Intertidal Coral) SMI2a
- Artificial (m)
a. Coral (Marine Intertidal Coral Farm) SMI2am
- Natural
b. Seagrass (Marine Intertidal Seagrass) SMI2b
c. Seaweed (Marine Intertidal Seaweed) SMI2c
- Artificial (m)
c. Seaweed (Marine Intertidal Seaweed Farm) SMI2cm
- Natural
d. Tree/Shrubs (Coastal mangrove) SMI2d
- Artificial (m)
d. Tree/Shrubs (Coastal mangrove-Plantation) SMI2dm
Nontidal (SMN)
1. Non Vegetated (SMN1)
- Artificial (m)
a. Mariculture (Nontidal Mariculture) SMN1am
b. Salt Work (Nontidal Salt Work) SMN1bm
ESTUARINE (SE)
Subtial (SES)
1. Non Vegetated (SES1)
- Natural
a. Rock Bottom SES1a
b. Unconsolidated Bottom SES1b
2. Vegetated/Coral (SES2)
- Natural
a. Coral (Estuarine Subtidal Coral) SES2a
- Artificial (m)
a. Coral (Estuarine Subtidal Coral Farm) SES2am
- Natural
b. Seagrass (Estuarine Subtidal Seagrass) SES2b
c. Seaweed (Estuarine Subtidal Seaweed) SES2e
- Artificial (m)
c. Seaweed (Estuarine Subtidal Seaweed Farm) SES2cm
d. Mariculture (Estuarine Subtidal Mariculture) SES2dm
Intertidal (SEI)
1. Non Vegetated (SEI1)
- Natural
a. Beach (Estuarine Beach) SEI1a
b. Mudflat (Estuarine Mudflat) SEI1b
c. Cliff (Estuarine Cliff) SEI1c
d. Salt Flat (Estuarine Salt Flat) SEI1d
2. Vegetated/Coral (SEI2)
- Natural
a. Coral (Estuarine Intertidal Coral) SEI2a
- Artificial (m)
a. Coral (Estuarine Intertidal Coral Farm) SEI2am
- Natural
b. Seagrass (Estuarine Subtidal Seagrass) SEI2b
c. Seaweed (Estuarine Subtidal Seaweed) SEI2c
d. Trees/Shrubs (Estuarine Mangrove-Swamp) SEI2d
e. Fords (Estuarine Saltmarsh) SEI2e
Nontidal (SEN)
COASTAL LAGOON (SC)
Coastal Saline/Brackist lagoon
INLAND SALT LAKE (SI)

Making sense of multiple rules, interests, and values
An examination of the legal and institutional framework and economic valuation of Prukuankreng Wetlands, southern Thailand

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September 2005

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List of Abbreviations and Acronyms

CORIN	Coastal Resources Institute, Prince of Songkla University
DOF	Department of Fisheries
DOH	Department of Health
DOL	Department of Land
DOLD	Department of Land and Development
IUCN	World Conservation Union
MOAC	Ministry of Agricultural Cooperation
MOI	Ministry of Interior
MoInd	Ministry of Industry
MOSTE	Ministry of Science, Technology and Environment
NESDB	National Economic and Social Development Board
NGO	Non-Governmental Organization
OEPP	Office of Environmental Policy and Planning
RFD	Royal Forest Department
RID	Royal Irrigation Department
TAO	Tambon Administrative Organization
TOT	Tourism Organization of Thailand
UNESCO	United Nations Educational, Scientific and Cultural Organization

Introduction

This report outlines the results of the Thai component of the Mekong Wetlands Approach, part of the project, "Legal and Institutional Framework and Economic Valuation of Resources and Environment in the Mekong River Region – A Wetlands Approach" (hereinafter referred to as the Mekong Wetlands Approach), conducted between 1999 and 2004. This is a collaborative project between government institutions involved in riparian issues, and a number of regional organizations including, Wetlands International, the Asian Institute of Technology, the Mekong River Commission and the World Conservation Union (IUCN), coordinated by the WorldFish Center. The Southern Thailand component was coordinated by the Coastal Resources Institute, Prince of Songkla University, Hat Yai.

The aim of the project was to develop an integrated framework for the sustainable management of wetlands, by developing recommendations for their improved valuation and governance in Thailand. The project analyses the current systems of governance relating to wetlands, and methods currently used to evaluate wetland resources, functions and services. Emphasis is placed on the need for information to facilitate wise use and sustainable management of wetlands, and to stimulate discussion and exchange of information about wetland management between stakeholders, with the aim of improving management.

This report outlines the results of an institutional and legal framework analysis of Prukuankreng wetlands in Southern Thailand, and an economic valuation of the Thale Noi Non-hunting Area within the wetlands. Specific attention is given to recent changes to the institutional framework within the Thai central government, and to conflict among multiple stakeholders over the use of wetland resources. The economic valuation addresses how the wetlands are perceived to improve the livelihoods of the people using the resources.

The report is divided into four sections. The first outlines the approach to the research and includes a definition of wetlands in Thailand; the threats and issues facing sustainable wetlands management; and an introduction to the Prukuankreng wetlands. The second section presents the findings of the legal and institutional analysis, using Prukuankreng as a case study. Section three presents the results of an empirical economic valuation of the Thale Noi Non-hunting Area. The final section presents the conclusions and policy recommendations for future wetland management in Thailand.

The 'Wetlands Approach' and the study area

The importance and extent of wetlands in Thailand

Wetlands have been a fundamental part of Thai society and culture since prehistoric times. The inscription found on the Ramkhamhaeng memorial from the Sukothai period (1238-1350 AD), "in the water there are fish, in fields there is rice," exemplifies an importance of wetland resources to Thai society that persists today.

In the Thai language 'wetland' translates as *pru*, a word common to all parts of the country. The ubiquitous nature of the term reflects the extent of wetlands, which cover 3.5 million hectares of the country, from the mountainous north, to the Mekong River Basin in the northeast, and the Central Plains and Southern Isthmus (CORIN 2001). The Ramsar definition for wetlands (below) is regarded as suitable for this highly diverse classification of wetlands:

> "...an area of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters" (UNESCO 1994)

Working groups in Thailand have identified 61 wetlands with international importance and 48 with national importance (Choowaew 1993; Davis 1994; Land Development Department 1994). Classification into the two groups is based on criteria relating to the uniqueness of characteristics, trans-boundary issues, and biodiversity, and is seen as a fundamental step toward implementing appropriate conservation and management strategies for wetlands that meet international, national and local requirements.

Prukuankreng and Thale Noi: The study area

Prukuankreng wetlands reaches into Phatthalung, Songkhla and Nakhon Sri Thammarat Provinces in Southern Thailand (see Figure 1). It is the largest freshwater wetland system in Thailand, comprising peat swamp forest and freshwater mangroves, and draining both north into the Pak Phanang basin and south into the Songkhla Lake System. The total area of the Thale Noi Non-hunting Area is 45 700 hectares, of which 2 800 hectares is water and 42 900 hectares is agricultural land. The three dominant land uses within the wetlands are rice farming (25% of the total area), melaleuca forest (29%) and *kra-jood* grasslands (34%).

Kra-jood (Lepironia articulata) is a reed that is used primarily in handicraft production; its harvest constitutes a major livelihood activity for many communities surrounding Prukuankreng, providing an important source of income.

The wetlands are recognized as nationally and internationally important habitats for biodiversity. In total, 13 species of mammals, 29 species of reptiles and amphibians, 54 species of fish and 260 species of plants have been recorded within the area (Goodyer 2002; Sittikahapak 2002). Thale Noi, the first Ramsar site in Thailand, is renowned for its avian biodiversity, with 187 recorded species, and a bird population that reaches 43 000 between October and March.

The communities that live around Thale Noi are highly dependent on the wetlands for their subsistence and semi-subsistence livelihoods. In total, there are 50 villages adjacent to the wetlands, with a total population of 37 662 people. It is estimated that 74% of the population are rice farmers with a per capita income averaging US$422 per year. The overall average per capita income in the communities is US$468. Those involved in rice farming, rubber production, *kra-jood* collection and fishing have the lowest incomes in these communities, while the highest income earners are laborers and tour boat operators (Table 1).

The communities are well aware of the importance of the Thale Noi wetland. In 1974 the communities

Figure 1. Location of Prukuankreng and the Thale Noi Non-hunting Area

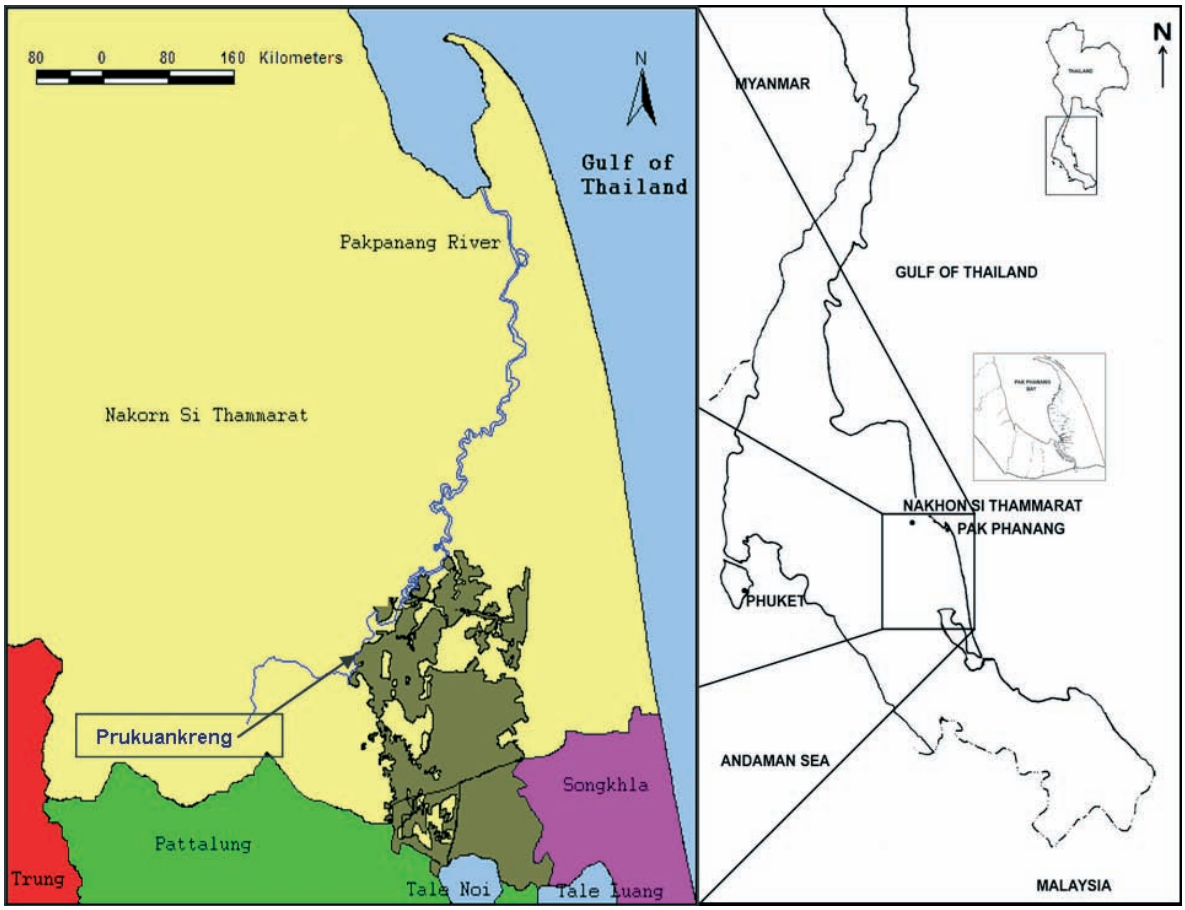


Table 1. Main occupations and average annual income in Phatthalung Province

Occupation	Percent of the total TNNA population	Annual Per capita Income (baht/yr)	Annual Per capita Income (US$/yr)
Rice farming	73.5	17 315	422.32
Fishing	7.6	24 670	601.71
Kra-jood	14.5	22 054	537.90
Rubber	2.0	20 985	511.83
Labor	2.4	40 928	998.24
Tour boat operations	< 0.1	36 000	878.05
Average	-	19 201	468.32

Source : Adapted from Office of Environmental Policy and Planning (OEPP) 1999, Report on conservation and preservation of important wetlands – Thale Noi Non-hunting Area, Phatthalung Province, Vol. 4.

approached the Royal Forest Department to support their efforts to establish the waterfowl and bird sanctuary that now comprises the Thale Noi Non-hunting Area. This eventually led to the successful nomination of Khuan Khee Sian wetland within Thale Noi as the first Ramsar site in Thailand.

Threats and issues

The major threats facing Thale Noi and Prukuankreng stem from changing social and economic conditions in Southern Thailand. The traditional dependence on rice farming and fishing has declined in the last decade as these activities have become less profitable. In order to maintain rice production levels, farmers have had to intensify. Double-cropping has made farmers more dependent on canal irrigation and wage labor. Capture fish stocks have significantly declined as a result of a combination of over-fishing and habitat degradation caused by wetland sedimentation, and coastal erosion. Consequently, farmers have turned to production of other vegetable and fruit crops and to intensive freshwater fish and shrimp farming.

