Healthy Wetlands, Healthy People

Report of the Shaoxing City Symposium

Mike Ounsted and Jane Madgwick (eds.), 2008

WETLANDS INTERNATIONAL

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1. Preface

On 8 November 2007 the People's Government of Shaoxing City hosted a symposium, organised by Wetlands International, entitled *'Healthy Wetlands, Healthy People'*. The opening sessions were chaired by Chen Kelin, Director of Wetlands International - China, and the technical sessions and discussion by Mike Ounsted, Chair of the Wetlands and Livelihoods Working Group. The symposium was attended by 80 development and conservation actors from both governmental and non-governmental sectors.

The symposium was structured in five sessions. The opening and welcome sessions, with messages from the national government, Shaoxing City and Wetlands International, were followed by two keynote speeches, one giving a global overview and the other a perspective on wetlands and health as seen from Africa. The seven technical papers provided broad perspectives and focused on specific issues related to wetlands and human health.

The technical presentations were followed by panel and plenary discussions after which a joint statement, the Shaoxing Communiqué, which consolidated the symposium's major conclusions and areas of action, was agreed.

2. 'Healthy Wetlands, Healthy People'

The Shaoxing Communiqué

'An increased understanding of the functioning of wetland systems has led to the realisation that good wetland management benefits both wetland ecosystem health and human health. This affects people in all social, economic and geographic categories. Although this is a complex correlation, immediate multi-sectoral action is essential in order to minimise the risks and maximise the benefits to human health and well-being of good wetland management.'

This was the consensus reached by the 80 members of the global development, aid and conservation communities who discussed these issues at a symposium entitled *'Healthy Wetlands, Healthy People'* held in Shaoxing, People's Republic of China, on 8 November 2007, and hosted by Wetlands International and the People's Government of Shaoxing City.

Participants at the symposium urged governments, development, health and conservation agencies, and all those involved in wetland management to take action to improve the health of all people, in harmony with wetland conservation objectives, and committed themselves to the same aim. The symposium noted the following conclusions:

- We are living at a time when altered hydrologies and altered ecosystems are leading to increased hardship, global environmental change, the resurgence of a number of water-related diseases and, most recently, a host of new, *'emerging'* infectious disease epidemics.
- Sustainable management of wetlands contributes to implementing national and international commitments to reduce and eradicate water-related disease.
- For many wetland-dwelling human communities, hunger, malnutrition and a lack of access to clean water are the root causes of poor health. Health and well-being are closely linked to people's livelihood rights and their access to education opportunities, which lead to self-determination and form the *'basic-needs'* foundation for reducing poverty and vulnerability to poverty.
- The scientifically proven contributions that naturally functioning wetland ecosystems make to good health and well-being are rarely recognised by the key ministries and agencies responsible for health, sanitation and water supply. Wetland managers therefore have a duty to promote the value of wetlands.
- Wetlands are frequently seen as linked in negative ways to many natural diseases, such as malaria, schistosomiasis, bilharzia and onchoceriasis (river blindness). Unsustainable wetland management may increase the occurrence of these diseases, and it can also introduce others such as diarrhoea, avian influenza and pollution-related conditions. Conversely, well-managed wetlands can contribute to the reduction or eradication of these illnesses.
- The high nutritional value of wetland resources contributes significantly to the human body's resistance and immunity to many diseases. Very many indigenous wetland plants and animals have significant medicinal values and are often the only source of medicine available to indigenous people.

- Well-managed wetlands, especially in a context of water supply and sanitation, will increasingly play an important role in the health of people in urban and rural communities.
- Women usually bear responsibility for health issues in families, and they are themselves particularly vulnerable during pregnancy and when providing maternal care. Women are usually responsible for food preparation and often for water collection. The often-isolated nature of wetland-dwelling communities emphasises the significance of this responsibility, and causes women to be, in general, at greater risk of poor health.

Participants noted that 2008 will be the UN International Year of Sanitation, and that *'Healthy Wetlands, Healthy People'* is the theme for World Wetlands Day on 2 February 2008, and also for the Ramsar Convention's Conference of Contracting Parties on 28 October - 4 November 2008. The symposium participants identified the following six key areas for action:

- Strengthen collaboration and seek new partnerships between the sectors concerned with wetland conservation, health and water, within and between governments, non-government organisations and the private sector;
- Make the interrelationship between wetlands and health a mainstream part of international national policies, plans and strategies. For example, define specific wetland targets and indicators that link sustainable wetland management to the Millennium Development Goals;
- Transmit this communiqué and other results from the Shaoxing Symposium to the Ramsar Scientific and Technical Review Panel, among other things as an input to the Panel's preparation of draft decisions on wetlands and health for consideration by the Ramsar Conference of Parties;
- Encourage on-going and new research investigating the links between wetlands and health;
- Build capacity for more integrated approaches to wetland and water management and health. For example, create opportunities for learning outside formal structures, with an emphasis on district and local levels; build on and apply local and traditional knowledge;

Encourage fora such as the Wetlands and Livelihoods Working Group of Wetlands International to gather and disseminate information about wetlands and health, and encourage Wetlands International and its partners to develop further projects in this field.

The symposium participants complimented the People's Government of Shaoxing City on their achievements at the Jinghu State Urban Wetland Park, and expressed their appreciation to Wetlands International and the City Government for their initiative in formulating and hosting this significant symposium. All agreed that the event was successful in helping to improve understanding of the relationship between health and wetland management, and that this should help to stimulate future action.

Shaoxing, 8 November 2007

3. Opening Remarks

Chen Kelin

Director, Wetlands International - China

Welcome to this special symposium, *'Healthy Wetlands, Healthy People'*

Looking at wetlands from the perspective of health may be quite new to many of the participants in this room. We mostly think of wetlands and health in a negative light; wetlands foster disease and can be dangerous places to live in. The link between malaria and wetlands is one well known example of the bad press wetlands have received.

However, if we look at the issue more carefully we will find that there is a whole range of interactions between wetlands and health and human well-being, and that these linkages are by no means all negative. Wetlands provide the foundations of human well-being - water, food and much more besides. Poor health is most likely the result of poorly managed and degraded wetlands where the ecosystem is no longer able to provide the health-giving services that protect people from disease and provide food and water resources.

We are particularly grateful to Shaoxing City Government for promoting this symposium today. Wetlands are generally thought of as part of the rural landscape, however this year, 2007, marks the first time in human history that more people live the urban environment than in rural areas. It is apt, therefore, that Shaoxing City's interest in this subject reminds us that well managed wetlands are as important for the good health and well-being of urban people as they are for rural communities.

I wish all participants a day of fruitful discussion and hope that we will strengthen our knowledge by listening to the expert presentations.

4. Welcome from the National Government

Chen Xiaoli

Former Chief Designer, Ministry of Construction of China

4.1. Healthy Wetlands, Healthy People

There is no water, no life, without healthy wetlands: they are the basis of human survival. With its rapid economic development, China has stepped into the era of urbanisation. Our cities have embraced the new development opportunities, and great social progress has been made. As part of this challenge, ecological improvement and wetland conservation and wise use have become especially important issues in urban development and construction. During the 17th Congress of the Chinese Communist Party it was repeatedly emphasised that a scientific outlook to development must be insisted upon, which means maintaining the harmony between society and the economy, between nature and human beings. Therefore great attention should be paid to ecological conservation and human living conditions in our urban development. In terms of economic development, our environment and, especially, wetlands should be well protected, and every effort is being made to seek a model that is appropriate to the direction that China's urbanisation is taking.

4.2. Shaoxing City and Jinghu Urban Wetland Park

Shaoxing, well-known for its aquatic landscapes, is one of the most famous of China's *'water cities'*, with a long history. Shaoxing City was actually built on wetlands, and already enjoyed a good environment and long cultural history. Jinghu Wetlands Park in Shaoxing was first designated as an urban wetland by the Ministry of Construction in 2005; Shaoxing Municipal Government developed the Park using the principles of ecological conservation and prioritising wise use. The Park was open to the public on 30 April 2006; China Central TV conducted interviews and broadcast the news across the country. The First Symposium on Urban Wetland Conservation and Wise Use was organised here in 2006; this was a step forward for wetland conservation.

The 2007 annual plan for Jinghu Wetlands Park was formulated so as to bring the Park's management in line with its improved ecological condition. The water in the park is becoming clearer and attracting thousands of herons to Meishan Mountain. The Shaoxing Government has made great efforts in terms of wetland conservation and wise use; this provides a good example for other wetlands and we can learn from local practices. However, wetland conservation is a long-term undertaking and there is a long way to go. I believe that China will explore innovative approaches and means and, guided by technical expertise and strong government interest at all levels, make great progress in wetland conservation and ecological and urban development. I sincerely wish Shaoxing City great success in improving its ecology whilst at the same protecting the environment of the city in this period of rapid development.

5. Welcome from Shaoxing Municipal People's Government

Zhang Jinru

Mayor, Shaoxing Municipal People's Government

5.1. To Build a Wetland of Harmony, and to Develop a Conservation Culture

The conservation and development of the wetland resource has become a key aspect of China's regional development. In particular, urban parks are being promoted since they clearly demonstrate the need to protect basic ecological functions and are intrinsic to the culture, landscape and social well-being of our citizens. A functioning wetland landscape is a force that is effective in enhancing the city's competitiveness.

Located at the centre of Jinghu District, the 'green heart' of Shaoxing, Jinghu State Urban Wetland Park covers a total area of 15.6 km2, including a 77.5% aquatic area of 12.1 km2. It is one of the first urban wetland parks in China, and the first of its kind in Zhejiang Province. Boasting abundant natural resources and a beautiful landscape, the Wetland Park is a typical freshwater urban wetland park, but its 'lotus leaf' shape is unique in China. With its ancient history and heritage, Jinghu is a district well known for its wine, bridges, famous artifacts and ancient town, harmoniously embracing both natural landscape and human culture.

With the need to expand central Shaoxing City, in 2002 the Provincial Political Consultative Committee and Municipal Government put forward the idea and concept of creating *'a green space in Shaoxing's central urban district'*. At the end of the same year, the construction of Jinghu district was officially initiated, and the administration committee of the district established. In May 2005, Jinghu State Urban Wetland Park was approved by the national Ministry of Construction. The Wetland Park was open to the public in April 2006. There were four key aspects to the development of the Park.

5.2. Planning the Wetland Park

From the outset, the Wetland Park was planned as in integral part of an 'experimental zone' for scientific development. The Park was developed on a strictly scientific basis in terms of its conservations needs, utilisation and operational mechanisms.

5.3. The principles underlying the establishment of the Park

The Park was established within the context of the development of the whole city and forms an essential part of the general ecological environment. The Park is key to the city's harmonious development, binding the natural and constructed environments and linking the present with the past. These guiding principles focused on conservation, and gave priority to ecological needs, reasonable utilisation and beneficial development. With the precondition of maintaining the completeness of the ecological system and its environmental benefits, it was necessary to permit reasonable utilisation of the Park's various resources and to give full play to its economic and social benefits, as well as to its function of beautifying the city. Every effort was made to build Jinghu

Wetland Park into a park with rich ecological resources, a beautiful natural environment, an authentic folk landscape, and a profound cultural base. When development projects are proposed with an uncertain influence on future land use, the policy is not to grant planning permission but to *'leave it blank'* so that future generations can maintain a holistic approach to development.

5.4. The implementation of a scientifically-based plan

The relevant laws and regulations were taken as the foundation of the development plan. The water city's existing features and historical culture were adapted, focusing on the biological diversity and ecological features and functions. Taking into account these preconditions, the general blueprint and tourism and land development plans were prepared. Three major tourist zones were brought together under one overall plan; these included Meishan Scenic Spot and Ang-Sang Lake, forming a 16-km river sightseeing route that links the four major attractions of Datan, Meishan, Bitang and Dongpu ancient town. This year, the overall Management Plan for Jinghu Wetland Park was compiled and issued, and measures for conservation and administration have been implemented. By continually optimising and consolidating the Management Plan, the conservation of the wetland is guaranteed.

5.5. An industrial, scientific development pattern

Preference has been given to service-orientated industrial development; for example, a modern commercial approach has been taken to ecological and recreational tourism. Metropolitan and technological industry and ecological agriculture that is wetland friendly are encouraged. The development of company headquarters and social housing has been proactively supported and receives preferential land allocation. An area of 67 ha of land has been specially designated to attract companies to build their headquarters in the zone. At the same time, work on conserving energy and reducing emissions is being carried out by upgrading the industrial requirements and raising the standards for development permits for the area. Clean production is advocated among the enterprises in the district, and pollution-creating companies are carefully monitored and controlled. Special modifications have been made to the waste systems of 32 setting machines in seven printing-and-dyeing enterprises. At the same time, an ecologically friendly industrial system has taken shape in Jinghu New District.

5.6. Prioritising Conservation and Constructing the Wetland Park to Restore and Balance the Ecosystem

It is vital to understand that the wetland is a fragile and original environment, that is to say, if it is destroyed, it is very difficult or even impossible, to restore it. Therefore, above all, the principles of conservation have been adhered to, and development has been pursued with conservation and conservation with development. Adhering to the doctrines of sustainable development, the concepts of an 'adjustment zone' have been maintained.

5.7. To maintain the flow of clean water

The key features of the water system in Shaoxing are the Xiaoshun River Reservoir, Cao'e River Floodgate, the inner rivers and the waste treatment network. As an integral part of the Cao'e River system, the quality of Jinghu Wetland Park is closely related to the system of *'reservoir, floodgate, rivers and nets'*. Therefore a huge amount has been invested in the project to clean up the river, and this has considerably improved the condition of the urban river systems, thus providing a favourable flow and water circulation in Jinghu Wetland

Park. A further RMB 6 million have been used to start a sewerage system for the new district and to initiate the renovation of sanitary sewerage in the rural areas. RMB 22 million have also been spent in clearing obstacles and mussels from the core water region of Jinghu Wetland Park to improve the water quality. A special campaign has been conducted to protect the rivers and to investigate unnecessary pollution such as siltation and the dumping of garbage. Agricultural pollution has also been placed under intensified management, and the ecological breeding and cultivation of aquatic products has been increased. These measures have now resulted in 538 ha of water surface and 1025 ha of shoals.

5.8. To maintain the biological diversity

The new district has invested RMB 82.75 million in the greening project in order to maintain biological diversity: some 5.8 million m^2 of green area is being maintained systematically. The Meishan wetland project has introduced over a million trees and shrubs and 700,000 m^2 of wetland plants. Trees have also been planted along the wetland tourist trail. A dock has been built at Datan Lake, where over 80,000 trees have been planted, plus over 1 million m^2 of wetland plants. The district has also added new aquatic plants such as water chestnut and lotus over an area of 10,000 m^2. Some 2300 m of river banks have been repaired and protected. At present, the Wetland Park contains plants of 65 families, 132 genera and 151 species, and there is a good variety of plankton. Furthermore, the mountains in the district are now home to many wild animals and birds, including Little Egret, a species protected at Grade 2 at the national level.

5.9. To protect the original ecology

Throughout the conservation and development of the Park the principle of maintaining the original patterns and interfering only minimally has been adhered to. The original lake was recreated from fields that had been drained for agriculture. The degraded parts of the wetland have undergone active ecological restoration so as to expand the ecological carrying capacity of the wetland itself and increase the volume of natural resources. The transition zones between the wetland and the neighbouring urban district have been remarkably effective in minimising excessive disturbance from the city. The rapid restoration of the ecological environment and the improvement in the wetland landscape have attracted egrets and many other birds to settle here.

Developing the Wetland in Such a Way that It Forms a Buffer Zone for the Urban Area
Great importance has been attached to managing the relationship between ecological conservation and appropriate development, and to finding the right balance between protection and utilisation so as to maximise the value of the wetland and develop it sustainably.

5.10. A *'green heart'* function

Situated in the *'green heart'* of the city, Jinghu Wetland Park has a uniquely advantageous location and can play an important role in the development of Shaoxing into a large city comprising several districts. There is a clearly set target to *'build a big city'*, and the Municipal Government is working hard to speed up the inter-connection of the various districts. The first phase of the highway projects has been completed, with five roads and one bridge already in operation, which greatly improves transportation to the Wetland Park. A solid foundation has been laid for the city's expansion to the north, and the city

centre will correspondingly be moved from the old town to Jianhu Lake, and finally to Hangzhou Bay.

5.11. Opportunities for tourism

To enhance the abundant natural resources of the Wetland Park, RMB 40 million have been spent in the protective construction of Meishan wetland scenic zone, which has four major parts: the entrance zone, the egret foraging zone, the rock view zone and the riverside bird-viewing zone. A sightseeing trail along the river is open to the public. The social influence and popularity of the Wetland Park have been vigorously promoted. The park received 190,000 visitors in 2006, bringing in revenue of RMB 2.58 million. Jinghu Wetland Park has become a new tourism highlight in Shaoxing, effectively complementing the traditional culture-based tourism. The successful promotion of Jinghu State Wetland Park will definitely contribute to further enhancing the city's renown and competitiveness in the tourism market.

5.12. A functional habitat

In order to develop Datan into a modern riverside residential zone with good supporting facilities and a beautiful environment and so as to make best use of the natural ecological environment, the habitat has been proactively optimised. For the buffer zone of the Wetland Park, it is planned to attract corporate headquarters of companies involved research and development, finance, information consultancy, architecture and design, commerce and recreation. Our definition of the comprehensive service industry covers well established service functions such as top-class hotels, fashion, public activities, and a high quality residential area with supporting facilities.

5.13. In the Pursuit of Harmonious Development, to Build the Wetland into an Area to Display Ancient Shaoxing Culture

Hand in hand with wetland conservation, great importance is also attached to the protection and exploration of the historic culture and the local cultural landscapes, scientific research on wetland subjects, and the development of scientific education. Moreover, a harmonious socialist culture is actively being constructed with the aim of introducing a cultural factor into the Wetland Park, so as to orient and upgrade the Wetland Park.

5.14. To promote the cultural heritage

Along with the restoration and rebuilding of the ecological system, great attention is being paid to exploring cultural heritage and folk customs, especially those of Meishan Mountain and Ang-Sang Lake. Special mention should be made of Dongpu town, which has begun protective development work on its ancient town, and is making a serious application to become a historic and cultural-protection zone at the state level. A Dongpu to Bitang water-themed trail has recently been added. Key protection has been given to the 216 bridges of different shapes and styles. The former residence of Xu Xilin and the historic streets of Dongpu are also being repaired and protected.

5.15. To enhance the educational function

The rich resources of the wetland provide good conditions for professional scientific research, as well as educational visits and laying the foundations of science education for the younger generation. A scientific and educational visitor centre has been set up outside the core protection zone in which awareness-raising and educational activities are held to introduce the public to the natural scenery and to feature the wetland landscape using a range of methods.

5.16. To concentrate on social harmony

Successful conservation of the wetland must rely on the people, and the fruit of the conservation effort must be shared by the people. During the process of building the Wetland Park, the concept of harmonious development has always been foremost and no effort has been spared to develop education, medical care and social security, encourage innovation and renovation, to ensure an improvement in the environment and living standard of the people. Jinghu Primary School has been built and opened, at a total cost of RMB 40 million; and two hospitals have been built in the towns of Lingzhi and Dongpu, at a cost of RMB 3.05 million. Nearly 80,000 farmers are now able to have an annual medical check-up. Social security is provided for enterprise employees and those farmers whose land has been expropriated. Citizens with no work, no income or dependants are supported entirely by the government. A society of peace, harmony and civilisation is being fostered.

It is a mission bestowed on us by our ancestors to take very good care of the *'kidney of the earth'*. It is right to develop our wetland resources sustainably. It is the urbanisation of Shaoxing that has called us to build Jinghu State Wetland Park. We will take this conference as an opportunity, following the guidelines of the conservation culture put forward by the 17th Congress of the Chinese Communist Party, to do a fine job in conservation, management, operation and research, so as to promote the sustainable development of the wetland. We welcome your valuable suggestions and comments on the development of Jinghu Wetland Park and the development of the city as a whole.

6. Welcome from Wetlands International

Jane Madgwick

Chief Executive Officer, Wetlands International

6.1. Human health as an integral part of Wetlands International's strategic programme

Wetlands International is delighted to welcome you to this symposium. During the last few days, Wetlands International's Board of Members, staff and associates have been reviewing the progress we are making in reaching the strategic goals that we set for Wetlands International three years ago. We thought that this would be an excellent occasion and venue for us all to share our experiences on wetland management in relation to human health.

Wetlands International's goals are particularly linked to livelihoods, socio-economic values, sectoral sustainable development and improving our knowledge regarding the relationships between people and wetlands. Although health as such has not been specifically mentioned, we have learnt over the past three years from our cooperation and partnerships with the development sector, as well as from some of our own policy and demonstration projects on the ground. We have learnt that health issues should always be considered as a part of poverty reduction programmes and the establishment of a sustainable economy. Sustainable livelihoods are a prerequisite for the wise use of wetlands. Wise use of wetlands will result in improved food security, improved access to clean water, and improved environmental security by safeguarding people against floods and droughts. Therefore healthy wetlands are important for healthy people. This relationship is what this symposium is about. We want to further define this issue during the symposium and use this to strengthen and enhance our programmes in the future.

The Wetlands International Strategy, in its broadest interpretation, includes the aim to conserve wetlands for people and biodiversity. Hence our members and partners have mandated us to address any issues which negatively affect the provision of wetland services. We have become aware that the impact of wetland degradation on human health, in any of its dimensions, is a crucial item to be included in our considerations, strategies and programme development. Given the many sectors that have an influence on wetlands and therefore on people, the theme *'healthy wetlands, healthy people'* can embrace a wide range of different issues, as evidenced by the programme of this Symposium.

Key issues to consider are water-related diseases, floods, pollution and the availability of clean water for human consumption. They also include food and medicine provided by wetlands. These water-related issues are perhaps rather obvious, but sometimes unsustainable wetland use causes unexpected health issues to emerge. Earlier this week, Professor Gordon Reid explained to us how the introduction of the Nile Perch, an alien species, into Lake Victoria resulted in an increase in the incidence of schistosomiasis. In Indonesia, drained peatlands have caught fire, creating a smoke haze that has been shown to result in a significantly increased occurrence of respiratory diseases, particularly in children, throughout the Southeast Asia region. During fire seasons, 30-40% of children under the age of 5 may be affected

by the haze, as CARE, our development partner in the Central Kalimantan Peatlands Project, discovered. Another example is avian influenza. Over the last three years Wetlands International has been working, in partnership with organisations such as the United Nations Food and Agriculture Organisation (FAO), the World Organisation for Animal Health (OIE) and the World Health Organisation (WHO), on the issue of avian influenza and promoting bio-security as the key to reduced transmission.