The wetlands have also been threatened by the development of roads, irrigation systems and forestry. Investment from both government and the private sector has led to uncontrolled land use changes in critical wetland habitats. This has meant that peripheral areas of Prukuankreng have been reclaimed for aquaculture ponds, farming land or infrastructure development and human settlement. Development and management of these changes and of the remaining wetland resources have occurred with little involvement of the local communities. This has led to increased conflict over wetlands and wetland resource use, the destruction of unique *kra-jood* and melaleuca forest, and the loss of habitat for fish and migratory birds.

Many development and management initiatives implemented in Thale Noi have failed to address the over-utilization of wetland resources, and the need for better institutional arrangements to deal with conflicts over land use. Planning and management systems that adopt integrated approaches to wetland use and conflict resolution are much needed.

The diverse interactions of wetland use and development provide an opportunity to analyze the complex dynamics of integrated governance and of economic valuation. Prukuankreng and Thale Noi together provide an ideal demonstration site for such analysis; the site provides local communities with a range of uses; it is unique as a tourist site; it enjoys an active management; there is already a large body of information and research relating to the area; and there is a pressing need for improved conflict resolution through better governance.

The wetlands approach

The Mekong Wetlands Approach provides a framework for wetlands' valuation and analysis of wetlands' governance. This approach views wetlands in their broadest sense, integrating governance with environmental services, livelihood use and cultural value. By addressing the threats and challenges outlined above, the approach includes a number of perspectives from different line agencies working at all levels of government.

To date, much research attention has focused on the difficulties managers face in trying to understand the importance and integrated nature

of wetland resources. Application of the Mekong Wetlands Approach in this study helps:

- To apply appropriate valuation methods and strategies for an improved understanding of resource values in management and policy decisions.

- To increase the participation of organizations with responsibility for the management of water resources in discussion about institutional constraints to improved management of wetlands.

The project enables a wide range of stakeholders to share their experience and knowledge of water resources management and development. As it addresses the decline in fishery resources, the importance of an integrated approach to wetlands is increasingly acknowledged by the government. The government recognizes that focusing on fisheries management alone does not adequately address the needs of fishing communities, and that an integrated wetlands approach can incorporate a range of perspectives and sectors that influence the management of wetland resources.

Methods used

The methods used in this study were developed through a series of regional and national consultations, conducted as part of the Mekong Wetlands Approach. Two methods were employed, each corresponding to the empirical studies presented in this report.

Legal and institutional framework analysis

The legal and institutional framework analysis began in 2002. A research team from the Coastal Resources Institute, Prince of Songkla University (CORIN) reviewed all Thai legislation related to wetland resource management, and analyzed the current institutional structure of the Thai government. The team focused on the impacts of the legal and institutional frameworks in the Prukuankreng wetlands, with special attention given to conflict mediation between stakeholders. In addition, the research team carried out interviews and focus group meetings with a range of stakeholders, including traders, fishers, farmers and tour operators. Questions and discussion focused on the different uses of, and conflicts over, wetland resources. The legal and institutional framework analysis enabled the limitations and gaps in governance systems relating to wetlands to be identified. Attention was given to the ways in which local communities gain access to and power over the decision-making process, as well as the role and power of various stakeholders in conflict over the wetland resources.

Economic valuation

The economic valuation of the Thale Noi Non-hunting Area was based on both qualitative and quantitative data. Both types of data have a combination of strengths and weaknesses, but the different approaches were seen as complimentary. Field surveys and meetings with stakeholders helped identify specific items of data to be included in the study. A rapid assessment survey was conducted to collect primary data, and, along with other data from secondary sources, was analyzed by means of simple calculation, functional estimation, and calibration of values using benefit transfer techniques.

The economic valuation was conducted by a research team from CORIN, consisting of an economist and an ecologist. The valuation was conducted in two stages, between June and September 2003. The first study was a reconnaissance survey to identify wetland issues and relevant stakeholders. During this field trip an analysis of trade networks for wetland products was conducted. Information was collected on the number and type of traders and on market price and quantity.

During the second field study, researchers identified and interviewed primary stakeholders involved in the use and trade of wetland products. These stakeholders included primary users of the wetlands, such as fishers, fish farmers, rice farmers, vegetable growers, traders and brokers, *kra-jood* harvesters, handicraft traders and tourist boat operators. The study was expanded to include secondary consumers of wetland products, such as consumers of retailed products and tourists. Finally, key informants from selected management bodies, including the Thale Noi Non-hunting Office, local administrative organization offices and the Department of Irrigation, were interviewed.

Legal and institutional framework

Prukuankreng is an example of wetland resource management in southern Thailand. The findings

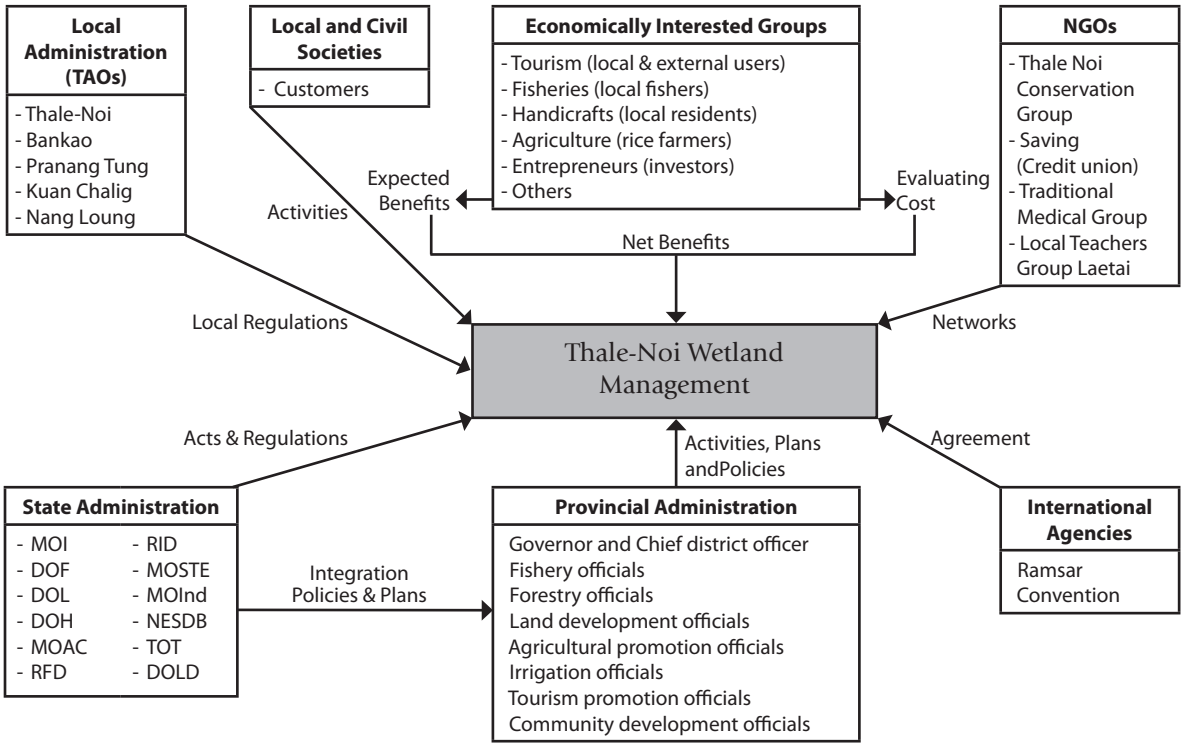
of the legal and institutional framework analysis can be extrapolated to wetlands and wetland resource management in other parts of Thailand. The aim of the analysis is to provide a better picture of the current framework under which wetlands are managed in Thailand. It provides an opportunity to discuss the main limitations of existing legislation and management frameworks, and to identify opportunities to develop an integrated management system that better reflects contemporary issues of wetland use in Thailand. The following analysis begins by outlining the existing institutional and administrative framework under which wetlands are governed. Discussion then turns to the specific legislation that is most relevant to wetlands. Finally, the main stakeholders involved in Prukuankreng wetlands are described, and the main conflicts that arise between these stakeholders and the government are discussed.

Institutional framework for wetland management

National administration

The Thai public administration structure involves line agencies with jurisdiction running from central to provincial and local administrations (Figure 2). Under the existing system, the central administration controls policy and planning, while the provincial and local administrations are responsible for implementation (Boromthanarat et al. In prep.). The complexity of the government system, with multiple government agencies working in cross-sectoral areas (such as natural resource management), has led to numerous areas of institutional duplication and conflict (Anon. 1995). Several agencies have been established to resolve these problems but have not been successful as they lack the authority

Figure 2. Institutional and administrative structure of wetland management in Thale Noi



MOI – Ministry of Interior; DOF – Department of Fisheries; DOL – Department of Land; DOH – Department of Health; MOAC – Ministry of Agricultural Cooperation; RFD – Royal Forest Department; RID – Royal Irrigation Department; MOSTE – Ministry of Science, Technology and Environment; MoInd – Ministry of Industry; NESDB – National Economic and Social Development Board; TOT – Tourism Organization of Thailand; DOLD – Department of Land and Development; Danced – Danish Cooperation for Environment and Development; TAO – Tambon Administrative Organization.

to control the activities of other agencies (Jenkins et al. 1999). In addition, public participation in the management of natural resources in Thailand, a key constitutional right, has not been realized. Instead, Non-Governmental Organizations (NGOs) have become prominent in assisting communities with resource management issues, and in advocating and representing the concerns of communities in public debate.

Administration of wetland resources in Thailand exemplifies the difficulties faced in natural resources management. In response to interagency conflict, a National Sub-Committee on Wetland Conservation was established. Representatives were included from the relevant natural resource-related agencies (Office of Natural Resources and Environmental Policy and Planning; Royal Forest Department; and Department of Land Development), as well as from the private sector and NGOs. Technical assistance was given by independent wetlands experts. The Committee produced a national wetlands action plan that was approved by the Thai Cabinet in 2000. The hub of the plan placed wetlands under a system of protected area management. This neglected the growing recognition in Thailand of the importance of wetlands to rural livelihoods throughout the country. Because of this, a number of questions about the practical management of economically productive wetlands were left unanswered.

Structural reform

In 2002, the government implemented the Structural Reform Act, under which the roles and responsibilities of wetland management were changed. The details are yet to be outlined, and it is yet to be seen whether or not the changes will improve agency performance. The main change is a shift from multi-tasking to agency specialization. Responsibility has been moved from the Ministry of Agriculture and Cooperation and the Ministry of Social Development and Human Settlement to the Ministry of Social and Human Resource Development, and the Ministry of Natural Resource and Environment. These new agencies focus on the capacity of communities to protect and maintain wetland resources. Other relevant departments directly involved in wetland resource management include the Department of Marine and Coastal Resources, the Coastal Land Management Department and the Human Settlement Department.

In summary, the reform has not only resulted in the reorganization of the government agencies involved in wetland management, but also has reduced the number of Ministries and agencies governing wetland resources. Wetlands now come directly under the Ministry of Natural Resource and Environment. The aim of this reform is to place greater responsibility, power and authority in one agency, in order to improve wetland resource management. However, confusion remains over the details.

The institutional framework for wetland management in Prukuankreng

Prukuankreng straddles the administrative boundaries of three provinces: Phatthalung, Nakhon Si Thammarat, and Songkhla. Even though Songkhla province has the highest percentage area of wetland, the management comes under the control of Phatthalung province, where both the Thale Noi Non-hunting Area and the Kuan Khee Sian Ramsar site are located. These wetlands provide a good case study of a multiple-use, multiple-stakeholder resource existing across a number of provincial jurisdictions. As such, the area is subject to resource conflicts and a wide range of competing values.

A major institutional limitation to wetland planning and management in Prukuankreng is the lack of a responsible authority. Although various government agencies – such as the Royal Irrigation Department, the Rural Water Authority, the Tourism Authority of Thailand, the Department of Public Works, and the Royal Forest Department – bear responsibility for their own area of technical expertise, coordination of the agencies is lacking.

Not only are the responsibilities of the individual authorities narrowly defined, but also the legislation they develop is rarely enforced. This is seen throughout Prukuankreng, where wetlands are being converted to agricultural land and aquaculture ponds. This process is driven by private interests that are empowered by weak law enforcement.

Impact of laws on Prukuankreng wetlands management

National laws and legislation

There is no single set of policy, laws and legislation concerning management of wetland resources in Thailand. However, the National Environmental

Board of Thailand has outlined strategic measures for the development of policy and an action plan for wetland management (see CORIN 2001). Despite the need for developing new policy and legislation there are a number of existing Acts and codes relevant to wetlands and wetland resources (see Appendix A) The most relevant of these focus on aquatic animals, natural sources of water, wildlife, and forest resources including plants (see Table 2).