Of course, wetlands have always been considered as disease-infected areas, harbouring illnesses such as malaria, schistosomiasis, bilharzia, onchoceriasis (river blindness) and various other worm-related diseases. Some wetland-related diseases affect large numbers of people and have made certain areas uninhabitable. However, the impacts of unsustainable management of such wetlands have often aggravated the situation for the local communities, and in many cases where wetlands have been drained and converted the *'cure'* has had more severe effects than the disease itself. During this symposium we hope to learn more about how to manage the health hazards in combination with the many positive wetland values.

Wetlands International recognises the need for an improved knowledge base to develop and underpin our approaches and strategies in addressing human health and well-being. With this knowledge we can begin to move beyond informing and influencing the conservation sector and reach out to pertinent development sectors including the health sector. I would like to touch upon some examples from our current work.

Over the last two years we have allocated significant resources to researching the transmission of avian influenza to improve understanding of the role of migratory waterbirds, their interactions with domestic fowl and, particularly, the limitations of the wild birds' role. This information is of critical importance in determining good wetland management practice. Such information has also helped the health sector to improve targeting of their programmes to combat and monitor this disease.

Food security is key to healthy people. Our work in the Inner Niger Delta in Mali has looked at this in various ways. We have considered the impact of different water management strategies in the Niger River and its floodplains in relation to food security as well as ecosystem health. We have also looked at the role of key habitat types such as the flooded forests in terms of their importance for supporting fish stocks. In addition we have looked at the risks to human health of pesticide use, storage and disposal.

In our Central Kalimantan Peatlands Project we have engaged with CARE as a partner because of their expertise with livelihood issues in the region. The project has invested in improving access to health facilities in villages and the provision of ante-natal training for women. In addition, we have supported research and monitoring of the peat-smoke-induced respiratory diseases and provided medicines and help. Moreover, the project as a whole has prioritised fire prevention and control, equipped villages to stop fires, and supported large-scale initiatives for peat swamp forest conservation and restoration, thus decreasing fire occurrence. The project also supported the development of a provincial green government policy and supported the development of sustainable livelihood strategies that will enhance environmental and food security.

A new area that we will be giving attention to in the coming years will be water supply and sanitation, or *'WatSan'*. We have the long-term aim of making development interventions in this area more environmentally sustainable. We will build

an initiative that will influence key actors in water and sanitation - both donors and practitioners. Poor sanitation and water-supply practices degrade wetlands and the food and fresh water that they provide. Some small but very strategic projects already conducted in this field include activities around Chilika Lagoon in India. Currently we are active in establishing partnerships with key organisations engaged in WatSan such as WASTE and IRC, based in the Netherlands, and WaterAid, based in the United Kingdom. Further, we are developing on-the-ground pilot projects to improve our understanding of the issues and to engage our development partners in action research.

In 2004, when we developed the current Wetlands and Poverty Reduction Project, we did not take health issues into account. This project will be continued in 2009-2010 as the Wetlands and Livelihoods Project (WLP), which is also generously supported by the Dutch Ministry of Development Cooperation. In the WLP, health issues have been structurally incorporated in our targets and achievement indicators. This will require further development of our partnerships within the health sector.

In all our current activities in this field we acknowledge that we need to learn and improve our understanding of the interactions between human well-being and the condition of wetlands of all kinds. Our partnerships will be crucial for this, as will our work in and with the conventions. We have raised the issue of livelihoods in the last two meetings of the Conference of the Parties (CoPs) to the Ramsar Convention and are delighted to see that the Convention is now embracing this topic and promoting awareness and dialogue on the integral aspects of wetlands and health. Next week the Convention will be holding a Scientific and Technical Review Panel (STRP) meeting on *'healthy wetlands, healthy people'*. The forthcoming World Wetlands Day and the CoP later next year will have the same focus. Our work with the Convention of Biodiversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), World Water Forum (WWF), Global Water Partnership (GWP), World Water Council (WWC), and the development sector (including the private sector) will be crucial to stopping the degradation of wetland ecosystems that are so critical to the security (food, health and environment) of large numbers of people, especially women and the poor.

This symposium will contribute to a process that is now more widely shared and should lead to further enhanced awareness and understanding that the value of wetlands can not be overstated. We are happy to see the recognition of this also in the creation of Jinghu Wetland Park, and would like to express our appreciation with a token of respect for the steps undertaken by the Shaoxing Municipality to improve the management of this great urban wetland. I therefore would now like to invite representatives of the Shaoxing Government to join me on the stage and receive a plaque to commemorate their excellent efforts.

7. Wetlands, Health and Sustainable Development - Global Challenges and Opportunities

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Abstract

When ecosystems services fail, human health suffers - and for no ecosystem is this link more direct than for wetlands. One third of the world's population lacks sufficient clean water for drinking, personal hygiene and cooking, and about two million people die annually from waterborne diarrhoeal disease. Even when water is available in abundance, ecosystem disruptions can carry a heavy disease burden: over-irrigation results in standing water in which disease-carrying mosquitoes breed, and water used by industry often allows toxins to enter the human food chain. Altered hydrologies and vegetation structures can lead to hardship, global environmental change, and, most recently, a host of new, 'emerging' *infectious disease epidemics.*

Poor wetland management leads to a deterioration of both wetland ecosystem health and human health. It is only in the last couple of decades that we have come to appreciate the strength of the fundamental relationship between wetland ecosystem health and human health, and therefore the importance of developing environmental management strategies that support the maintenance of both wetland ecosystem health and human health concurrently. However, the concept of what constitutes a healthy wetland is not straightforward. Whilst the slogan 'Healthy Wetlands, Healthy People' *may resonate with many people, wetland health is still largely a subjective concept. It is also one that is heavily influenced by our political ecologies; there are many complexities and uncertainties when considering healthy people and healthy wetlands. These complexities and the inter-related scientific issues are explored in this paper - what is a healthy wetland and how does a healthy wetland affect human health?*

Key Words: wetland health, human health, human well-being, ecosystem services, wetland loss and degradation

7.1. Introduction

The interactions between people and ecosystems have received more attention in recent years with the Millennium Ecosystem Assessment (2005) providing an assessment of the consequences for human well-being of ecosystem change. The Assessment was based on synthesised information; it added value to existing scientific information rather than generating new primary knowledge. In this manner it established with high certainty that as a result of human actions the structure and functioning of the world's ecosystems changed more rapidly in the second half of the twentieth century than at any other time in human history. A major consequence of these changes is that biodiversity globally is being depleted at an accelerating rate, with wetlands amongst the most adversely impacted ecosystems (Revenga *et al*. 2000; Dudgeon *et al*. 2005; Finlayson *et al*. 2005a; Falkenmark *et al*. 2007). Changes in land cover and use have resulted in major transformations in wetlands with substantial gains for human well-being and health from the production of food, but there are concerns whether this is sustainable (Foley *et al*. 2005).

Corvalan *et al.* (2005) have also reported that ecosystem changes may occur on such a scale as to have a catastrophic effect on human health. This is more and more likely as multiple land-use practices that result in the loss of biodiversity lead to an increasing risk of non-linear changes in ecosystems, including accelerating, abrupt and potentially irreversible changes. Similar nonlinearities are anticipated in social-economic-political systems: for example, widespread food insecurity resulting from severe climate change, institutional failure and increasingly damaged soils could worsen inequality and even lead to widespread conflict. At the same time a great many individually less dramatic losses in ecosystem services are likely to influence human health adversely.

Various global assessments have shown the extent of the dire interaction between human health and wetlands/water (Corvalan *et al*. 2005; UNESCO-WWAP 2006; Molden *et al*. 2007; UNEP 2007). One third of the world's population lacks sufficient clean water for drinking, personal hygiene and cooking, and about two million people die annually from waterborne diarrhoeal disease. Even when water is available in abundance, ecosystem disruptions can carry a heavy disease burden: over-irrigation results in standing water in which disease-carrying mosquitoes breed, and water used by industry often allows toxins to enter the human food chain. Altered water regimes and vegetation structures can lead to environmental change, and, most recently, *'emerging'* infectious disease epidemics.

It is only in the last couple of decades that we have come to appreciate the strength of the fundamental relationship between wetland ecosystem health and human health, and therefore the importance of developing environmental management strategies that support the maintenance of both wetland ecosystem health and human health concurrently. As wetlands are amongst the most degraded ecosystems globally, further degradation could greatly affect the well-being and health of people dependent on them both directly and indirectly. These issues are expanded in this paper through examining the links between wetlands and health as expressed through the metaphor *'healthy wetlands, healthy people'*. The emphasis is on how wetlands support human well-being and health through the provision of ecosystem services.

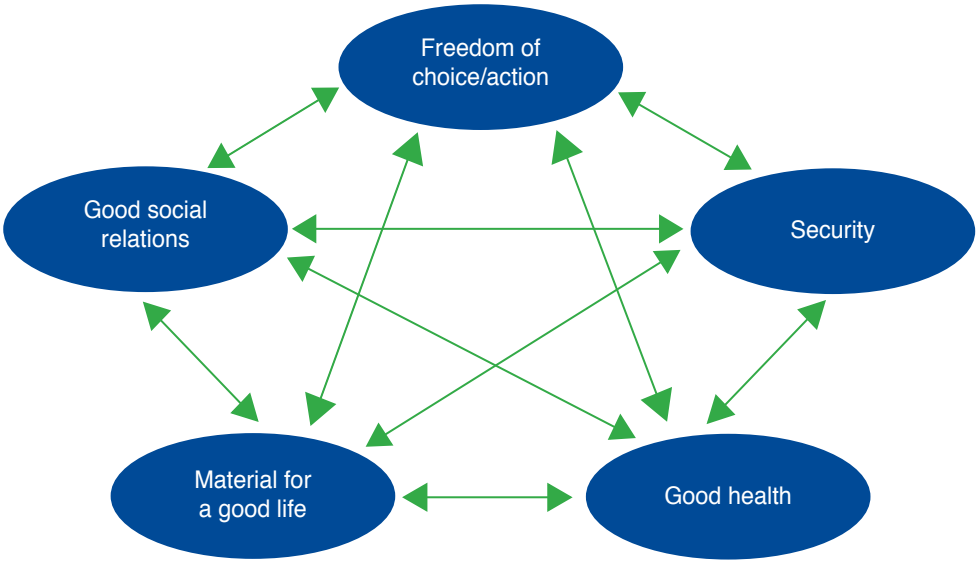
7.2. Human Well-being and Health

- Human well-being is a much debated term - the Millennium Ecosystem Assessment (2003) treats human well-being as representing the basic material needs for a good life, the experience of freedom, health, personal security and good social relations. Combined, these provide the conditions for physical, social, psychological and spiritual fulfilment, and encompass five interlinked components (see Figures 7.1 and 7.2):
- the necessary material for a good life including secure and adequate livelihoods, income and assets, enough food at all times, shelter, furniture, clothing, and access to goods;
- health including being strong, feeling well, and having a healthy physical environment;
- good social relations including social cohesion, mutual respect, good gender and family relations, and the ability to help others and provide for children;
- security including secure access to natural and other resources, safety of person and possessions, and living in a predictable and controllable environment with security from natural and human-made disasters; and
- freedom and choice including having control over what happens and being able to achieve what a person values doing or being.

These components reinforce each other, positively or negatively, with a change in one often bringing about changes in the others, at times through complex multi-dimensional linkages. Human health as one of these components is interlinked with the others and influenced by them:

There is some agreement that well-being and poverty are the two extremes of a multi-dimensional continuum, but less agreement on the complex and value-laden nature of how well-being or poverty are expressed and experienced. A discussion about the

Figure 7.1. The components of human well-being (adapted from Millennium Ecosystem Assessment 2003).



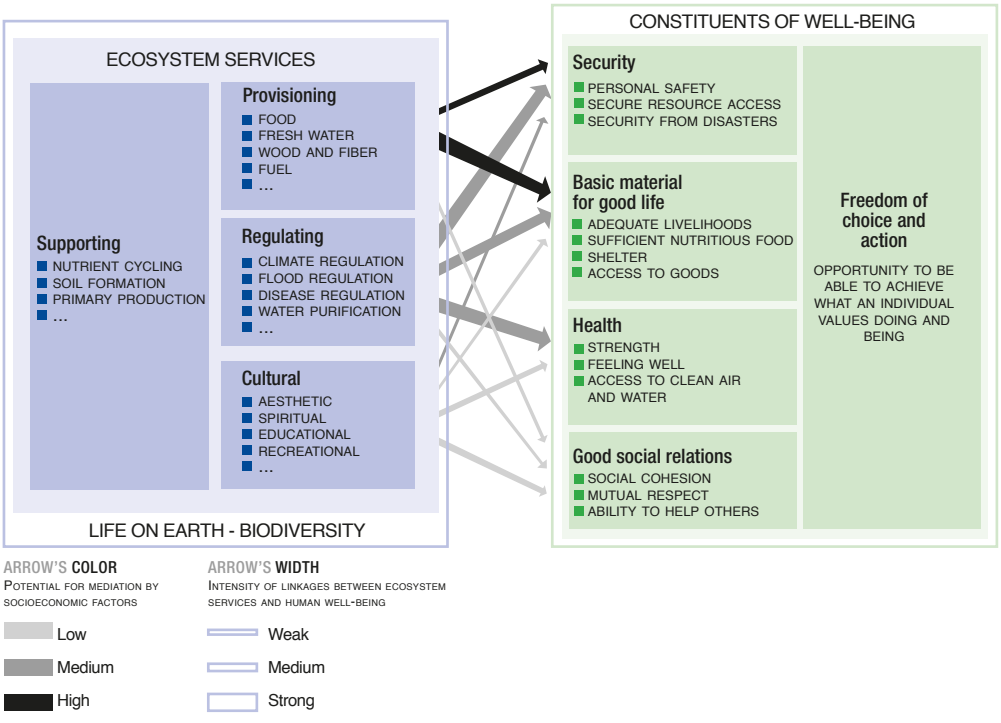
complex and value-laden and context- and situation-dependent nature of well-being and poverty associated with water is beyond the scope of this paper, but is expanded in recent reports (UNESCO-WWAP 2006; UNEP 2007). For the purpose of this paper it is assumed that human well-being, poverty and health are inter-related concepts with many common features, but also differences that assume more importance in specific and intricate treatments of each.

7.3. Human Well-being and Ecosystem Services

The Ramsar Convention has adopted the concept of ecosystem services as outlined in the Millennium Ecosystem Assessment (2003), namely: ecosystem services are the benefits people obtain from ecosystems, which include provisioning, regulating, supporting and cultural services. Ecosystem services from wetlands include products such as food, fuel and fibre; regulating services such as climate regulation and disease control; and non-material benefits such as spiritual or aesthetic benefits. Changes in these services affect human well-being in many ways (Figure 7.2):

The strength of linkages between categories of ecosystem services and components of human well-being that are commonly encountered are outlined in Figure 7.2. Human health is most influenced by provisioning and regulating services, but the strength of the linkages differs in different ecosystems and regions. As with other components of well-being human health is being affected by increased demand for

Figure 7.2. Linkages between ecosystem services and human well-being with human health presented as one component of well-being (from Millennium Ecosystem Assessment 2003).



ecosystem services from many ecosystems, including those from wetlands. The problem posed by the growing demand for wetland services is compounded by increasingly serious degradation in the capacity of wetlands to provide these services (Finlayson *et al*. 2005a). In many parts of the world the degradation of wetlands is exacerbated by the loss of the knowledge and understanding held by local communities that could help to ensure the sustainable use of wetlands and support human well-being.

The Ramsar Convention has long recognised that some wetland development is inevitable and that many developments have important benefits to society, but strongly emphasises that any development should be sustainable and not undermine the ecological character of the wetland. Further, parties to the Convention undertake to make wise use of all wetlands through appropriate polices and practices. As wise use is synonymous with sustainable development and the ecological character of a wetland is *'the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time'* parties are also required to maintain the ecosystem services that characterise the wetland. This approach to wetland development is in line with the concepts outlined in the Millennium Ecosystem Assessment (2003), which also recognised that past adherence to narrower approaches to conservation had not stemmed the loss and degradation of wetlands globally.

7.4. Wetland Health

It is increasingly recognised that productive, healthy wetlands with their array of services provide people and communities with resources that can be used in everyday life and options. There are also many claims that healthy wetlands reduce vulnerability to flood, drought, crop failure or disease, and that, conversely, poorly managed or unhealthy wetlands are increasingly exacerbating vulnerability by increasing the risks of flood, drought, crop failure or disease, all of which can affect human health; the evidence for some claims is still being debated: for example, the role of wetlands in regulating water regimes and groundwater recharge (Bullock and Acreman 2003) and the role of coastal wetlands in buffering storm and tidal surges (Baird 2006).

Despite the ongoing discussion the concept of ecosystem health is being widely promoted, both popularly and scientifically. The latter is shown by the adoption of the theme for the Ramsar Convention's next conference of parties in 2008 - *'Healthy Wetlands, Healthy People'*. Building on key messages from recent global assessments about the state of ecosystems and the impact on people there has been an emphasis placed on health - human health and ecosystem health. This is seemingly an attractive and potentially widely popular message, but it is far from a proven concept given the complex and value-laden and context- and situation-dependent nature of human health. Human health is dependent on many medical, social and cultural factors which may or may not be linked with ecosystem health. It is, though, anticipated that the metaphor *'healthy wetlands, healthy people'* could have wide appeal whether or not the scientific evidence is available or complete!

At the same time the concept of ecosystem health has been incorporated into an increasing number of monitoring and management programmes despite largely being a superficial scientific concept beset with social, cultural and political interpretations (Norris and Thoms 1999). The attractiveness of the concept has been realised, but it is contended that further deliberation and scientific analysis are required before a universally accepted

concept can be agreed and applied. Within the context of the Ramsar Convention there have been some largely superficial attempts to relate ecosystem health to ecological character - they have much in common, but they are not the same. As it stands, the concept of ecological character does not encompass the concept of ecosystem health, although this may be assumed in many instances, i.e. wetland use and character can be inseparable, but not necessarily directly equated with wetland health; further analysis is needed to inform an evidence-based debate on these links.

Leaving aside the complex issue of reconciling ecosystem health with ecological character there has been much debate over what constitutes ecosystem health. A number of approaches to measure ecosystem health have been outlined by Rapport (1989) and are summarised below:

- The absence of stress measured by specific indicators - mainly biotic;
- The ability to bounce back from stress - resilience; and
- The extent of risk to stressors/pressures on the ecosystem.

The common approach has been to measure ecosystem health through a number of ecological measurements with comparisons to reference sites or conditions to establish ecological integrity. Reference conditions have been proposed frequently, but there are some difficulties in determining a suitable temporal scale, the extent of replication, and suitable indicators. It has also been proposed that reference conditions should be based on the biotic integrity of the wetland and should be set *a priori* and sites classified to provide specific comparisons. Overall, much scientific effort is still needed to provide ecological indicators and methods for assessing wetland health, especially given the many different types of wetlands.

An alternative approach that is being developed, perhaps more slowly, is to base wetland health on social values and indicators (e.g. Rogers and Biggs 1999). It is contended that this fits with the current emphasis being placed on ecosystems services as a component of the ecological character of wetlands. A socially-oriented approach could comprise the following steps:

- establish the best possible reference condition, given acceptable land or water use;
- make judgements based on uses of human amenity derived from the wetland;
- acknowledge that restoration may be necessary, especially where wetland uses prove to be non-sustainable; and
- accept that changes in use/amenity can change the condition and hence perception of the health of the wetland.

It is not known if this emphasis on social values would be acceptable to the conservation and ecological communities that seem to have embraced the concept of ecosystem services and their link with human well-being and health (see Armsworth *et al*. 2007; Ghazoul 2007). One objection could come from the greater anticipated complexity of reaching agreement on social values of wetlands and how these relate to the health of the wetland. Another could arise if the promotion of a socially-oriented approach to wetland health leads to further changes in the balance between traditional wetland conservation and development. While some conservation and ecological communities have embraced the concepts of ecosystem services and the importance of such services for human well-being, the adoption of social outcomes per se may be a step too far for these communities.

Two examples are used to illustrate the difficulties that can arise when considering social perceptions of wetland health. The first is from northern Australia, where popularised images of healthy wetlands frequented by tourists may not be shared by traditional Aboriginal users who can not readily access preferred food items from the wetlands given changes in the vegetation in recent decades (Finlayson *et al*. 2005b). The second concerns rice fields that are classed as wetlands under the Ramsar Convention and considered as an integral part of the wetland landscape even though in some instances they are not suitable replacements for natural wetlands (e.g. Richardson and Taylor 2003), or may contain high levels of pesticides (e.g. van den Brink *et al*. 2003).

7.5. Wetland Types and Classification

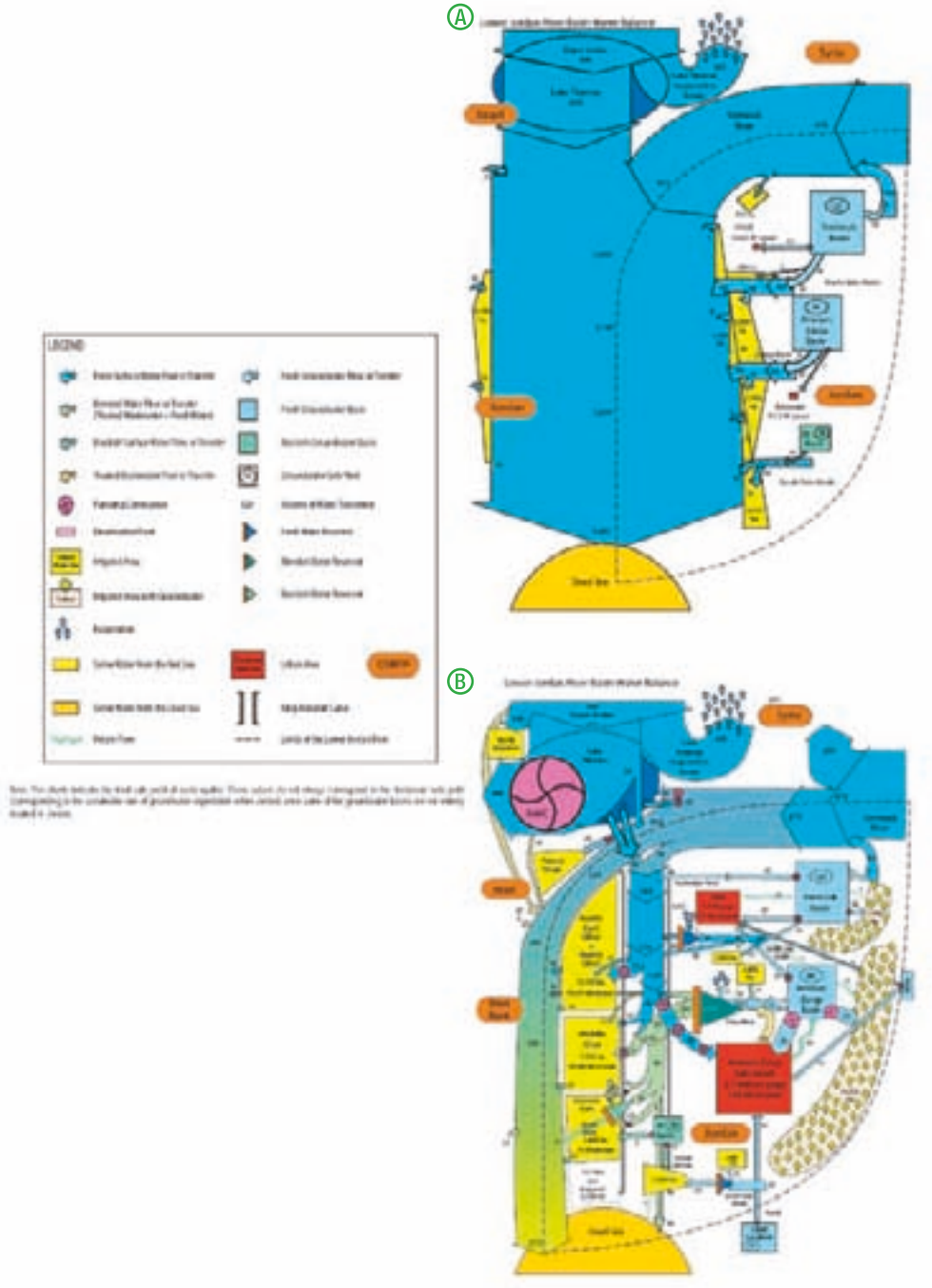
A further issue when considering wetland health is the classification of wetlands; many analyses of ecosystem health require classifications to enable comparisons with reference sites. The wetland definition and classification adopted by the Ramsar Convention are very broad, encompass many wetland types and are used for many general purposes, e.g. for wetland inventory and national wetland planning and management (Finlayson and van der Valk 1995; Scott and Jones 1995). The definition is '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 does not exceed six metres'. The resultant classification includes 12 types of marine/coastal, 20 inland and 10 human-made types.