Aquatic animals and wildlife are governed by the *Fisheries Act*, the *National Park Act* and the *Wildlife Preservation and Protection Act*. These legislate for the preservation of animals in areas such as the Thale Noi Non-hunting Area and National Parks. In addition to promoting conservation, the *Fisheries Act* also promotes the wise use and management of aquatic animals and of water resources that are important for fish production.

The use and management of water resources come under a number of pieces of legislation, including the *Land Law Code, Canal Protection Act, People Irrigation Act, State Irrigation Act, National Park Act* and *Thai Navigable Waters Act*. These provide a balance between the use and preservation of water resources, as well as regulating, maintaining and issuing rights over the use of water.

Forests and forest resources are governed by the *National Park Act*, the *Forestry Act* and the *National Forest Reserve Act*. Again, these provide a balance between the use and preservation of forests and for the regulation of forests and forest resources.

Overall, these Acts provide a diverse set of legislation for the governance of wetland resources in Thailand. However, two problems inherent within these laws emerge. First, there is considerable crossover between legislation, which confuses the jurisdiction of different government agencies. Secondly, this confusion is coupled with a lack of capacity to enforce these laws at the local level.

The impact of laws in Prukuankreng

Prukuankreng provides an example of the problems faced in implementing legislation relating to wetlands and wetland resources. The pieces of legislation most relevant to Prukuankreng are the *Enhancement and Conservation of the National Environmental Quality Act*, the *Fisheries Act* and the *People Irrigation Act*. Together, these address a number of pressing issues in Prukuankreng, including the management of aquatic animals, the regulation of water resources and of canal construction, and the protection of wetland forest areas. The jurisdiction of these laws is linked to systems of land use practiced in different wetland areas. For example, the Thale Noi Non-hunting Area is a protected area and has historically come under the jurisdiction of the Royal Forest Department, while agricultural land is under the jurisdiction of the Department of Irrigation.

The government structural reform program placed responsibility for the management of Prukuankreng under the newly formed Department of

Table 2. Major laws and acts related to wetland resources management and conservation

Natural resource	Laws	Objectives of the laws
All aquatic creatures	Fisheries Act	Regulate the use of aquatic creatures Aquatic creatures preservation
Natural sources of water, i.e. rivers, canals, lakes, sea	Fisheries Act	Regulate the use of water sources Safeguard water reservoir
	Land Law Code	Issue right of land
	Canal Protection Act	Canal maintenance
	State Irrigation Act	Provide irrigation for agriculture, electricity and industry Safeguard water reservoir for irrigation
	People Irrigation Act	Regulate use of water for agriculture
	Thai Navigable Waters Act	Navigation and transportation management
	National Park Act	Preserve water sources in national parks
Wildlife	National Park Act	Preserve wildlife in national parks
	Wildlife Preservation and Protection Act	Protect wildlife in preservation areas
Forest and plants	National Park Act	Preserve plants in national parks
	Forestry Act	Regulate use of forest and preserve forest
	National Forest Reserve Act	Regulate use of forest and preserve forest

Marine and Coastal Resources and the Ministry of Natural Resources and Environment. Despite these changes, the legislation governing the management of wetlands remains the same. The laws and regulations are not relevant to the specific problems facing resource users in Prukuankreng, and there is limited capacity to enforce laws and regulations.

There is a clear divide between community perceptions of the value and effectiveness of the various pieces of legislation in Prukuankreng. On one hand, the *Fisheries Act, People Irrigation Act, and Tambon Administrative Organization Act*[2] have been perceived to be effective in balancing resource use and conservation without inciting conflict between communities and the government (Table 3). On the other, the *National Forest Reserve Act* is seen to have been highly divisive, removing land use rights to enforce preservation and conservation.

In Prukuankreng, limitations and confusion over the effective implementation of legislation is highlighted by conflicts over land tenure and infrastructure development. The designation of forest reserves by the Royal Forest Department has caused major conflict in Prukuankreng as it has removed the rights of communities to use various wetland areas that they do not own (usufruct rights). In addition, conflict has emerged over constraints on basic infrastructure development in wetland areas that have been designated forest reserve. These conflicts have persisted since the inception of government protection of the wetlands in 1974. Legislation that focuses narrowly on conservation limits the participation and ownership of communities in Prukuankreng. Without further empowerment of these communities in the management of the wetlands and wetland resources, encroachment by exploiting agencies and consequent degradation of the areas are sure to continue.

Resource users in Prukuankreng

Thailand is unique in the region in the extent to which mechanisms of accountability are constitutionally guaranteed and practiced in legal, judicial and political processes. The 1997 Constitution grants affected people the legal right, not only to participate in development planning, but also to dispute development decisions in the courts. Within the 50 villages surrounding Prukuankreng there are a diverse range of livelihood activities, including rice farming, fishing and the collection of wetland resources. The variety of livelihood activities, and the confusion about departmental jurisdiction over wetland resources has led to a number of unresolved conflicts. Before discussing the institutional limitations and main types of conflict, the activities, stakeholders and areas of responsibility in Prukuankreng are outlined.

Capture fisheries and aquaculture

Fish and other aquatic animals are an important source of income and nutrition for communities surrounding Prukuankreng, especially for poorer communities and households. However, the fishery is facing increasing pressures. These arise from market demand in the large urban areas of Nakhon Sri Thammarat; the use of non-selective and more efficient fishing technologies; and, changing hydrology associated with degraded wetland habitat. All of these factors cause declines in overall fish catches.

Conflict over illegal fishing practices has increased as both wetland communities and outsiders invest in the fishery, and as the use of non-selective fishing gears – such as electricity – is increasingly employed. Even though the community has agreed to ban many of the gears, many fishers still employ them – highlighting the lack of capacity in local organizations and government agencies to enforce existing legislation.

Table 3. Perceived impact of laws on wetland management

Laws	Resource access and use	Preservation or conservation	Conflict
National Forest Conservation Act	*	***	***
Fishery Act	***	**	*
People Irrigation Act	***	*	*
TAO Act	***	***	*

*Note: * = low impact; ** = moderate impact; *** = high impact*

[2] The Tambon Administrative Organization Act seeks to decentralize resource administration to the sub-district, or Tambon, level.

While the outsiders profit from investing in fishing technology and higher catches, the local communities suffer decreased food availability. The outcome has been a shift in livelihood activities away from a reliance on the wetland fisheries to supplemental activities, such as wage labor.

Aquaculture development in wetland areas of Prukuankreng has increased considerably since the early 1990s. This development has been supported by a number of projects, including the Pak Phanang Basin Development Project and the Prince Chulaborn Walailak Project; both of which aim to increase food and income security from a declining capture fishery. The development of ponds has increased encroachment on wetland, forest reserve and agricultural areas. This has led to a number of conflicts over land use. However, as government officials prefer to avoid conflict, and as they support the overall government policy of increased export of aquaculture products, little action has been taken to prevent illegal encroachment.

Kra-jood harvesting and handicrafts

As mentioned above, a major livelihood activity for many communities surrounding Prukuankreng is the harvesting of the reed *kra-jood*, which is used primarily in handicraft production. The activity provides an important source of income to communities in Tambon Khuan Kreng in Phatthalung Province. However, like the fishery resource, the health and abundance of this plant has faced increased pressure from high demand and changing wetland hydrology. Pressure has also come from forest fires. The prevalence of these fires has increased as outside investors have sought to occupy lands surrounding Prukuankreng. By burning areas of *kra-jood* they have been able to claim that the land has not been occupied, and become eligible to apply to the government for tenure over it. As a result, not only has land use changed but also a large area of *kra-jood* beds in the wetlands has been damaged.

Kra-jood is recognised as an important economic resource and has attracted investment from people living outside Tambon Thale Noi. Since 1997, these 'absentee landlords' have exacerbated the problem of over-harvesting and caused a decline in the natural area of *kra-jood*. Furthermore, rapid harvesting has damaged the *kra-jood* beds and significantly reduced regrowth. The decline in the resource has had negative impact on the livelihoods of communities, with approximately 80% of people in Tambon Kreng now importing *kra-jood* from other wetland areas of Prukuankreng. Importantly, the loss of *kra-jood* has disproportionately affected women, who are more active in collection of the reeds and its use to produce handicrafts.

In response, supported by Tambon Administrative Organizations and the Thale Noi Non-hunting Area Field Office, the communities in Tambon Phanang Thung and Tambon Thale Noi are cultivating large areas of *kra-jood*. However, progress is being hindered by poor wetland habitat and the destruction of seedbeds by the protected Chilli Birds or Bronze-winged Jacana (*Metopidius indicus*). As these birds are protected, the farmers are limited in their course of action.

Other wetland resource uses

Communities surrounding Prukuankreng depend on the wetland and wetland resources for a range of other livelihood activities, including wildlife hunting, agriculture, honey collection, cattle grazing and forestry. However, forest fires, land encroachment and rezoning of wetlands as conservation areas adversely affect the communities, especially the poorer communities which are more dependent on the wetlands for their subsistence.

Wildlife hunting

Wildlife hunting is an important activity for communities surrounding the wetlands. Farmers catch a large range of terrestrial and aquatic animals, including monkeys, birds, turtles and crocodiles.

Cattle

Cattle grazing is an extensive activity in melaleuca forest areas in the wetlands. The wetlands provide a valuable source of common grazing land. Between 20% and 90% of households in the surrounding communities own cattle. However, this activity is only regarded as a supplementary source of income.

Forestry

For communities surrounding Prukuankreng, timber resources are important for house construction, charcoal production, and crafting fishing poles. To use or cut any tree in the wetland, permission must be sought from the Forest Preservation Voluntary Group of the Thale Noi

Non-hunting Area Office. The main function of this group, which is made up of community members from around the wetlands, is the monitoring of forestry activities.

Government and non-government organizations in Prukuankreng

In practice, the management of wetlands and wetland resources is controlled by the resource users, who are represented by community leaders, with support from the local Tambon Administrative Organizations. These organizations, in turn, are supported by government offices that implement legislation and policy relevant to wetland management. The main resources in Prukuankreng – fisheries, *kra-jood* and forestry – each have a similar combination of organizations influencing their management and use.

Fisheries

There are a number of organizations involved in supporting management and advocacy of wetland fisheries. The Thale Noi Non-hunting Area Office and NGOs are most active in education and raising awareness of the importance of natural resource preservation. Other organizations, such as the District Fishery Office and the District Community Development Office, concentrate on alerting communities to the damage caused by illegal fishing gears. Practical management and monitoring of illegal fishing gears is carried out by the Tambon Administrative Organization, which collaborates with community leaders to arrange local surveillance systems and create locally enforced penalty systems.

Kra-jood harvesting

A range of organizations work to educate people on the impacts of over-harvesting *kra-jood*, and encourage communities to re-plant it. Most active in education and advocacy are the District Agricultural Office, the Thale Noi Non-hunting Area Office and various NGOs. In the setting up of monitoring activities, and the enforcement of laws prohibiting the illegal harvesting of *kra-jood* they are directly supported by the Tambon Administrative Organization and community leaders.

Forestry

The management of forest resources in Prukuankreng is a highly contentious issue, with a number of conflicts arising between communities and the Royal Forest Department. At the local level, the District Forestry Office is responsible for regulating the use and preservation of forest lands. It is supported by the District Community Development Office and the Thale Noi Non-hunting Area Office in the tasks of educating communities and promoting responsible use of forests and forest products. Management, law enforcement and monitoring are carried out through the local TAO Office, with the support of community leaders.

Conflicts or competitions among stakeholders

The range of stakeholders, in addition to the top-down implementation of legislation, the lack of institutional coordination and the multitude of organizations influencing resource use, has resulted in a range of conflicts over the use and management of wetlands and wetland resources in Prukuankreng. These conflicts involve government agencies, NGOs and local communities.

Conflict between communities

Communities surrounding Prukuankreng are conscious of the ongoing degradation of the wetlands, and have made serious attempts to implement protection and management strategies. Many communities have a system of management over the resources within their own village area but come into conflict over resource use with neighboring communities. In many cases these conflicts are based around the local politics associated with resource access. Conflict has also arisen in relation to competing land uses in wetland areas. For example, some communities may allocate an area to construct fish ponds and canals for rice irrigation, while the same area is allocated by others to buffalo and cattle grazing. The limited nature of the wetland resources and the multiple uses by local communities is a major factor in conflicts.

Conflict between communities and outsiders

As Prukuankreng is increasingly recognized as a valuable economic resource, local communities have also come into conflict with outside interests that invest in land and infrastructure. These outsiders include land speculators who buy large tracts of land from communities and subsequently obtain land registration documents from the

government. As a result, many local communities have lost use rights over the wetlands. Similarly, habitat degradation has been accelerated by the removal of mangroves, melaleuca forests and *kra-jood* by outsiders.

Conflict between communities and government

There are many areas of conflict between communities and the government; they are associated with land allocation, forest preservation and law enforcement. In many cases, the government has set boundaries after only limited local consultation. Customary rights over the wetlands have not been recognized, and land has been removed from the control of individuals and communities, without compensation. Furthermore, the process of land allocation is not transparent, with inequitable distribution of rights and land to selected groups.