The Ramsar classification, however, is not considered as systematic or consistent as others that have been proposed (Semeniuk and Semeniuk 1997). Nor are the definition and breadth of wetland types fully accepted by other ecologists, conservationists, land and water managers or decision makers, with lakes, rivers and coastal/marine types at various times not being seen as wetlands (Scott and Jones 1995; Semeniuk and Semeniuk 1997; Finlayson and Spiers 1999). This has raised a number of issues that may or may not be seen as problematic; many wetland types are not widely accepted by others as being wetlands and are not fully represented in the list of Ramsar sites (Rebelo *et al*. in press), and the classification is not generally seen as sufficiently supporting systematic wetland inventory (Finlayson *et al*. 1999). The importance of these issues could be seen as a matter of personal choice, but a further difficulty arises when considering wetland health - the Ramsar classification, whether widely accepted or not, is too coarse for the classifications that have been used in many ecosystem health assessments for wetlands. This is an important point that could be overcome with the adoption of a more systematic and multiple-tier classification; to date this has not been achieved, although there have been proposals to adopt multiple-level classification based on scale-related core data (Finlayson *et al.* 2002).

7.6. Wetland Condition and Pressures

As mentioned above, the Ramsar Convention has redefined ecological character to include ecosystem services - a significant move with consequences for conservation planning and management that may not be fully realised. This has resulted in a situation whereby to maintain the ecological character of a wetland we need to maintain the ecosystem services, including the products that people use in a direct sense - the complexity being that the use of wetlands can change in response to social and economic reasons, both local and external. Under these circumstances we need to accept that changes in use/amenity of wetlands will occur and could result in a change in ecological character and a change in the health of the wetland.

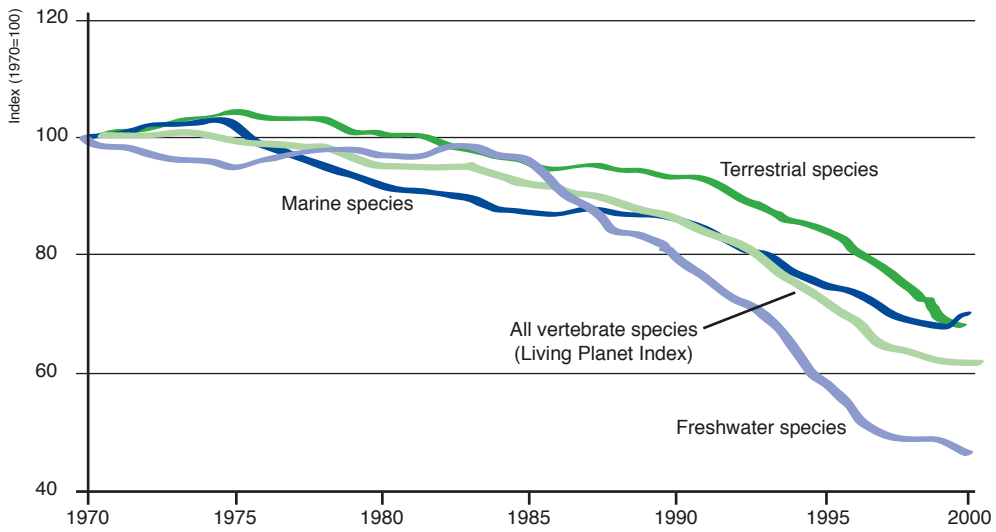
Figure 7.3. Transformation of the lower Jordan river basin from 1950 (A) to the 2000s (B) (from Courcier *et al.* 2005).



The Millennium Ecosystem Assessment (2003) has outlined the extent of change in wetlands globally with some spectacular large examples, such as the Everglades, the Aral Sea and the Mekong delta, as well as many smaller, but still significant examples (Finlayson *et al*. 2005a). To a large extent wetland health has been undermined by water and agricultural management including transformation and conversion, pollution and eutrophication, and disrupted water regimes. While changes in land cover and land use to accommodate expanding agriculture have had many beneficial outcomes for many people, the failure to tackle the loss and degradation of wetland ecosystems and their species, such as that caused by the development of agriculture and water resources, could undermine progress toward achieving the human health and poverty components of the Millennium Development Goals (Finlayson *et al*. 2005a). The first United Nations World Water Development Report noted that a healthy and unpolluted natural environment was essential for human well-being and sustainable development, and further stressed that wetland (aquatic) ecosystems and their dependent species provided a valuable and irreplaceable resource base that helped to meet a multitude of human and ecosystem needs which are essential for poverty alleviation and socio-economic development (UNESCO-WWDR 2006).

The extent of wetland loss and degradation globally is widely recognised but not often supported by quantitative data. More than 50% of specific types of wetlands in parts of North America, Europe, Australia and New Zealand were lost during the twentieth century, but extrapolation of this estimate to other areas is fraught with inaccuracy and can only be seen as speculation

Figure 7.4. Trends in freshwater, marine and terrestrial species: Living Planet Index, 1970-2000 (from Loh and Wackernagel 2004).



Note: The index incorporates data on the abundance of 555 terrestrial species, 323 freshwater species, and 267 marine species around the world. While the index fell by some 40% between 1970 and 2000, the terrestrial index fell by about 30%, the freshwater index by about 50%, and the marine index by about 30%.

Table 7.1. Status and trends of major groups of wetland-dependent species.

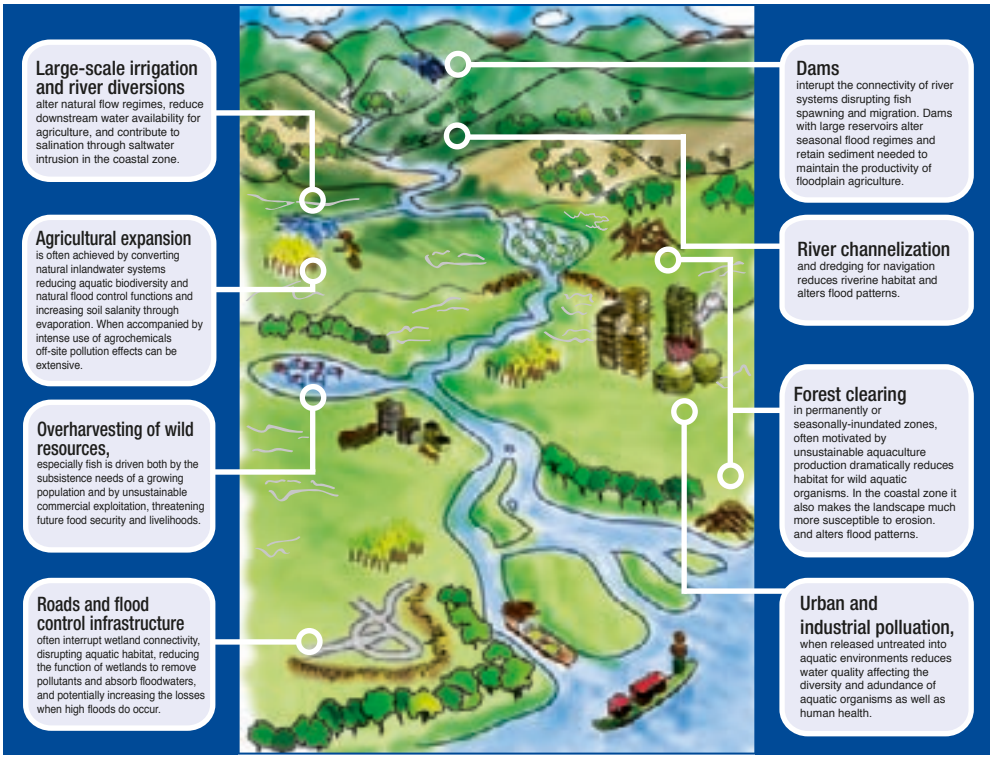
Species group	Status and Trends
Waterbirds	Forty-one per cent of the 1138 biogeographic populations of 868 waterbird species of known trend are in decline. Of the 964 bird species that are predominantly wetland-dependent, 203 (21%) are extinct or globally threatened, with higher percentages of species dependent on coastal wetlands being globally threatened than are those dependent only on inland wetlands. The status of globally-threatened birds dependent on freshwater wetlands and, to an even greater extent, the status of coastal seabirds, have deteriorated faster since 1988 than has the status of birds dependent on terrestrial ecosystems.
Mammals	Over one third of the freshwater-dependent species that were assessed for the IUCN Red List are globally threatened; these include groups such as manatees, river dolphins and porpoises, in which all species assessed are listed as threatened. Almost a quarter of all seals, sea lions and walruses are listed as threatened.
Freshwater fish	Approximately 20% of the world's 10,000 described freshwater fish species have been listed as threatened, endangered or extinct in the last few decades. In the countries for which assessments are most complete, an average of 17% of freshwater fish species are globally threatened. In addition a few well-documented cases clearly show this level of threat.
Amphibians	Nearly one-third (1856 species) of the world's amphibian species are threatened with extinction, a large proportion of which (964 species) are from freshwater, and especially flowing freshwater, habitats. In addition, the population sizes of at least 43% of all amphibian species are declining, indicating that the number of threatened species can be expected to increase in the future.
Turtles	At least 50% of the 200 species of freshwater turtles have been assessed in the IUCN Red List as globally threatened, and more than 75% of freshwater turtle species in Asia are listed as globally threatened, including 18 that are critically endangered, with one being extinct. All six species of marine turtles that have been assessed that use coastal wetlands for feeding and breeding are listed as threatened.
Crocodiles	Of the 23 species of crocodilians that inhabit a range of wetlands including marshes, swamps, rivers, lagoons and estuaries, four are critically endangered, three endangered and three vulnerable.
Freshwater crustacea and molluscs	The IUCN Red List reports some 275 species of freshwater crustacean and 420 molluscs as globally threatened, although no comprehensive global assessment has been made of all species in these groups. In the USA, where a comprehensive assessment has been made, 50% of crayfish species and two-thirds of freshwater molluscs are at risk of extinction, and at least one in 10 freshwater molluscs are likely to have already gone extinct.
Dragonflies and damselflies	A review of the global threat status of dragonflies and damselflies in 22 regions covering most of the world found relatively high levels of threat. In Australia 4 species are listed as globally threat ened, with 25 species in critical condition and another 30% of species data-deficient. In North America 6% (25 species) are of conservation concern. In the Neo tropics 25 species are globally threatened and a further 45 of high conservation priority, with many others data-deficient.