The establishment of the Thale Noi Non-hunting Area has imposed a rigid system of management that ignores the complex local systems of land tenure. The preservation areas overlap with village common land, and this has turned many people into illegal squatters.

Conflict between communities and the government has emerged most clearly through the legal framework of the Royal Forest Department. The Department focuses on the technical aspects of conservation management, with the predominant aim of maintaining biodiversity. This technical focus has ignored the use of the wetlands by communities for their livelihoods; this has caused a series of conflicts as communities continue to use the resources in contravention of laws and regulations that restrict their access. As a result, tension and distrust between the communities and government have increased and become obstacles to the further participation of communities in wetland management and conservation strategies.

Summary

An integrated approach to wetland management gives government agencies an opportunity to apply technical expertise within a broader context of infrastructure, agriculture, ecology and land use management. The government must continue to implement changes to the institutional structure of natural resource governance agencies in order to find adaptive solutions supported by legislation and local enforcement capacity. In particular, the newly formed Ministry of Natural Resources and Environment must continue to provide adaptive systems of management that include the large number of stakeholders found in wetland areas. An inclusive, integrated system of management remains a major challenge for Thailand, particularly in wetland areas, where effective management is hindered by disproportionate power in select groups. A top-down process is an inappropriate system of governance; legislative restructuring must allow for the inclusion of all interested stakeholders if a decentralized system of management is to be successfully implemented.

With multiple stakeholders interacting in the use, management and development of natural resources, Prukuankreng highlights the diverse and integrated nature of wetland exploitation in Thailand. Wetlands provide an important resource for a range of stakeholders, including poor rural communities, urban dwellers and investors. There is a considerable body of relevant information on wetland ecology, biology and specialized areas, such as water engineering. However, what is lacking is an integrated approach that combines the specialized government agencies with the needs of local communities. There is currently little understanding of the complexity of legal and institutional frameworks, and both local government and local communities are limited in their ability to participate in these systems of governance. Research that incorporates the needs of resource users in an integrated approach to wetland management is needed.

Economic valuation of wetlands

As stipulated in the 1997 Constitution of Thailand, a key objective of the government's decentralization policy is to improve the involvement of local administrations in resource management. To establish a system of integrated wetland management at local levels, a complete set of values associated with wetlands must be incorporated in decision-making processes.

Presented below are the results of an economic valuation of the Thale Noi Non-hunting Area, which focuses on a range of wetland resources, functions and attributes. These results can assist decision-makers consider the importance of wetlands to a wide range of stakeholders, particularly those who depend on the wetland for their subsistence and well-being.

The research was conducted with the following objectives:

- To apply existing economic valuation techniques to the valuation of wetland resources, function and attributes
- To investigate alternative economic valuation techniques suitable for the analysis of resource use in Thale Noi
- To propose ways to incorporate economic value into wetland management processes, particularly at the local government level.

This section outlines the valuation framework adopted in this study, describing the range of values associated with Thale Noi Non-hunting Area. Particular attention is given to the geographical distribution of wetland products, demonstrating how benefits from wetland resources are dispersed over a much wider area than the actual wetlands themselves. A valuation of the main wetland resources and functions is then presented.

The valuation framework

The Wetland Approach provides a framework for incorporating a wide range of values, thus allowing for the development of a more equitable management system.

Value is defined as the benefit derived from the resources, functions and attributes of wetlands less the cost of acquisition or provision of these resources, functions and attributes. It includes financial and opportunity costs. These diverse values are incorporated within the Total Economic Value (TEV) framework, which is the sum of 'use' and 'non-use' values (UV and NUV). This is represented as:

TEV = UV + NUV

Use values can be further divided into direct and indirect values. Direct use values are those arising from consumption of fish, aquatic plants, timber, fuel wood and tourism services by both subsistence and commercial stakeholders. Indirect use values relate to wetland functions that support and protect economic activities and property. These include ecosystem functions such as flood attenuation, ground water recharge, nutrient retention, and gas regulation.

Non-use values include both bequest and existence values. These exist regardless of current or future use, and include values such as biological diversity, and cultural and heritage values.

Wetland resources, functions and attributes

Use and non-use values of wetlands can be divided into wetland resources, functions and attributes; these categories provide a framework for the incorporation of values into integrated wetland management. Figure 3 summarizes each of the categories discussed below.

Wetland resources

Wetland resources have direct use value arising from their use in both economic and subsistence livelihoods. These resources are important for communities surrounding the wetlands, and especially for poorer, resource-dependent households. In Thale Noi, wetlands resources include fish, timber and non-timber forest products and aquatic plants (see Appendix B for an extensive list of these resources). Resources also include land and water, both of which provide a basis for agricultural production and support services such as transport.

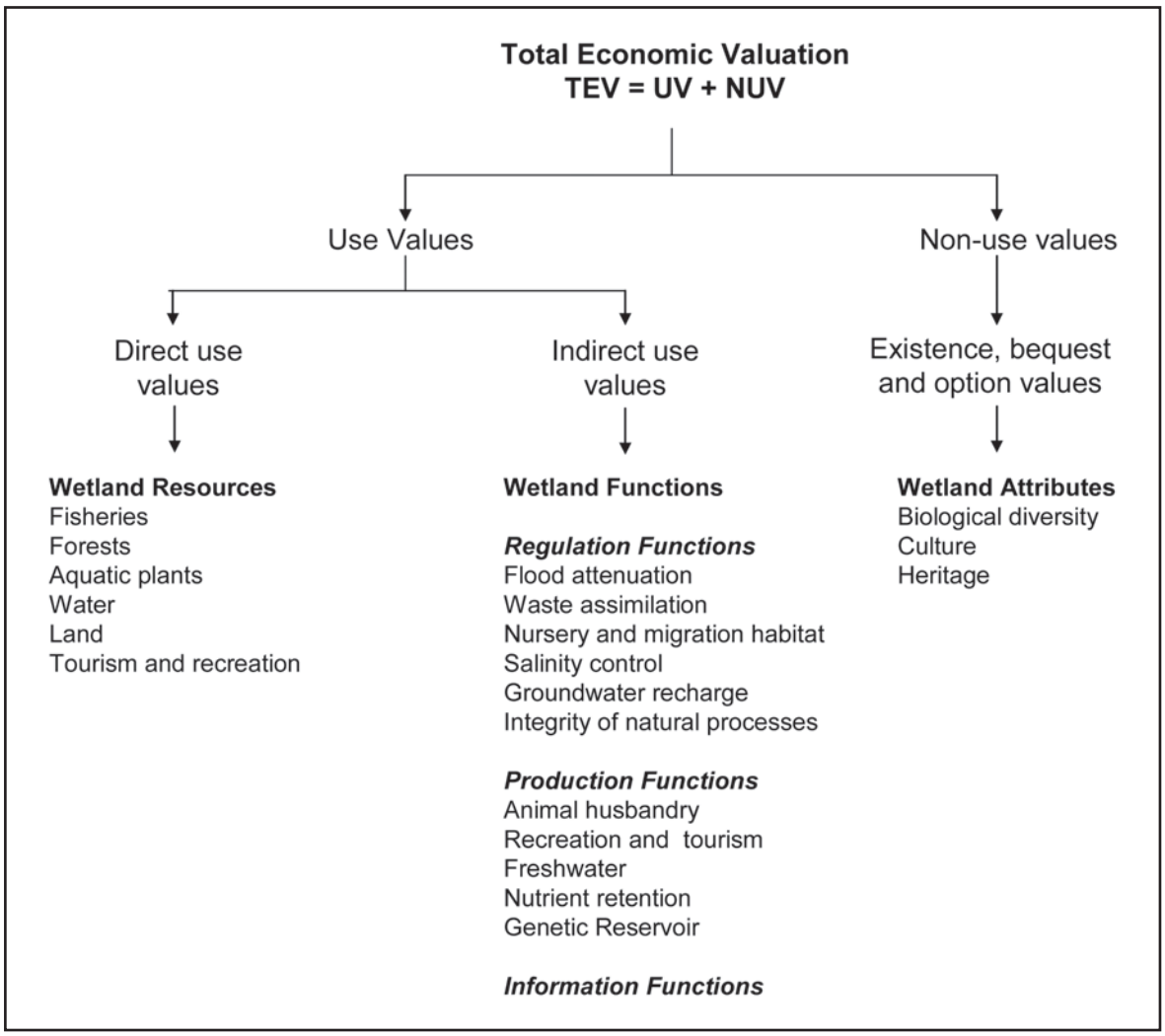
Wetlands functions

Wetland functions provide non-use benefits by supporting the integrity of wetland environments and the livelihoods dependent upon them. The functions of wetlands can be categorized into the following three groups:

Regulation functions – These functions control the flow, storage and recharge of water, nutrients and, in some cases, salinity in wetlands. Within Thale Noi these functions are threatened by infrastructure development and land clearing, both of which are altering hydrological systems in the wetlands and, consequently, the habitat available for fish and wildlife.

Production functions – These functions transfer wetland resources and services into economic and social benefits. They include the productivity of animal and plant biomass, the retention of nutrients, and the provision of freshwater, all of which help ensure that the living wetland resources are sustained.

Figure 3. Total economic valuation framework for Thale Noi Non-hunting Area



Information functions - Information functions relate to the protection of resources that provide a stock of educational value and potential value. These provide important option values for future wetland resource use that may contribute to ecosystem and human well-being. Education and option values exist in the genetic reservoir, landscape aesthetics and ecological integrity, all of which continue to contribute to wider understandings of the natural environment.

Wetland attributes

Wetland attributes are non-use values that provide existence, bequest and option values. These include a diverse range of cultural and heritage values derived by communities using the wetland environment both now and in the future.

Valuation methods

A combination of qualitative and quantitative methods were used for the valuation of wetland resources, which together provide a means of considering a range of use and non-use values of wetlands and wetland resources. The qualitative analysis shows that the wetlands are an important resource for a range of stakeholders. However, estimation of the economic value of the Thale Noi Non-hunting Area is complicated by the lack of information on a range of resources, functions and attributes. A rapid assessment survey was conducted which partially addressed this deficiency in data; however, even so, the information provided by the survey was able to value only a portion of the full range of wetlands resource.

Qualitative valuation

Qualitative approaches to economic valuation are not well developed for wetlands. However, if used in conjunction with quantitative methods, they contribute important contextual information in an integrated approach to wetland management. Interviews of traders and stakeholders were conducted every four months during 2002, and questions focused on the importance of wetland resources, functions and attributes to local communities, town settlements, economic activities, public infrastructure and social activities. These were analyzed through market trailing and a function-value matrix.

The market trailing exercise examines the extent of wetland resource trade and the role of outside users and consumers of wetland resources. Analysis incorporates fish-dependent people, such as fishers, as well as 'fish-related' people, such as traders and transporters across Southern Thailand.

A function-value matrix is used to identify key wetland functions, and to determine their perceived importance to resource-dependent communities. The matrix represents the multi-resource, multi-function, multi-attribute wetland system and, as such, provides a convenient format for starting discussion on economic valuation.

The results of the function-value matrix are presented as the perceived importance of the wetlands to both rural and urban communities. Each function is ranked in a relative scale of importance – low, medium and high. Three categories are used:

- **Economic activities** – including activities that are important to local subsistence livelihoods and to urban livelihoods through activities such as tourism.

- **Public activities** – including public access activities, such as water supply for households and agriculture, and the provision of public recreation areas.

- **Social activities** – including activities that integrate (or separate) people in the society, such as tradition, value, norms, or conflicts.

Quantitative valuation

Field surveys and meetings with stakeholders were conducted to collect primary and secondary data for the valuation of wetland resources in the Thale Noi Non-hunting Area. Market and pricing data were collected through a rapid assessment survey of traders. While legitimate concerns about the validity of rapid surveys remain, large-scale surveys are often complex and require a considerable amount of time and resources to carry out. Rapid surveys provide an alternative in situations where time and cost constraints exist, and can be more appropriate where timely, relevant data are required to assist the policy process. Analysis of the data was done using simple calculation, functional estimation and calibration of values as outlined below.

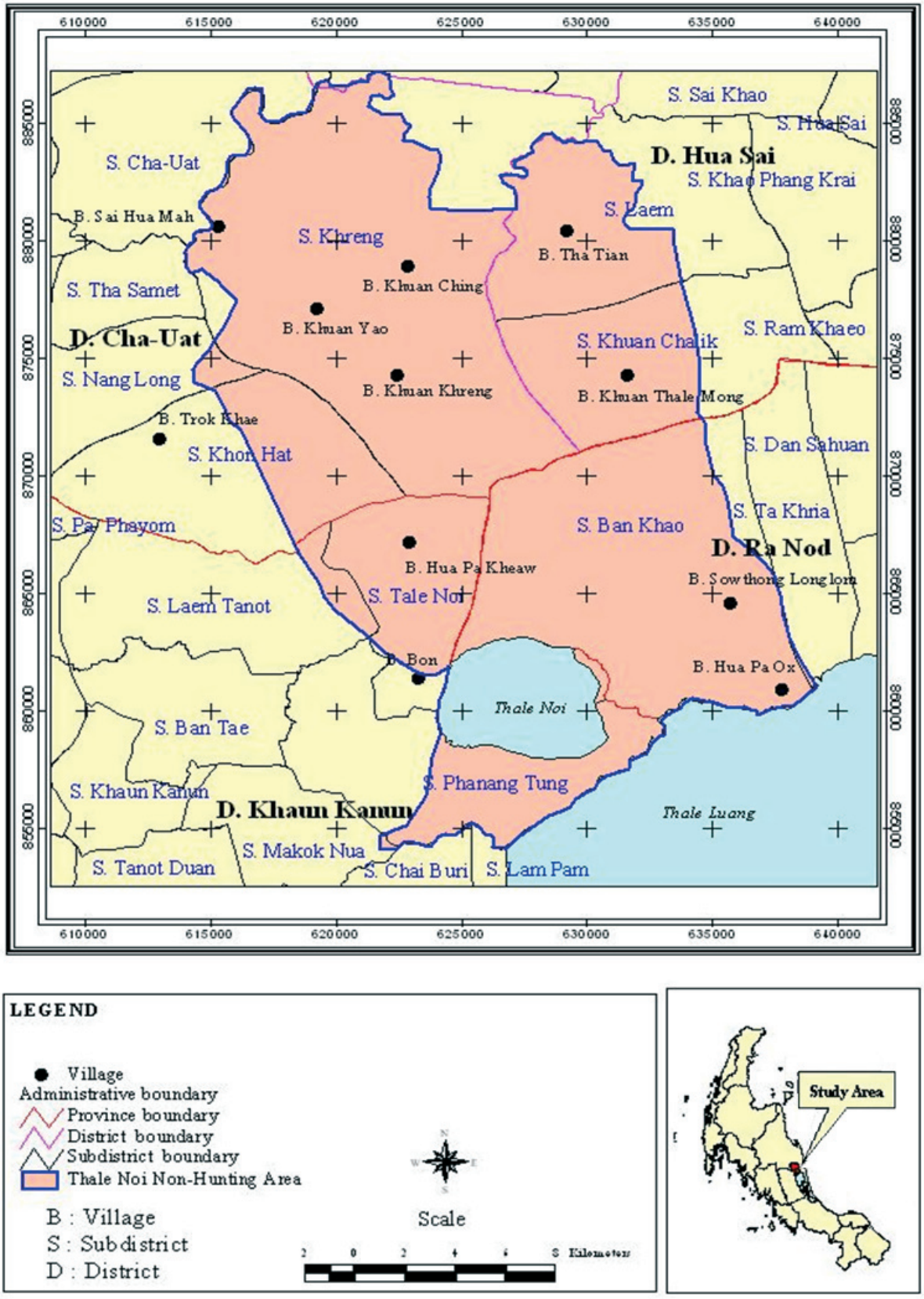
Market value is a direct method of valuing wetlands and wetland resources, calculated by multiplying the volume of trade by the unit price. This technique was applied to a range of wetland resources that are traded from Thale Noi.

Resources and functions that are not traded were valued using surrogate pricing techniques. These include a range of contingent valuation methods that ask people to place a monetary value on wetland goods and functions. A widely used contingent value method is *willingness to pay* (WTP), which can be estimated through direct questioning of the price resource users are willing to pay for a resource. Alternatively, the WTP value can also be estimated by calculating the costs incurred in visiting and using them – the *travel cost method* – which is especially effective in estimating the value of uses such as tourism. Together, these methods can be applied to a range of wetland resource functions and attributes, including tourism and recreation, cultural and heritage values, genetic resources, habitats and refugia.

Market trailing and function-value matrix

Presented below are the results of the market trailing exercise and the function-value matrix undertaken for this study of the wetlands in the Thale Noi Non-hunting Area. The results provide information on the range of values that are

Figure 4. Map of Thale Noi Non-hunting Area showing the locations of the surveyed villages



derived from wetlands, not only by direct users but also by a wider group of stakeholders. Understanding these diverse values and incorporating them into decision-making processes is an important part of an integrated approach to wetlands management.

Market Trailing

Three important commodity groups collected and traded by local communities were included in the trailing exercise – fishery, water and forest resources. These are mostly traded from villages to informal local markets held on alternating days of the week in medium-sized communities surrounding Thale Noi.

The market trailing exercise demonstrates the importance of wetland resources to rural livelihoods and facilitates the identification of the wider benefits of these resources and their inclusion in decision-making.

Fishery resources

There are 2 395 registered fishers in the Thale Noi Non-hunting Area; they fish for a range of economically important species, including *Clarias macrocephalus, Channa striata, Anabas testudineus, Notopterus notopterus, Pristolepis fasciata*, *Osteochilus* spp. and *Hampala macrolepidota*. These species are either traded in local markets by fishers or sold on to traders who distribute both fresh and processed fish in markets up to 200 km away, including markets in Bangkok, Songkhla, Nakhon Si Thammarat, Yala and Pattani. A small portion of the processed fish is also sold to tourists visiting Thale Noi.

The price of fish ranges from US$0.12 to US$2.43 per kilogram.[3] The quantity of fish sold per day in wholesale markets ranges up to 50 kilograms. Retail sales account for smaller amounts of fish, in bundles of 5 kilograms per day. The more abundant species are sold daily in the markets, while other species, such as *Clarias* spp., are sold about every four months. The type and value of fish determines how far away they are sold. Smaller, less expensive fish are sold in local markets, while the more expensive species are sold in distant markets.

The fish trade involves a number of fishers and traders in local and regional markets. These fish-dependent and fish-related people demonstrate the wider 'catchment' of the wetlands, which highlights how the fishery resource is changing from a localized resource to a more regionalized one in which a widely distributed group of people draw value from the wetland and wetland resources.

***Kra-jood* mats and handicrafts**

Kra-jood handicraft in communities surrounding Thale Noi is an increasingly supplementary activity as, driven by tourism and increased trade, supplies of the resource continue to decline. Traders in Bangkok sell *kra-jood* products domestically and also export them to Malaysia, Japan and the Middle East.

Water resources

Each day, approximately 160 000 liters of water from Thale Noi are used for irrigated rice production and public water supply. This use is managed by the local government and Regional Public Water Office.

Function-value matrix

The Thale Noi wetlands has multiple resources, functions and attributes that provide a range of goods and services to multiple users. These are summarized in the function-value matrix shown in Table 4. The matrix focuses on the relative importance of wetland resources to the rural and urban communities and analyzes the impacts on economic, public and social activities of wetland resources, functions and attributes.

The matrix indicates that wetland functions provide important services for rural livelihoods. Overall, the subsistence and economic activities are highly valued, but are less important to urban areas. Social activities are shown as being of medium importance to both rural and urban areas. For example, the wetlands are very important to rural communities in that they support economic activities such as tourism and resource harvesting, and important in that they provide a source of quality water.

The matrix shows the high indirect use values associated with flood attenuation, habitat, the integrity of natural process, and recreation and tourism. The function of flood attenuation is

[3] Calculations based on conversion rate of 41 baht to US$1.00

Table 4. Function-value matrix of the Thale Noi wetlands

Wetland resource supply	User demand				
	Local subsistence	Town settlement	Economic activities	Public activities	Social activities
Resources					
Fishery resources	***	*	**	*	*
Forest resources	***	*	*	**	*
Aquatic plants	***	*	*	*	***
Water	***	*	***	***	***
Land	***	*	***	***	***
Functions					
Regulation functions		*			
Flood attenuation	***	***	***	***	***
Waste assimilation	**	*	***	***	*
Nursery and migration habitats	***	*	***	***	***
Salinity control/groundwater recharge	***	*	**	***	*
Integrity of natural process	***	*	***	***	***
Gas regulation	*		*	*	*
Carrier functions		*			
Animal husbandry	***	**	***	*	***
Recreation/tourism	***	**	***	***	***
Nature protection	***		**	***	***
Production functions		*			
Freshwater	***	*	***	***	*
Fish and vegetation biomass	***	*	***	*	*
Nutrient retention	***		**	*	*
Information functions		*			
Aesthetic landscape	**	*	**	***	**
Educational and scientific information	**		**	*	***
Attributes					
Biological diversity	***	**	***	**	**
Cultural/heritage	**	**	***	***	***

*Note: * = low demand; ** = moderate demand; *** = high demand.*

crucial, especially for the poor, who rely on the wetland for their livelihoods (for example, by harvesting *kra-jood*, and aquatic plants for livestock and household consumption), and for water transportation. In Thale Noi, tourism is highly related to the use of resources, whether this is by way of appreciation of aesthetic values or by way of direct consumption. If these values are degraded, poorer members of many of the surrounding communities will be adversely affected, as they are proportionally more dependent on the tourism industry for their livelihoods.

The wetlands also support the culture and heritage traditions of the surrounding communities, which are especially important to rural communities, and attract tourists. The traditions include songs, music, shadow puppets and plays unique to the area. While their values are recognized by tourists and decisions-makers alike, there has been no attempt to include these attributes in wetland management systems.

Overall, the results of the qualitative analysis of wetland values shows that a large number of people derive benefits from the wetlands. These people are geographically dispersed, highlighting the regional importance of the wetlands. The analysis also shows that poorer rural communities place higher importance on the resources, functions and attributes of wetlands than do urban communities.

Estimating the economic value

The qualitative analysis shows that the wetlands are an important resource for a range of stakeholders. However, estimating the economic value of the Thale Noi Non-hunting Area is complicated by the lack of information on a range of resources, functions and attributes. Instead of focusing on the full range of resources, functions and attributes, the following focuses on the valuation of a selection of resources: namely, forests, fisheries, aquatic plants, tourism, agriculture and water. A preliminary valuation of the opportunity costs of selected resources, such

as land, forest resources, and wildlife is also presented.

Forest resources

Valuation of forest resources is limited to the net market value of melaleuca trees, saplings, seedlings, firewood and charcoal. The estimations are based on empirical data from the village survey and on secondary information from the Office for Environmental Policy and Planning (Thale Noi Non-hunting Area Office 2003). The use of forests in Thale Noi for commercial purposes has been restricted by virtue of it being a Non-hunting area, and the net economic value of existing trees, sapling and seedlings were treated as opportunity costs. However, agreements can be made with the officials and local government if the utilization of forest resources is for subsistence livelihoods, and most requests are granted and controlled.

Based on tree density data over a total area of 492 hectares it was estimated that there are 909 172 adult trees, 31 993 saplings and 108 297 seedlings in and around Thale Noi.[4] Unit prices of trees, saplings and seedlings (Table 5) were gathered from the village survey. The total value of trees is calculated at US$7 173 000, while saplings and seedlings are estimated at US$12 000 and US$650 respectively.

A total of 394 households are involved in the collection of firewood and charcoal, 10 of which trade commercially (Table 6). The Thale Noi Non-hunting Area Office reports a total of 591 000 kilograms of firewood and charcoal is consumed and traded annually, while data gathered from the rapid assessment survey found the average unit value of firewood and charcoal to be at US$0.073 per kilogram. Taken together, this provides for a total estimated annual value of US$43 000 for firewood and charcoal in the Thale Noi wetland.

Aquatic plants

The two most popular species of aquatic plants in Thale Noi are *kra-jood* and water lilies. As outlined above, *kra-jood* is sold as a raw material and used to make handicrafts in surrounding communities. Water lilies are used for food and are traded to

Table 5. Tree, sapling and seedling valuation

Thale Noi Area	Area		Tree			Sapling		Seedling	
			Count	Density	Tree volume	Count	Density	Count	Density
	rai	ha	No.	ha	(m^2)	No.	ha	No.	ha
Central and Northern Thale Noi	2 459	393	806 667	2 050	202 585	27 053	69	88 537	225
Southern Thale Noi	617	99	101 505	1 038	25 743	4 940	50	19 760	1 097
Total	3 076	492	909 172	1 847	228 328	31 993	65	108 297	400
Unit price (US$ /unit)					31.41	0.366		0.006	
Net value (US$)					7 173 000	12 000		650	

Sources: Adapted from OEPP (1999) and 2003 rapid assessment survey.
Note: 1 rai = 0.16 ha.
Note: The exchange rate used is US$1 = 41 baht, and may have changed since date of publication.
Note: Slight discrepancies may occur due to rounding and currency conversions.

Table 6. Households in Thale Noi involved in firewood and charcoal collection

Thale Noi Non-hunting Area (District, Province)	Number of households collecting for home consumption	Number of households collecting on a commercial basis*
Khuan Kanun, Phattalung	176	-
Chaouad, Nakorn Si Thammarat	78	9
Hua Sai, Nakorn Si Thammarat	100	1
Ranod, Songkhla (2542)	40	-
Total	394	10

Source: Adapted from OEPP (1999)
** These households are a subset of the 394 households collecting for home consumption; they are not additional households.*

[4] An adult tree is characterised as a tree with a trunk diameter greater than 15 cm

tourists. They are not a popular vegetable but provide a niche market for a small number of traders.