Adapted from Finlayson *et al.* 2005a

(Finlayson and D'Cruz 2005). Much of the known loss of wetlands occurred in the northern temperate zone during the first half of the twentieth century, whereas many tropical and sub-tropical wetlands, such as swamp forests, have been lost or degraded more recently (Finlayson and D'Cruz 2005). However, there is insufficient information available on the extent of all wetland types, such as inland wetlands that are seasonally or intermittently flooded, and some coastal wetlands, to document the extent of wetland loss globally. At the same time, widely applicable measures of the condition of wetlands are not available for the whole range of wetland types; however, proxy indicators, such as the degree of fragmentation of rivers, have been used to infer the likely condition of at least some wetlands. Rivers in many parts of the world have been severely degraded through water abstractions and regulation of flows (Smakhtin *et al.* 2004; Nilsson *et al.* 2005). This is shown by major changes in many large rivers such as the Colorado, Nile, Yellow/Huang He, Murray-Darling and Jordan. The latter is well illustrated in the analyses provided in Figure 7.3 (Courcier *et al*. 2005).

In contrast to the situation with wetland ecosystems there is an increasing amount of evidence showing a continuing widespread decline in many populations of wetland-dependent species, including molluscs, amphibians, fish, waterbirds and some

Figure 7.5. Pictorial representation of the direct drivers of change in wetlands. Invasive species, climate change and land conversion affect all components of the catchment and coastal zone and are not represented pictorially (from Finlayson and D'Cruz 2005).



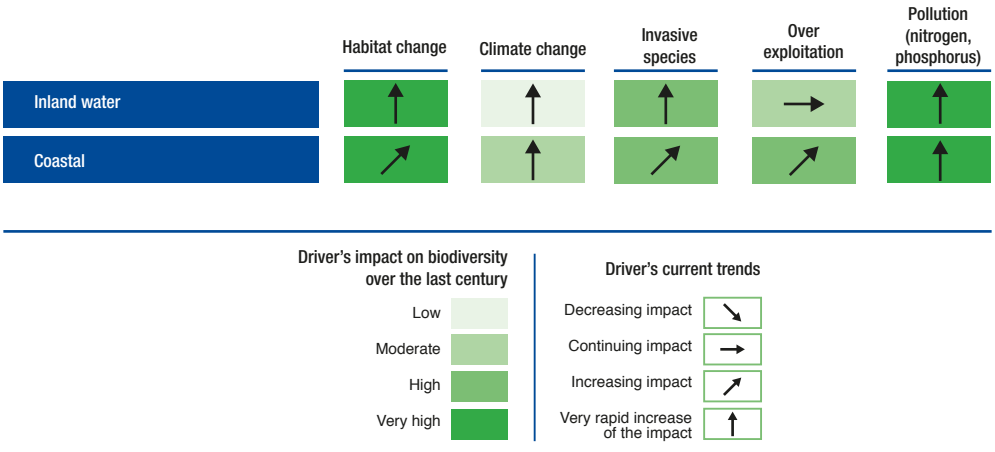
mammals (Finlayson and D'Cruz 2005). The Living Planet Index (Figure 7.4), an index of the trend in vertebrate species populations, shows a continuous decline in freshwater vertebrate populations since 1970 - with the decline being more drastic than that for terrestrial or marine species (Loh and Wackernagel 2004). A summary of information on the status of wetland species is shown in Table 7.1.
A pictorial representation of some of the direct drivers of change in inland and coastal wetlands is shown in Figure 7.5. Invasive species, climate change and land conversion to urban or suburban areas affect all components of the catchment and coastal zone, and are not represented pictorially.

A pictorial summary of the impact of each of the main drivers of change in wetlands over the past 50-100 years is shown in Figure 7.6. The intensity of impact is shown by colours - high impact meaning that the particular driver has significantly altered the biodiversity, and low impact indicating that it has had little influence. Arrows are used to indicate the trend in the drivers.

The information in Figure 7.6 is based on expert opinion consistent with and based on the analysis of drivers of change in the Millennium Ecosystem Assessment and summarised for wetlands in Finlayson *et al*. (2005a).

There is increasing evidence that wetland degradation is having adverse impacts on agriculture and fisheries in many parts of the world as well as causing a loss of regulating services such as storm protection and nutrient retention and cultural services such as recreational and aesthetic uses (Falkenmark *et al*. 2007). In some cases wetlands have passed thresholds or gone through regime shifts leading to a collapse of ecosystem services, making the costs of restoration (if possible at all) very high, with adverse effects on livelihoods, health and economic production (Falkenmark *et al.* 2007). This has resulted in ongoing debate on whether the positive outcomes in terms of increased upstream production of food outweigh the negative consequences for people dependent on downstream ecosystem services.

Figure 7.6. Main direct drivers of change in wetland systems. The cell colour indicates the impact of each driver on biodiversity in wetlands over the past 50-100 years; the arrows indicate the trend in the driver (from Millennium Ecosystem Assessment 2005).



7.7. Global trends and wetlands

The pressure on wetlands from agriculture and water regulation is now seen as a double-edged sword - there have been many benefits for people, and human health has been enhanced in many instances through better nutrition and diets and access to clean water, but in many places this has come at a cost (Falkenmark *et al.* 2007; Molden *et al.* 2007). Despite advances in food supply and water management there is a pending water supply crisis due to the mismanagement of water resources. About 2.8 billion people, more than 40% of the world's population, live in river basins where water scarcity is a real issue. More than half of these people face economic water scarcity where human, institutional and financial capital limit access to water for basic human needs. Others face physical water scarcity in river basins where water resources development has exceeded sustainable limits and environmental degradation and competition for water occur. While it is possible with good management to treat the symptoms of water scarcity, the reality is that many people face many difficulties and poverty and under-nourishment persist (Molden *et al.* 2007).

Similarly, while food production has outpaced population growth globally and food prices have generally declined, poverty and malnutrition persist in many regions including Asia, Sub-Saharan Africa and parts of Latin America; the benefits of the gains made in agriculture have been unequally distributed. Molden *et al*. (2007) have provided a summary of the poverty statistics: more than 1 billion people live below the $1 a day poverty line; 1.5 billion people live on between $1 and $2 a day; the majority of people living in abject poverty are women and children; in 2004 1.1 billion people had no access to clean water and 2.6 billion people had no access to improved sanitation; 850 million people are undernourished, 815 million of them in developing countries, representing 17% of the population of these countries. Many poor people either do not produce sufficient food for their own consumption or do not earn enough to buy the food they need, and they are vulnerable to changes in water quantity, quality and timing brought about by increased competition, climate change, floods and droughts, and loss of access to ecosystem services.

Global climate change is expected to exacerbate the poverty and health issues as well as the extent of wetland degradation, as outlined above. The impact of increasing temperature and changing weather patterns on water resources and wetlands has been outlined in the recent reports of the IPCC (2007). It is not known whether adaptation to climate change impacts on agriculture will at the same time exacerbate poverty and human well-being or place further pressure on wetlands and the ecosystem services that they provide. It is anticipated, though, that many wetland species will be affected by changing weather patterns, flooding and drying cycles, and/or sea level rise (Finlayson *et al*. 2006). It is further contended that with increased population pressures and demands for food/water ecosystem services provided by wetlands will be under further pressure both directly and indirectly. This will undoubtedly lead to further health issues if people lose access to wetland products and freshwater, as well as to wider erosion of human well-being. The key to safeguarding and improving human well-being and health lies with adaptation at different scales, locally and across and between landscapes, and could include restoration as a way of reversing past actions that have degraded wetlands and fragmented many landscapes, including riverine and coastal zones.

Based on the analyses contained within the Millennium Ecosystem Assessment (2003) and furthered by the World Water Development Report (UNESCO-WWAP 2006) and Global Environment Outlook

(UNEP 2007) it is not unreasonable to conclude that in the face of ongoing changes in land cover/use the biodiversity approach to conservation has not been able to halt, yet alone reverse at a global scale, the degradation and loss of wetland ecosystems and their species. Whilst there has been an increased emphasis on ecosystem services alongside biodiversity conservation there is insufficient evidence to show that this has or will provide a different outcome. The reasons for this are many, but one seems to warrant far more attention than it has received from many wetland-related sectors: namely, changes in institutions and policies that govern and affect wetland management are needed. To borrow from the agricultural water sector (Merrey 2007), it may be necessary to *reform the reform processes* that do not seem to have succeeded in integrating wetland values and wise use into mainstream land and water management.

There have been many calls for institutional and policy reform through the Ramsar Convention on Wetlands and associated fora (e.g. Hollis 1984, 1992). Yet under existing policy (and policy reform processes) poverty, hunger, gender inequality and wetland degradation continue - this begs a question about whether or not more effort should be directed towards political and institutional failings rather than to technical shortcomings in addressing these issues. Policies such as Integrated Water Resource Management have been proposed and accepted, but may be unachievable (e.g. Molle 2006), and parties to the Ramsar Convention have agreed to the wise use of all wetlands and to implement national wetland policies; is a different approach needed?

7.8. Conclusions

A key outcome from many analyses of wetland conservation and management is the lack of global progress in conserving wetlands and ensuring that valuable ecosystem services are sustained. Past calls to not only stop but also reverse the loss of wetlands globally have not been widely heeded. As a consequence the well-being and health of many people have been adversely affected. Based on recent evidence it is doubted that this realisation is sufficient to change the way we think about and manage wetlands and agriculture and water. The water and agriculture sector has identified a range of responses that could provide some relief from the relenting pressures on wetlands - these are listed below, but it is doubted that without substantial institutional change the intended outcomes can be achieved.....

There is a range of management options for water and agriculture:

- Get water to poor people; use it better;
- Increase water productivity and upgrade rainfed agriculture - reduce the impact of agriculture;
- Adapt yesterday's irrigation for tomorrow's needs;
- Invest in wider ecosystem services from agriculture - manage for diversity; and
- Make the difficult choices - relative importance of agriculture, dams, fisheries

There are a number of responses recommended, but as many of them have been stated in other documents the emphasis is on finding those that best suit the circumstances, or on adapting them as circumstances develop. These include:

- Integrated planning mechanisms, e.g. IWRM, ICM
- Strategic and environmental impact assessment
- Risk and vulnerability assessment
- Education and awareness
- Economic incentives and removal of perverse incentives
- Economic valuation and participatory approaches to trade-offs
- Rehabilitation of degraded ecosystems and re-establishment of the benefits they supplied

The smartest response, though, may be to prevent further adverse change rather than expect to recover what has been lost at some later stage of development; that is, the *'economic before environment'* approach is not appropriate and is likely to exacerbate wetland management and undermine efforts to support human well-being and health. This requires an overt recognition that environmental degradation is running down a finite resource base, and wetlands should be treated as a shared resource with high value for people. Further, it needs to be recognised that in many places agriculture is being undermined by the degradation of wetlands - data are lacking for many areas but there is other evidence - the evidence of the obvious and the well-being and health of people who most directly depend on these services and ecosystems.