Table 7 shows a total of 1 579 households growing *kra-jood* over 1 151 hectares in Thale Noi. The survey found an average household production of 1 875 bunches per hectare per year, with an average total production cost of US$762 per hectare (see Table 8). The net profit of *kra-jood* is US$1 525 per hectare, giving a net profit of US1 112 per household per year and a total annual value of US$1 755 275 for the Thale Noi area.

There are a further 2 894 households involved in *kra-jood* handicraft production. The average annual net profit per household is US$330 (Agricultural Extension Plan 2003). This is calculated by estimating total household income from various *kra-jood* handicraft sales minus total costs. The net annual economic value of *kra-jood* handicraft is therefore estimated at US$954 000.

According to the Office of Environmental Policy and Planning (1999), there are 1 579 households involved in the growing of *kra-jood*, and 2 894 households involved in the production of *kra-jood* handicrafts. The Agricultural Extension Plan (2003) estimates the average household profit from the production of *kra-jood* handicrafts to be US$330 per year, resulting in an estimates annual household profit of US$955 000.

Water lilies can be harvested for three months in a year, with an average of 100 bunches per day (Khuankhanun Agricultural Office 2003). The rapid assessment survey found their market value to be at US$0.12 per bunch. The annual net value of the water lilies traded in markets is therefore estimated at US$1 000.

Table 8. Cost of production of *Kra-jood*

Cost	Cost per unit area (US$/ha)
Seedling cost	213
Land preparation	305
Labour	243
Total cost	762
Average production (bunch/ year)	1 875
Price per unit (US$)	8
Revenue (US$)	2 287
Net profit (US$)	1 525

Source: Khuankhanun Agricultural Office (2003) and Saranophakul (2000)

Agricultural land

The main crops cultivated on agricultural land in Thale Noi are rice and vegetables. A range of by-products sourced from cultivated land include fish and aquatic plants. Estimates of the value of each of these are given below.

The cost of rice production was calculated from secondary data and is summarized in Table 9. The results show that the average profit is low – just US$37.62 per hectare (Khuankhanun Agricultural Office 2003; OEPP 1999). Indeed, in Panantung village, farmers on average even encountered a net loss of about US$84.50 per hectare of rice cultivation.

However, it was found that these losses can be offset through supplemental activities and other by-products derived from these rice farms. In the off-season, rice farmers often convert a portion of their rice farms into fish ponds, culturing the *Clarias macrocephalus* variety of catfish and producing approximately 400 kilograms of catfish

Table 7. Number of households growing *Kra-jood* and making *Kra-jood* handicrafts

Thale Noi Non-hunting Area (District, Provinces)	*Kra-jood*		*Kra-jood* handicraft (households)
	Number of households	Area (rai)	
Khuan Kanun, Phattalung	892	4 091	1 490
Chaouad, Nakorn Si Thammarat	604	2 878	1 189
Hua Sai, Nakorn Si Thammarat	-	-	-
Ranod, Songkhla	83	225	215
Total	1 579	7 194	2 894

Source: Adapted from OEPP (1999).

Table 9. Cost of rice production

Cost	Thale Noi	Panangtung	Bankow	Average
	US$/ha	US$/ha	US$/ha	US$/ha
Land preparation	45.75	45.75	53.38	48.31
Seeding	18.31	9.13	22.88	16.75
Fertilizer	45.75	45.75	53.38	48.31
Labor	7.63	85.38	12.19	35.06
Chemicals	10.69	27.44	0.00	12.63
Harvesting and Threshing	53.38	53.38	45.75	50.75
Transportation	15.25	6.13	16.00	12.50
Total cost per hectare	**196.63**	**280.50**	**203.50**	**226.81**
Average production (kg/ha)	2 187.50	2 000.00	3 906.25	2 698.28
Price per unit	0.098	0.098	0.098	0.098
Profit per hectare	**214.38**	**196.00**	**382.81**	**264.43**
Net profit per hectare	**17.75**	**-84.50**	**179.31**	**37.62**

Source: Derived from data provided by the Khuankhanun Agricultural Office (2003)
Note: Derived from original figures presented in Baht and rai. Discrepancies may arise from rounding and currency conversions. Conversion rates used are as follows: US$1 = 41 Baht; 1 rai = 0.16 ha.

in two harvests per year; these are then processed and sold in the market (OEPP 1999; Charoenjiratrakul et al. 2002).

From these data, the annual net economic value of rice stands at US$304 000, while by-products from rice cultivation is estimated at US$1 026 000. This is a surprising result, as it shows the value of rice by-products to be more than three times greater that the net annual value of rice. This result highlights the importance of an integrated approach to wetland valuation and management.

Vegetables are another important source of income. Most of the vegetables are consumed within the households that cultivate them. The most common vegetable grown is chilli, with an estimated 56 hectares cultivated in and around Thale Noi each year (Khuankhanun Agricultural Office 2003). The average value of chilli production is estimated by the rapid assessment survey of primary market prices to be US$6 700 per hectare. The net annual economic value of chilli is therefore estimated at US$378 000.

Birds and wildlife

The total value of birds and wildlife is estimated as an opportunity cost because, as hunting is restricted in Thale Noi, the value will never be realized. The Royal Forest Department and Kasetsart University (2001) estimated the average value of each bird to be 150 baht. A study by Angkhapreechaseth (1980) estimated an annual population, including all species, of 39 276 birds. This figure is believed to be accurate for recent years. Park officers and local community members stated that the number of birds varied between years – however, this variation was agreed to be minimal. The annual net value of birds in Thale Noi is therefore estimated at US$144 000.

Fishery resources

Fishery resources are an important source of both protein and income for communities surrounding Thale Noi. The fishery is highly diverse, covering a range of habitats, including lakes, canals, rivers and ponds. Estimates of total value are complicated by the lack of catch data and the highly seasonal prices of many species. Calculations are based on a combination of data for the year 2000 from the Department of Fisheries (2003) and a market survey conducted as part of this report.

Monthly catch and pricing data for Thale Noi are shown in Table 11. The average monthly catch is 10.15 tonnes with a value of US$2 098 per tonne. This gives a total annual net value of US$255 000.

Table 10. Quantity and prices of fish species caught in Thale Noi, 2000

Species	Quantity (Tonne/yr)	Price (Baht/kg)
Asian Bumblebee Catfish (Pseudomystus siamensis)	9.73	19.98
Sawfish	16.69	19.97
Channa striata	26.26	53.83
Clarias macrocephalus	28.34	69.40
Anabas testudineus	9.66	35.05
Other perch	8.90	19.98
Freshwater shrimp	15.83	286.00
Other shrimp	6.43	236.81

Source: Department of Fisheries (2000)

Table 11. Quantity of fish traded from Thale Noi, 2000

Month	Quantity (Tonne)	Value (1 000 baht)
January	10.76	873.31
February	11.18	931.49
March	10.88	937.98
April	9.86	842.01
May	12.57	1 163.11
June	9.80	906.66
July	10.50	964.48
August	9.04	790.77
September	9.44	778.82
October	9.60	817.81
November	8.84	715.98
December	9.37	752.19
Average	10.15	872.88

Source: Department of Fisheries (2000)

Table 12. Aquaculture area and number of participating households

District (Provinces)	Number of households	Number of ponds	Area (ha)
Khuan Kanun, Phattalung	1 632	2 227	167.68
Chaouad, Nakorn Si Thammarat	1 020	1 209	58.40
Hua Sai, Nakorn Si Thammarat	578	711	66.08
Ranod, Songkhla	1 495	1 504	718.24
Total	4 725	5 651	1 010.40

Source: Department of Fisheries (2003)

There are a total of 4 725 households in Thale Noi that practice aquaculture. They have a combined pond area of 1 010 hectares (Table 12) and the primary species grown on these farms are the *Clarias macrocephalus* variety of catfish. The Department of Fisheries (2003) and Charoenjiratrakul et al. (2002) estimate an average profit from aquaculture ponds growing catfish at US$2 408 per hectare. Using this figure as a surrogate for all aquaculture gives a net annual value of US$2 432 000.

Water resources

Water resources in the Thale Noi Non-hunting Area are used primarily for irrigation in the dry season and for household consumption. Thale Noi's public water system is administered by the regional water board and the Tambon Administrative Organization. The value of the water resources used for agriculture and domestic consumption is based on secondary data from the Provincial and District Agriculture Office.

Most communities surrounding Thale Noi pump water to irrigate dry season rice and vegetables. The total area of dry season rice fields is about 2 558 hectares, and the average cost of irrigation for this period is estimated at US$18 per hectare (OEPP 1999).

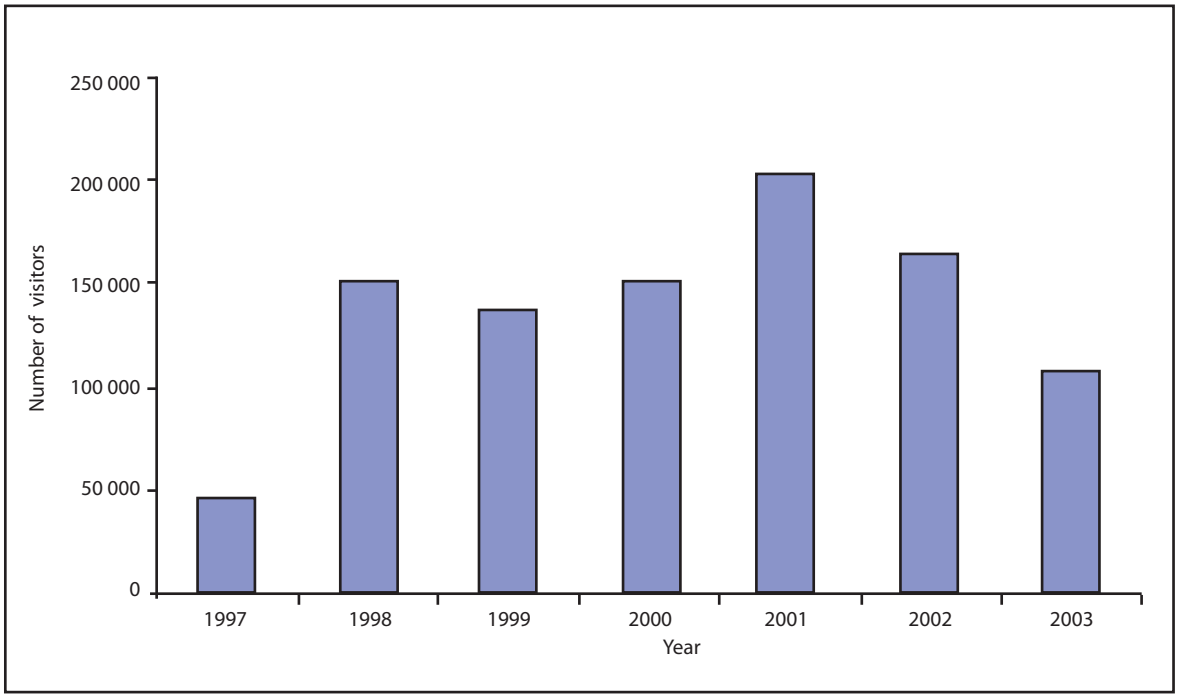
Water for public consumption is supplied by the Regional Public Water Office and the Tambon Administrative Organization. The maximum capacity of both organizations is 200 000 liters, and the annual value of public water provision is estimated by these offices at US$22 000.

Tourism

Tourism and recreation in the Thale Noi Non-hunting Area has become increasingly important since the listing of Khuan Khee Sian wetland as a Ramsar site in 1998. Between 1997 and 2003 an average of 137 882 people visited the park each year; most of these are from Thailand (Figure 5). Most visits are during the dry season, from January to April (Figure 6).

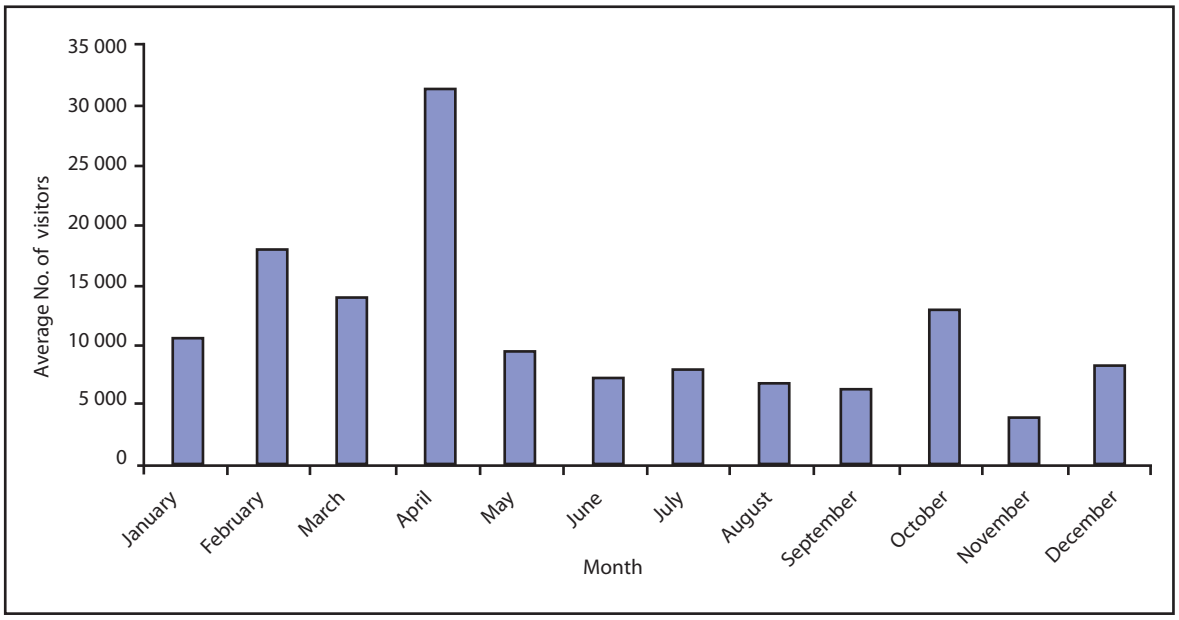
The value of tourism in Thale Noi was calculated based on the Benefits Transfer technique as outlined by Barbier et al. (1997) and Loypha and Thaisuda's 1998 economic valuation of the Thale Noi Non-hunting Area as a recreation site. Benefits Transfer refers to the practice of using values estimated for an alternative policy context or site as a basis for estimating a value for the policy context or site in question. This can be appropriate in the present research due to the scarcity of data.