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8. Wetlands and Sanitation - A View from Africa

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Abstract

Despite being landlocked, Mali has an extensive and variable range of wetlands that are critical to the country's economy and the livelihoods, well-being and health of the rural people. The paper details the types of wetlands in Mali and the environmental services they provide and describes the ongoing degradation of and multiple threats to the wetland systems. Malian wetland dwellers face a range of serious water-related diseases, common to other African nations, which the government is addressing as a national priority. Government actions include approving a national wetlands policy and defining the roles of the state bodies, implementing a Water Code with formal basin committees and engaging in a number of major infrastructure projects.

Key Words: Mali, wetlands, waterborne disease, health, sanitation

8.1. Wetlands

8.1.1. The status of wetlands

Wetlands, as multifunctional ecosystems, provide many resources to the communities exploiting them. Thus the valleys of Rivers Niger and Senegal, the numerous lakes and ponds, and the Selingue, Markala and Manantali dam reservoirs are of critical importance for all the sub-regions of the country (Bamako, Kayes, Koulikoro, Sikasso, Segou, Mopti, Timbuktu, Gao and Kidal) and for Mali as a whole. These wetlands contribute partially to the attainment of the major development objectives of the country, that is to say:

- Food self-sufficiency
- The fight against desertification
- Water control
- Opening up of inner cities

There are several wetlands in the sub-region, despite its being landlocked and, above all, despite the fact that it belongs to climactic areas largely characterised by great aridity, notably the Sahel and Sahara. These wetlands may be classified in four main groups, spread across the different agro-ecological areas and natural regions of the country and with special characteristics according to their geographical situation. They include river basins, lacustrine ecosystems, wet ecosystems of waddies, and oases.

River basins and floodplains
The basins of the Rivers Niger, Senegal and Volta play a key role in the conservation of biodiversity and in the economy of the area thanks to their vast floodplains, which provide for the agricultural and pastoral activities of the riparian and foreign (incomer) communities.

Lacustrine ecosystems
Mali has a number of key lakes, nearly 100 which have been identified on the basis of an inventory made by IUCN in 1995 (IUCN 1995). Most of these lakes are located in the Timbuktu, Mopti, Kayes, Segou and Koulikoro Regions.

Pond ecosystems
The country includes 200 ponds (DNHE 2004); more than two-thirds of the ponds are unsustainable, and they often cover very small areas. Most of the ponds are located in the Gao and Timbuktu Regions, especially in the Gourma.

Wet ecosystems of waddies and oases
The desert regions of Mali were covered 10,000 years ago by landscapes similar to those of the Sahel today. Thus, the southern part of the Sahara had several drainage networks, notably:

- The Araouane basin in the Timbuktu Region, which was connected to the River Niger in Timbuktu with an Inner Delta of 50,000 km^2
- The Tilemsi valley, flowing from the Iforas Massif into the Niger in Gao
- The Azaouak basin, which is the largest drainage network of the Sahara.

The waddies and oases are currently located in the Saharan part of the regions of Gao and Kidal in the Tamesna and Tilemsi valleys (IUCN 1995).

8.1.2. The pressures on wetlands for self-sufficiency in food

The history and culture of Mali intermingle largely with those of the basins of the Niger and Senegal Rivers. Indeed, most of the great empires and kingdoms of Mali were founded in wetlands, notably: the Empire of Ouagadougou, and the Kingdom of Kaarta in the Senegal valley, the Empire of Mali, the Bambara Kingdom of Segou, the Peul Empire of Macina in the Inner Niger Delta and finally the Songhay Empire of Gao in the Niger Loop. The capital cities of most of these empires and kingdoms were located in

river cities: Niani, Segou, Macina and Gao. Wetlands are the main agricultural areas of the sub-region and are also the fall-back areas for most of the livestock during the dry season, when large zones are covered by abundant vegetation (bourgou pastures). In addition to agro-pastoral activities, forestry and fishing are also practised there. Wetlands are also the focus of local and foreign populations because of the presence of dams and gold mines. The great cultural value of these wetlands makes them one of the major tourist areas for the country.

Agricultural activities
Agriculture is practised mainly in the basins of the main rivers, the Niger, Senegal and Sourou. Thanks to reservoir dams built on the Rivers Niger and Senegal, huge agricultural areas have been developed. The building of these dams has promoted the agricultural development of 55,000 ha in Selingue and 180,000 ha in the Office du Niger in the Segou region out of a potential of 1,105,000 ha of irrigable land. Huge areas of land have also been developed in Senegal, Mauritania and Mali thanks to the Manantali dam.

The region of Sikasso in the Sudan-Guinea area abounds in hydro-agricultural potential. It covers 6017 ha of developed plains out of a potential area of lowlands estimated at 37,428 ha (CMDT 1991-2004). Numerous lowlands are favourable for cotton farming and the production of food crops.

Lakes, notably the Horo, are subject to large agricultural development in addition to their pastoral and fish-farming functions.

Pastoral activities
Wetlands, notably the river valleys and their tributaries, serve as fall-back areas for most of the livestock of Mali during the dry season, when large areas are covered by abundant vegetation (bourgou pastures). The importance of these pastures depends on the level and duration of the rise in water level.

The Senegal basin supports the animals of the Kayes region and also those of neighbouring countries, such as Mauritania and Senegal. During the dry season, when water levels fall, the animals move down the river bed to the south, at the end of the harvest. They stay there until the rainy season begins in the southern agricultural regions and then start moving back towards the river and other wetlands (ponds and lakes).

In the Niger basin cattle-raising is also based on the exploitation of natural pastures and gleanings left from the harvest.

Cattle-raising in the Sahelian areas of the floodplains of the Niger Delta and the Office du Niger and in lacustrine areas is based on the mobility of animals; this transhumance lasts for a longer or shorter period depending on when the flood recedes and on the beginning and duration of the rainy season. The dominant grasses and shrubs are those of Sahelian and Sahelian-Saharan ecosystems. Cattle-raising associated with the crops and pastures of flood areas is practised in the floodplains of the Vif Delta and in lacustrine areas. The Office du Niger, with its irrigation system, generates huge quantities of rice straw and agro-industrial by-products.

Thus, these bourgou pastures attract thousands of cattle every year. After the water levels fall, 5 million head of cattle invade the delta, particularly its bourgou pastures, in search of forage without which the delta livestock would not survive during the dry season (IUCN 2002).

Fishing
Fishing is practised in various places, but its main centres are the dam reservoirs (Selingue and Manantali) and the Inner Niger Delta, where production varies between 40,000 tonnes per annum during the dry season, as in 1984, and more than 100,000 tonnes during an average year (1994) or wet

year (1970), generating an additional 30,000 jobs. The gross total value of the fishing production in Mali is estimated at 30 billion Communauté Financière Africaine (CFA) francs (Ministère du Développement Rural et de l'Environnement 1997). The Niger is very rich in fish; Daget (1954) recorded 138 species and subspecies, the most important species in the Delta being from the genera Alestes, Synodontis, Hydrocyon, Tilapia, Labeo, Bagrus, Mormyrus, Citharinus etc. The fisher communities spread out across the different basins according to the rise and fall in the water levels, often creating cohabitation problems with the native population and sometimes with neighbouring countries (e.g. during the 1986 war between Mali and Burkina Faso).

The lacustrine ecosystems are also great areas for fish farming, the Goundam area producing more than 15,000 tonnes of fish a year (Mahalmoudou 1992).

Tourism
Tourism is well developed in the river basins. Several tourist sites are located there, notably in the Inner Niger Delta in the region of Mopti and the Niger Loop in Gao. In the Senegal basin the Felou and Gouina Falls and the Manantali dam are sites that are very appropriate for ecotourism. There are also arts and craft centres in the oases.

8.1.3. Major impacts on wetlands and main issues

In Mali, the impacts of anthropogenic factors such as the demographic boom, the discharge of pollutants and the production techniques associated with natural impacts such as drought and the decline in rainfall have led to a significant imbalance in the basins of the main rivers. Among the various environmental and management problems currently affecting wetlands are:

- Soil erosion
- Sand siltation
- Recurrent drought leading to a dramatic decline in fishing resources
- Deforestation
- Reduction in the water runoff feeding wetlands
- Overgrazing
- Proliferation of invasive water plants
- Unsustainable use of lands and waters
- Waterborne diseases

Thornes (1994) quoted by Mainguet (1995) summarises the hydrological constraints of Saharan wet ecosystems in seven points:

- There is erratic, high intensity precipitation with a low annual total, with irregular start to the rainy season and high variation between years.
- The rain falls on partially bare soils leading to a compacting of these soils which affects absorption and thus accelerates evaporation.
- Infiltration depends largely on the nature of the substrate.
- Losses through evaporation are caused by the presence of water in the soils, the pedogenetical profiles and atmospheric conditions.
- Flooding resulting from storms occurs on very rough soils.
- River flows are short-lived causing a loss of alluvial soils.
- Groundwaters follow the same rules as in temperate ecosystems, however the role of flows in the aquifers is increased.

Desiccation, sand siltation and salinisation are the main causes of degradation of oases, and of changes they are undergoing.

Recent studies (Mahé *et al*. 2000) have shown that 59% of the most important contribution in the Inner Niger Delta comprises water penetrating from the Niger and the Bani, while rainfall in the delta contributes another 41% to the total flow.

The reduction in the total flow noticed in recent years is probably linked to the low flows of the Bani and the Niger. This phenomenon might be related to the decrease in the volume of groundwater following the droughts of the 1970s and 1980s (Mahé *et al.* 2002).

The reduction in flow reduces the flood areas, causing significant losses, which affect, above all, the potential of the cultivable areas.

In the northern regions, the River Niger is subject to the strong impacts of shifting sand bars. The degradation of

Tabel 8.1. Prevalence of diarrhoea in Mali.

Socio-demographic characteristic	Diarrhoea reported in the two weeks preceding the survey (percentage of total)
Children	
< 6 months	13.9
6-11 months	28.6
1-2 yrs	26.8
2-3 yrs	21.3
3-4 yrs	13.3
4-5 yrs	0.94
Male children affected	19.3
Female children affected	17.8
All patients	
Prevalence in urban areas	13.1
Prevalence in rural areas	20.3
Level of education	
None	18.8
Primary	18.0
Secondary or over	16.0
Hand-washing facilities available in the household	
Water/tap	17.9
Soap, ash or other detergents	16.5
Basins	18.4
All three	18.1
No facilities	19.3
Water source	
Tap	14.0
Protected well	19.0
Unprotected well	20.0
Backwater	26.9
Others/NA	25.6

Source: Ministère Chargée de la Statistique 2001

Table 8.2. Prevalence in Mali of active trachoma among children under 10 years of age in 1996.

Region	Follicular trachoma (TF) (%)	Intense trachoma (TI) (%)
Gao-Kidal	46.2	8.5
Kayes	42.5	5.9
Koulikoro	33.5	1.5
Mopti	44.1	7.2
Segou	23.1	0.3
Sikasso	31.7	4.9
Timbuktu	31.7	5.9
Mean	36.11	4.88

Source: INRSP 2003

the environment has had a considerably impact on the environment of urban and rural populations: they are now suffering from sandstorms, the disappearance of the vegetation around cities and villages, sand siltation of streams, roads, farming land and housing, and difficulties with water supplies and the acquisition of firewood.

The collapse of banks and the silting up of streams, which are a consequence of the degradation of watersheds, have strongly reduced the functions and values of wetlands.