Figure 5. Number of tourists visiting Thale Noi, 1997-2003



Source: Thale Noi Non-hunting Area Office (2003)

Figure 6. Average number of tourists visiting Thale Noi per month, 1997 – 2003



Source: Thale Noi Non-hunting Area Office (2003)

This method was applied to Loypha and Thaisuda's 1988 economic valuation of the Thale Noi Non-hunting Area as a recreation site, which estimated willingness to pay figures for the area. Several methods were used and evaluated in this study, which found the *travel cost method* to be the most comprehensive method of estimating the willingness to pay value of tourism and recreation in the area. Data for the TCM demand function in Loypha and Thaisuda were adjusted for 2002 using the Consumer Price Index and population growth rate, and extrapolated to reflect the WTP of tourists visiting the Thale Noi Non-hunting Area in the year 2002.[5]

The willingness to pay as derived by the TCM for the TNNA as a recreational area was estimated at 11.07 million baht (US$270 000) in 1987 by Loypha and Thaisuda. Of this figure, 9.11 million baht (US$222 000) or 77.2 per cent represented direct contributions to local incomes by tourists. Extrapolation of this data for 2002 sees a total annual figure of 35.26 million baht (US$860 000), with direct income accounting for 27.23 million baht (US$664 000).

Summary

The Thale Noi Non-hunting Area provides a range of resources, functions and attributes that are important for sustaining the livelihoods of communities. Value is also derived by a number of distant stakeholders, as resources are traded regionally and internationally. Furthermore, the number of tourists to the area is increasing. Any valuation of these wetlands is only indicative of the minimum value that should be placed on them. By identifying and incorporating these values into decision-making processes, a more integrated approach to wetlands management can be developed.

The total economic value and opportunity costs of the key resources identified in this report are summarized in Table 13. The total annual value of the wetland resources is estimated at US$8.09 million and the annual value of opportunity costs is estimated at US$7.33 million. This gives a total estimated value of US$15.42 million.

In addition to the direct use values of Thale Noi, there are a number of indirect and non-use values identified by a range of stakeholders. While these have not been quantified, they nevertheless show

[5] The travel cost curve was calculated using the function $\ln(Q) = a + b \ln(TC) + u$, where Q is the number of tourists visiting per day per 1 000 people in each zone and TC is the total expenditure per tourist per day.

Table 13. Summary of the economic valuation for Thale Noi

Resources	Economic use value (US$ per year)	Opportunity costs (US$ per year)
Forest resources		
Trees		7 173 000
Saplings		12 000
Seedlings		650
Firewood and charcoal	43 000	
Aquatic plants		
Kra-jood	1 755 275	
Handicraft	955 000	
Water lilies	1 000	
Agricultural Land		
Rice	304 000	
Rice supplemental and by-products	1 026 000	
Chilli	387 000	
Birds and wildlife		
Birds		144 000
Fishery resources		
Natural fish	255 000	
Aquaculture	2 432 000	
Water resources		
Irrigation	46 000	
Public water	22 000	
Tourism	860 000	
Total	**8 086 275**	**7 329 650**

Note: Figures derived from original figures presented in Baht and rai. Discrepancies may arise from rounding and currency conversions. Conversion rates used were US$ 1 = 41 Baht; and 1 rai = 0.16 ha.

that there are wetland functions and attributes that can be related to tourism, the protection of land, water, and the maintenance of the wetland environment. There are also cultural and heritage values that have been identified but not dealt with in this study.

Integrated development and management planning must incorporate wetland resources, functions and attributes, so that the existence and richness of Thale Noi is not threatened. Furthermore, attempts should be made to incorporate these into an integrated wetland management system that includes decision-makers at local, regional and national levels and focuses specifically on the contribution of wetlands and wetland resources to the poor.

Policy conclusions and recommendations

Conclusions

Wetlands and wetland resources are an important resource for livelihoods in Thailand. The case study area of Prukuankreng, including Thale Noi Non-hunting Area, provides an example of a wetland that is under increasing pressure from a range of stakeholders. This range is increasing as the value of wetland resources increases, and, thus, the wetlands are increasingly contributing to the regional economy. However, the impacts of rapid development, land encroachment and overexploitation of wetland resources are most keenly felt by increasingly marginalized rural communities living around the wetlands. There is a pressing need to identify the multiple uses of the wetland resources and incorporate them into an integrated management system. This system should address the range of uses as well as the governance systems relating to the wetland resources, and provide equitable solutions and more effective conflict resolution.

The results of the legal and institutional framework analysis found no laws or regulations specific to wetland management, either for Prukuankreng or any other wetland in the country. Instead, there are a number of laws and regulations, administered by several government departments that are relevant to wetland management. However, many of these laws and regulations cannot be implemented because of low capacity at the local level. The newly formed Department of Marine and Coastal Resources under the Ministry of Natural Resources and Environment has the challenge of identifying adaptive solutions addressing the growing conflict in wetlands such as Prukuankreng. This can be achieved most effectively through the development of laws and regulations and through an adaptive management framework that involves all stakeholders. Through such a process the government might begin to successfully implement its decentralization process, and an equitable system of natural resource management at the local level might be established.

Successful management needs to understand and incorporate values from the range of stakeholders. Only then can wetlands and wetland resources be successfully incorporated into a successful management system. There are a number of tools available for wetland management research.

Quantitative methods provide a starting point for the economic valuation. However, as this report has shown, these mainly focus on direct uses of wetlands. Non-use values are difficult to incorporate into economic valuation. But without effective incorporation, the full range of values representing the interests of the multiple stakeholders will not be appreciated.

Recommendations

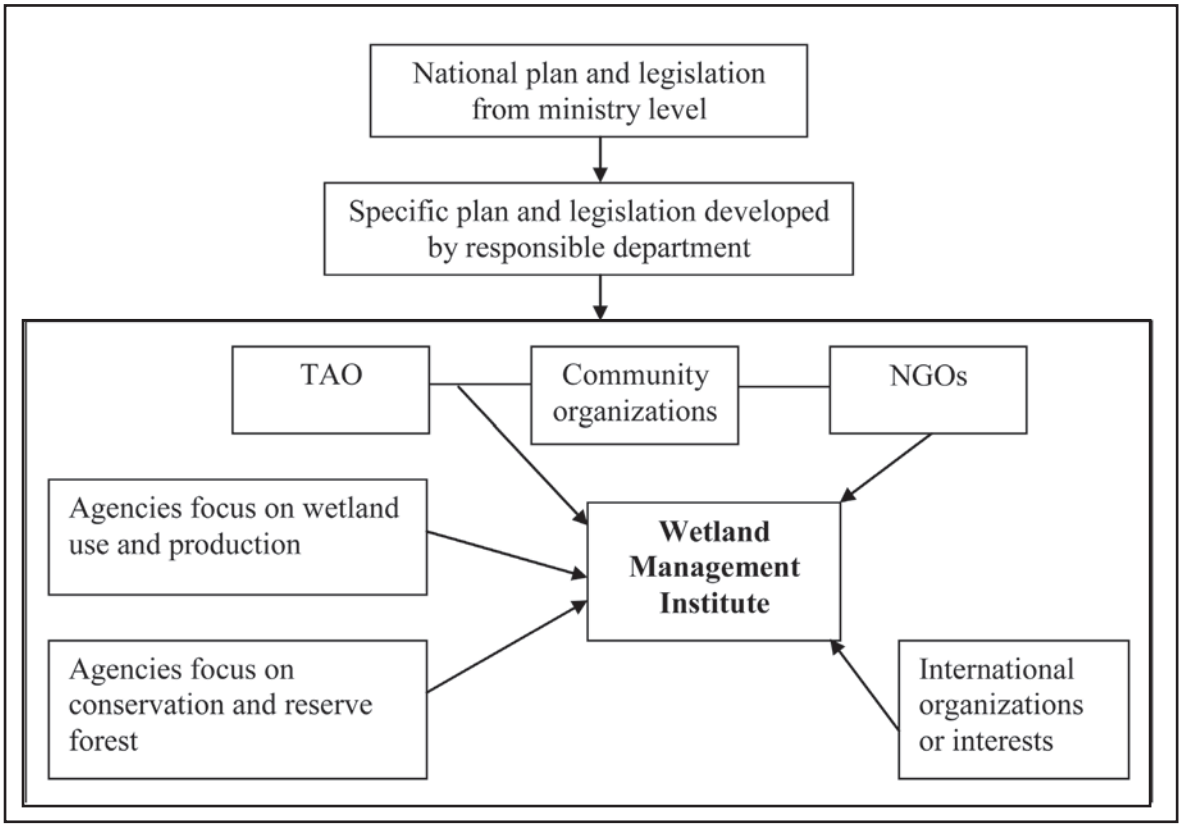
Institutional mechanisms to resolve land use conflicts

Greater emphasis needs to be placed on the development of systems that resolve conflicts between government and communities. Further support should be given to the Land Proof and Resolution Committee that was established for the purpose of conflict resolution. The Committee's activities should be extended to wetland-related disputes, and deal with issues such as:

- The use of heavy machinery in the cultivation of *kra-jood* and rice in wetland areas
- Conflict between advocates of forest reserves and advocates of village land
- The delegation of plantation management in wetland areas to Tambon Administrative Organization and Thale Noi Non-hunting Area
- Coordination of institutional support to farmers wishing to practice appropriate methods of protecting crops from wildlife
- Stakeholder involvement in new legislative structures.

A better system of coordination between stakeholders and government agencies is needed. Figure 7 outlines a proposed system whereby wetland management institutions would be developed locally, reflecting the interest of local communities, and authority to implement legislative actions would be devolved when necessary.

Figure 7. Proposed wetland management framework under existing legislation



Better coordination is needed between District Forestry Offices and Tambon Administrative Organizations in order to control the use of *krajood* in the protected areas of wetlands. This may involve empowering villages to monitor and self-regulate neighboring communities and villages.

Finally, more research is needed to determine the needs as well as the capacity of people to participate in wetland resource management. This should involve active application by government of indigenous and traditional knowledge in formal management systems. Funds and resources should be set aside for the development of a specialized institute for integrated and participatory systems of wetlands and wetland resource management.

References

Angkhapreechaseth, P. 1980. A study on bird population in Songkhla Lake. Paper presented at a seminar on Wildlife in Thailand, Thailand Institute of Scientific and Technological Research, 1980, Bangkok, Thailand. p.146-168.

Anonymous. 1995. The Environmental Management of Coastal Aquaculture: A Study of Shrimp Culture in Samut Sakhon and Chantaburi Provinces. Bangkok: NACA final report submitted to the Office of Environmental Policy and Planning.

Boromthanarat, S., Z. Hossain and B. Chaijaroenwatana. (In prep.) Community-Led Mangrove Rehabilitation: Experiences from Hua Khao Community, Songkhla, Thailand.

Charoenjiratrakul, S., A. Maesae, P. Kaewwongsri and P. Bunthito. 2002. Resource Management Planning in Phru Khuan Kreng: An analysis for training needs in sustainable resource management. Faculty of Natural Resources and Wetlands International, Prince of Songkla University, Thailand (in Thai).

Choowaew, S. 1993. Report on meeting for discussion on a mutual agreement on a sustainable wetland classification system for the Lower Mekong Basin. Vientiane, Lao PDR: Environment Unit Mekong Secretariat.

CORIN. 2001. Wetland Agenda – The Necessity of Management of Wetlands in Thailand. CORIN, Hat Yai, Thailand.

Davis, T.J. 1994. The Ramsar Convention Manual: A guide to the Convention on wetlands of international importance especially as waterfowl habitat.: Ramsar Convention Bureau. Gland, Switzerland.

Department of Fisheries. 2003. Preliminary Statistics of Provincial Fisheries: Songkhla, Nakhon Si Thammarat, Phatthalung: Department of Fisheries (in Thai).

Goodyer, N. 2002. Waterworld. *Sawasdee* 31(4)44-48.

Jenkins, S., P.T. Smith, S. Tookwinas and M. J. Phillips. 1999. An assessment of the status of shrimp farming industry in Thailand. In P.T. Smith, (ed.) *Coastal Shrimp Aquaculture in Thailand: Key issues for Research. ACIAR Technical Report 47.* Canberra.

Khuankhanun Agricultural Office. 2003. Agricultural Extension Plan for Sub-districts. Annual Report, Khuankhanun District, Phatthalung Province.

Land Development Department. 1994. Proceedings of the seminar on wetlands classification, 29 April and 13 June 1994, Bangkok. (in Thai)

Loypha, S. and W. Thaisuda. 1988. Benefit evaluation of Thale Noi Non-hunting Area as a recreation site. *Thai Journal of Forestry* 7:354-370. (in Thai)

Office of Environmental Policy and Planning (OEPP). 1999. Report on conservation and preservation of important wetlands – Thale Noi Non-hunting Area. Phatthalung Province, Vol. 4. (in Thai)

Royal Forest Department and Kasetsart University. 2001. Valuation of natural resources in protected areas: A case study of Phu Khieo Wildlife Sanctuary, Changwat Chaiyaphum. Royal Forest Department, Bangkok. (in Thai)

Sittikahapak, P. 2002. Thale Noi – Songkhla Lake. Nature Explorer 29:14-24.

Thale Noi Non-hunting Area Office. 2003. Annual Report of Thale Noi Non-hunting Area, Fiscal Year 2003. Thale Noi Non-hunting Area, Phatthalung Province, Office of the Conservation Forest Management 20. (in Thai)

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.ramsar.org/key_conv_e.htm

Appendix A Acts and codes relevant to wetlands in Thailand

National Policy and Planning
- National Economic and Social Development Act 1978
- Enhancement and Conservation of the National Environmental Quality Act 1992
- Tourism Authority of Thailand Act 1979
- Agricultural Economics Act 1979

Land Use Control
- Land Law Code, 1954
- Town and Country Planning Act 1975
- Building Control Act 1979
- Real Estate Development Control Decree No.286, 1972
- Hotel Act 1936
- Industrial Works Act 1969
- Industrial Estate Authority of Thailand Act 1979
- Agricultural Land Consolidation Act 1974
- Agricultural Land Reform Act 1992
- Land Development Act 1983

Environmental Quality
- Public Health Act 1992
- Canal Protection Act 1903
- Groundwater Act 1974
- Thai Navigable Waters Act 1913; amended in 1992
- Ditch and Dike Act 1962
- Fishery Act 1947
- People Irrigation Act 1939
- State Irrigation Act 1942
- Factories Act 1969 and 1978
- National Forest Reserve Act 1964
- Wild Animal Protection and Reserves Act 1992
- Forest Act 1975
- National Park Act 1961
- Enhancement and Conservation of National Environmental Quality Act 1992

Natural Resource Exploitation
- Public Health Act 1992
- Juridical Council of Thailand
- Forestry Act 1941
- National Forest Reserves Act 1964
- Fisheries Act 1947
- Wildlife Preservation and Protection Act 1960; amended in 1992

Conservation of Natural Areas
- Land Law Code, 1954
- National Park Act 1961
- National Forest Reserve Act 1964
- Wild Animal Preservation and Reserve Act 1960

Appendix B Wetland resources, functions and attributes

Source: OEPP (1999)

Key

Wetland functions:

C = Consumption and raw materials
E = External support
F = Flood and flow control
G = Groundwater recharge
M = Microclimate stabilisation
N = Nutrient retention
R = Recreation/tourism
S = Shoreline stabilization
Se = Sediment retention
St = Storm protection/windbreak
W = Water quality maintenance
Wa = Water transport

Wetland attributes:

B = Biological diversity
U = Uniqueness/cultural heritage

Category	Scientific name	Common name	Wetland functions	Wetland attributes
Agriculture	*Anacardium occidentale*	Cashew Nut Tree	C	B
and livestock	*Bouea oppositifolia*		C	B
	Cocos nucifera	Coconut	C, St	B
	Hevea brasiliensi	Malayan Spurge Tree	C, St	B
	Lepironia articulata	Globe Fringe Rush	C	B
	Mangifer indica	Mango Tree	C	B
	Mangifera foetida		C	B
	Oryza sativa	Paddy Rice	C	B
Amphibians	*Rana limnocharis*		C	B
	Rana rugulosa		C	B
Aquatic plants	*Acrostichum aureum*	Brazilian Tea	C	B
	Aniseia martinicensis	Little Ironweed	F	B
	Arundo donax	Giant Reed	F	B
	Blechnum indicum.	Mash Henna	F	B
	Bonamia semidigyna		F	B
	Coix aquatica	Water Coix	F	B
	Combretum acuminatum		F, C	B
	Combretum tetralophum		F	B
	Combretum trifoliatum	Sea Blit	F, C	B
	Commelina diffuse	Spreading Dayflower	F	B
	Crataeva adansonii	Indian Shot	F	B
	Cymbidium aloifolium	Scorpion Orchid	F	B
	Cymbidium finlaysonianum	Scorpion Orchid	F	B
	Cyperus haspan		C, F	B
	Cyperus iria		F	B
	Cyperus pilosus	Hairy Sedge	C, F	B
	Cyperus pulcherrimus	Elegant Cyperus, Sedge	C, F	B
	Echinochloa stagnina	Barnyard Grass	F	B
	Eleocharis dulcis	Water Chestnut	C,	B, U
	Eleocharis ochrostachs		C, F	B, U
	Eragrostis (L.) Beauv. Ex Roem.	Barnyard Grass	F	B
	Eugenia grandis Wight		F	B
	Fimbristylis sp.	Green Kylling	C	B, U

Category	Scientific name	Common name	Wetland functions	Wetland attributes
Aquatic plants (cont.)	*Fissendocarpa linifolia Bennet*	Water Lily	F	B
	Flagellaria indica L.	Ricefield Burhead	C	B
	Fuirena umbellata Rottb.		F	B
	Hanguana malayana (Jack) Merr.		F, C	B
	Hibiscus tiliaceus L.	Tree Mallow	F	B
	Hydrilla verticillata	Florida Elodea	N, F, G	B
	Hygroryza aristata Nees	Goose Grass	F	B
	Hymenachne myros	Goose Grass	F	B
	Ipomoea crassicaulis (Benth.) Robins	Little Ironweed	F, C	B
	Ipomoea reptans	Swamp Morning Glory	F, C	B
	Isachne globosa (Thunb.) Kuntze	Goose Grass	F	B
	Ischaemum rugosum Salisb.		F	B
	Jussiaea repens L.	Water Lily	F	B
	Leersia hexandra Sw.	Southern Cutgrass	F	B
	Lemna purpusilla Torr.	Chestnut Iron Wood	F	B
	Lepironia articulata (Retz) Domin	Globe Fringe Rush	C, F	B, U
	Limnocharis flava Buch.	Yellow Burhead	F	B
	Ludwigia octovalvis (Jacq.) Raven	Water Lily	F	B
	Lygodium microphyllum (Cav.) R. Br.	Bullet Wood	C, F	B, U
	melaleuca cajeputi Roxb.	Cajeput Tree	F, C, Se, St	B
	melaleuca leucadendra L.	Madros Thorn	F, C, Se, St	B
	Nymphaea lotus L.	Water Lily	F, C	B
	Nymphaea nouchali Burm.	Water Lily	F	B
	Nymphoides indicum Kuntze	Atap Palm	F	B
	Ottelia alismoides (L.) Pers.	Frog – Bit	N	B
	Pandanus immersus Ridl.		F	B
	Phragmites karka Trin. Ex Steud.	Common Reed	F	B
	Rhynchospora corymbosa (L.) Britt.		C	B, U
	Saccharum spontaneum L.	Wild Cane	F	B
	Salvinia cucullata Roxb.	Floating Water Fern	F	B
	Schmannianthus dichotomus (Roxb.)	Portia Tree	F, C	B
	Scirpus articulatus	Umbrella Grass	F	B
	Scirpus grossus L. f.	Green Kyllinga	C	B, U
	Scirpus macronatus L.		C	B
	Scleria poaeformis Retz.	Globe Fringe Rush	F	B
	Scleria sp.	Ricefield Bulrush	F	B
	Stenochlaena palustris	Elkhorn Fern	C	B
	Syzygium gratum (Wight) S.N. Mitra		F, C, Se, St	B
	Thelypteris interrupta (Willd.) K. Iwats.		F	B
	Utricularia aurea Lour.	Common Bladderwort	N	B
Fish	*Anabas testudineus*		C	B
	Betta splendens	Siamese Fighting Fish	R	B
	Chanda siamensis	Siamese Glassfish	C	B
	Channa lucius	Blotched Snake-head	C	B
	Channa striata	Striped Snake-head	C	B
	Cyclocheilichthys apogon	Red Tail Rasporel	C	B

Category	Scientific name	Common name	Wetland functions	Wetland attributes
Fish (cont.)	*Danio regina*	Blue Danio	C	B
	Duntius leiacanthus	Golden Little Barb	C	B
	Hampala-macrolepidota	Banded Barb	C	B
	Hemibagrus nemurus		C	B
	Hemibagrus trichopterus	Yellow Mystus	C	B
	Hemirhamphus dispar	Wrestling Halfbeak	C	B
	Hemirhamphus garmadi		C	B
	Lepidocephalus hasseltii	Loach	C	B
	Macrobrachium lanchesteri		C	B
	Macrobrachium sp.		C	B
	Microphis boaja	Pipefish	C	B
	Mystus gulio	Long Whiskers Catfish	C	B
	Nandus nebulosus		C	B
	Notopterus notopterus		C	B
	Osterchilus hasseltii	Trout Sweetlip	C	B
	Oxygaster oxygastoide	Minnow	C	B
	Pila ampullaceal		C	B
	Pristolepis fasciatus	Striped Tiger Nandid	C	B
	Puntius partipentazona	Sumatran Tiger Barb	C	B
	Rasbora borapetensis	Blackline Rasbora	C	B
	Rasbora sumatrana		C	B
	Rasbora trilineata	Three-lined Rasbora	C	B
	Unidentified pelecypod		C	B
Mammals	*Callosciurus notatus*	Plantain Squirrel	R	B
	Viverra zibetha	Indian Civet	R	B
Terrestrial plants	*Anacardium occidentale L.*	Ricefield Bulrush	C	B
	Bouea oppositifolia.	Florida Elodea	C	B
	Cleome viscosa L.	False Daisy	C	B
	Combretum trifoliatum Vent.	Siam Weed	C	B
	Cyperus brevifolius		C, F	B
	Cyperus pilosus Vahl.		C, F	B
	Cyperus pulcherrimus		C, F	B
	Lygodium circinatum Sw.		C	B
	Lygodium flexuosum Sw.		C	B
	Lygodium microphyllum	Elkhorn Fern	C	B
	Lygodium polystachyum		C	B
	Mangifer indica L.		C	B
	Mangifera foetida Lour.		C	B
	Pyrrosia longifolia	Bird's Nest Fern	R	B
	Stenochlaena palustris		R	B
Waterfowl and birds	*Acridotheres tristis*	Common Myna	E	B, U
	Alcedo atthis	Common Kingfisher	E, R	B
	Amaurornis phoenicurus	White-breasted Waterhen	R	B, U
	Ardea purpurea	Purple Heron	R	B
	Ardeola bacchus	Chinese Pond-heron	R	B, U

Category	Scientific name	Common name	Wetland functions	Wetland attributes
Waterfowl and birds (cont.)	*Bubulcus ibis*	Cattle Egret	R	B, U
	Chlidonias hybridus	Whiskered Tern	E, R	B, U
	Copsychus saularis	Oriental Magpie-robin	E	B, U
	Cypsiurus balasiensis	Asian Palm-swift	E, R	B
	Dendrocygna javanica	Lesser Whistling-duck	R	B
	Dicrurus macrocercus	Black Drongo	E, R	B
	Egretta alba	Great Egret	R	B, U
	Egretta garzetta	Little Egret	R	B, U
	Egretta intermedia	Intermediate Egret	R	B, U
	Gallinula chloropus	Common Moorhen	R	B, U
	Hirundo rustica	Barn Swallow	E	B, U
	Hirundo tahitaca	Pacific Swallow	E, R	B
	Ixobrychus sinensis	Yellow Bittern	R	B, U
	Metopidius indicus	Bronze-winged Jacana	E, R	B, U
	Mycteria leucocephala	Painted Stork	R	B, U
	Nettapus coromandelianus	Cotton Pygmy-goose	R	B
	Passer montanus	Eurasian Tree-sparrow	E	B, U
	Phalacrocorax niger	Little Cormorant	R	B, U
	Porphyrio porphyrio	Purple Swamphen	R	B, U
	Porzana cinerea	White-browed Crake	R	B
	Streptopelia chinensis	Spotted Dove	E, R	B, U
	Tachybaptus ruficollis	Little Grebe	R	B