According to Zwarts *et al.* (2005), the impact of irrigation and the Selingue reservoir have brought about a reduction of the maximum flood area of 600 km^2 in the Inner Niger Delta. The Office du Niger is likely to suffer an additional reduction of 300 km^2.

Since 1987 the bird populations have not changed markedly in the great ecological areas of the Delta. However, their numbers depend on the level of flooding, hence the intra and inter-seasonal variations in the numbers recorded.

According to Wymenga *et al*. (2002), the main distribution areas of migratory birds are as follows:

- Goudam: Horo, Fati and Télé (strong concentration) Lakes

Table 8.3: Prevalence of *S. haematobium* in Mali by age group and area.

Area	0-6 years %	7-14 years %	15-24 years %	>= 25 years %	Average prevalence (%)
Office du Niger	65.5	83.5	69.7	45.6	66.00
Baguineda	15.7	45.1	40.0	17.2	29.80
Dogon Plateau	42.3	73.4	68.1	38.3	55.52
Along the River Senegal	63.3	81.6	70.1	39.3	63.57
Along the River Niger	30.9	70.8	46.0	24.1	42.95
Selingue dam	18.0	22.9	27.0	32.7	25.15
Manantali dam	20.9	35.1	32.1	10.1	24.55
Bamako (capital city)	23.7	50.5	42.6	23.6	35.10

Source: INRSP 1996

- Léré and Niafunké: Tanda, Kabara and Takadji Lakes
- Gouma and Bambara Maoudé: Niangaye, Aougoudou Lakes etc.
- Youvarou: Debo/Korientzé Lakes (strong concentration)
- Djénné: Diaka and Pondori arm
- Toguéré coumbé: Seri Plains (strong concentration)

The most harmful invasive plant species in Mali are the Water Hyacinth *Eichhornia crassipes* and the water fern *Salvinia Salvinia molesta.* There are also other less invasive species such as Cattail *Typha australis*, Water Lettuce *Pistia stratiotes* and Mimosa *Mimosa pigra*.

The main problems caused by invading species include:

- Loss of water through evapotranspiration
- Blocking of the river, and increase in sedimentation
- Obstruction of navigation
- Disturbance to fishing activities
- Change in the physical and chemical properties of the water and environment
- Threat to agricultural production
- Proliferation of water organisms, disease vectors

Water Hyacinth occurs predominantly in the River Niger, in the irrigation channels in Baguineda and in Sukala, Dougabougou and Kabala. Downstream, the infestation is more extensive, stretching from Bamako to Macina, a distance of some 350 km along the river.

Salvinia was reported in 2000 on the right bank of the River Niger in Bamako. The infestation extended to the irrigation channels of the Office of the Irrigated Perimeter of Baguineda, the banks of the Niger in Segou, upstream of the Markala Dam, the irrigation channel of the Rice Office of Segou, the Thio ship canal and the supply channel of the Office du Niger. Mimosa has considerably reduced the areas of bourgou pastures in the Inner Niger Delta.

The current method of combating invasive species physically is effective only temporarily, as re-infestation occurs rapidly when uncollected plants regenerate.

8.2. Health and Sanitation

Water-related diseases are numerous and cause a high number of deaths every year. In Mali, these diseases include malaria, diarrhoea, schistosomiasis, methemoglobinemy and filarian diseases such as onchocerciasis.

The main causes of mortality and morbidity in children under five years of age are:

Malaria: According to the National Public Hygiene Plan 1997-2001 (INRSP 1996), fevers presumed to be malaria were the main reason for medical consultations in

Table 8.4. Prevalence rate of *S. mansoni* by age group in three regions of Mali.

Area	0-6 years %	7-14 years %	15-24 years %	>= 25 years %	Average prevalence (%)
Office du Niger	42.5	61.3	53.3	46.5	50.90
Baguineda	1.5	41.5	45.2	24.0	28.05
Plateau Dogon	27.4	36.4	45.6	31.2	35.15

Source: INRSP 1996

Mali. This disease is the main cause of general morbidity and mortality among children under five years of age. Malaria is the reason for 34% of medical consultations; 34% of consultations among the children under one year of age and 39% among children under four years of age.

Among children aged 0-5 years, 80-90% may carry the malaria parasite during the rainy season, according to area; mortality due to malaria is high within this very vulnerable target group. Malaria is the main cause of morbidity and mortality in this segment of the population, with a mortality rate of 16-25% in hospitalised cases.

According to the Rapport d'Enquête Démographique et de Santé du Mali (EDSM III) (Ministère Chargée de la Statistique 2001), 54.4% of households possess an impregnated bed net and 68.4% of children sleep under a bed net. The regions of Sikasso (25.8%) and Koulikoro (39.6%) record the lowest rates in the possession of bed nets but the highest usage rate by children. However, in the Gao region 90.2% of households have bed nets and they are used by 78.5% of the children.

Diarrhoea: 19% of children under five years of age had been affected by diarrhoea in the two weeks preceding the EDSM III survey (Ministère Chargée de la Statistique 2001). Diarrhoea prevalence is particularly high among children aged 6-11 months (29%), children in the rural area (20%) and children in the Kidal, Gao and Timbuktu regions (28%) (see Table 8.1).

Access to drinking water has had an impact on the prevalence of diarrhoea; only 14% of children living in households with access to tap water contracted diarrhoea compared to 27% of children living in households using water from backwaters (Government of Mali 2002).

The country was particularly affected by outbreaks of cholera during the years 1971, 1985, 1986, 1991, 1995, 1998, 2001, 2002, 2003 and 2004. In 2003, 1437 cases of cholera were recorded, including 484 for children under 15, with 33 deaths and a mortality rate of 6.8%.

8.2.1. Other diseases related to water and poor environmental conditions

Guinea worm: Guinea worm is still rampant in the regions of Mopti, Timbuktu and Gao, with more than 829 cases in 2003. Thirty-nine cases of guinea worm were recorded for children aged between birth and four years, and 256 among children aged between five and 14.

Trachoma: The main findings of a survey on trachoma prevalence carried out in the seven administrative regions of Mali in 1996 and 1997 by the Institut National de Recherche en Santé Publique (INRSP), Ministère de la Santé, Affaires Sociales et Population (INRSP 2003) (see Table 2) were:

- The prevalence of active trachoma (follicular [TF] or intense [TI]) among under-10s: 34.9%.
- The prevalence of intense trachoma (TI) among the same children: 4.2%.
- More than one million children are carriers of active trachoma and should benefit from local or general antibiotic treatment.
- More than 85,000 adults require surgery aimed at correcting trichiasis so that they do not lose their sight.

Lymphatic filariosis (LF): A survey carried out in 2002 by the INRSP (INRSP 2003) showed that LF is still endemic in Mali. The global prevalence rate is high, at 7.07%. Despite its size and seriousness, no preventive action and combative measures are being undertaken to reduce the problem.

To address this situation, the Ministère de la Santé, Affaires Sociales et Population has designated the fight against LF as a priority. Mali has developed a national plan for the elimination of LF, which is part of the global framework for the integrated fight against the disease. Other filarian diseases, such as onchocerciaris, are rampant in Mali.

Schistosomiasis: From 1984 to 1994 studies were carried out by the INRSP (INRSP 1996) over the whole country that showed that *S. haematobium* is the most widespread of the schistosomiases. It is estimated that 2.5 million people are infested, i.e. one in four of the population. The areas where the disease has the strongest hold are Kayes, Koulikoro, Segou, Mopti and the district of Bamako. In these regions, areas of agricultural development and settlements situated along streams are the most affected. Children are particularly affected by this disease, as shown in Table 8.3 below.

In the areas where *S. haematobium* prevalence is highest, 93.3% of the villages in the Office du Niger, 85.7% of the villages in the Dogon Plateau, 100% of the riparian villages along the River Senegal and 66.7% of the riparian population of the River Niger have at least 51% of their children infected by *S. haematobium*.

In the regions of Gao and Timbuktu the transmission rate is moderate and limited to camps around ponds. The INRSP studies suggest that urinary bilharziasis is the cause of high morbidity in Mali. According to the same studies, however, even in the areas where prevalence is low, serious damage occurs in the urinary tract of victims. Again, school-age children are the most affected, 50% having vesicle damage and 30% having urethral damage. Fortunately, this damage can be ameliorated by treatment.

There are high rates of infection with *S. mansoni* in areas of the Office du Niger and in Baguineda. More than 50% of the population are affected by *S. mansoni* in 53.3% of the villages of the Office du Niger, and more than 30% of the population in 77.8% of the villages of Baguineda. Bilharziasis with *S. mansoni* does not seem to be a major public health problem. No case of serious hepatoslenic attack has been observed during several studies in the area of the Office du Niger.

8.2.2. Environmental factors that have repercussions on children's health

Access to drinking water and sewage-disposal facilities
According to EDSM III (Ministère Chargée de la Statistique 2001) around 42% of households have access to drinking water, and most of this comes from wells. Water supply facilities are shared by households; the percentage of households having access to water is as follows:

- Open public wells: 37%
- Open private wells: 14%
- Protected public wells: 7%
- Protected wells in courtyards/houses: 7%
- Public taps: 20%

Only 8% of households have running water at home. Around 5% of households draw water from rivers, streams or ponds. According to the National Hydraulic Division (DNHE 2004), 62% of households still lack access to drinking water, well above the African average of 34%.

There are tremendous needs still to be met:

- Nearly 2200 villages, nomad and pastoral sites do not have any modern water point (MWP).
- Nearly 3400 villages do not have enough MWPs to cover all their needs.
- Around 40% of the existing MWPs are more than 15 years of age and are reaching the end of their lives. Many MWPs are boreholes that were sunk in the 1970s and 1980s as part of an

emergency response to drought, and most of them were not constructed properly.
- Nearly 80% of the MWPs have poor-quality water that should not be used for human consumption.
- Nearly one-third of the MWPs are not operational or permanent, and do not constitute an effective drinking water resource for the population because of maintenance problems.

With regard to the disposal of sewage, the situation is characterised by low access to sewage disposal facilities. Sixty-two per cent of households use very basic sanitary facilities and only 10% of facilities comply with hygiene standards (generally, cemented and ventilated: which is considered adequate for sewage disposal). Only one in ten households has a flush toilet, whereas 23% of households do not have a toilet of any kind. Furthermore, it is estimated that in rural areas 30% of households do not have any form of latrine.

These inadequacies in basic services (drinking water supply, sewage disposal) combined with inappropriate behaviours and practices in terms of hygiene are largely at the heart of the high incidence of waterborne diseases: guinea worm, which is still rampant in the Mopti, Timbuktu and Gao regions, with more than 829 cases in 2003; trachoma, with a national prevalence of 34.9% of active trachoma among the under-10s; and diarrhoea, with a prevalence rate of 19% among the under-5s and 29% among children aged 6-11 months. After malaria and acute respiratory infections, these diseases account for the highest number of medical consultations.

Liquid wastes
It is known that there is an insufficiency in both domestic and industrial sewage disposal works. Domestic wastewater is poured into the street, into badly designed gutters and sumps. Barely 8.3% of the population has a cesspool for the disposal of domestic wastewater. The city of Bamako has an embryonic gutter network which serves 1.5% of the population, but there is also a network of an estimated 300 km of drains for the disposal of rainwater. According to estimates, 84% of the population uses makeshift latrines. With regard to the disposal of industrial wastewater, 54% of Mali's industrial units are found in Bamako. Most of these units are not equipped with mechanisms to treat industrial effluents, and wastewater is discharged directly in the River Niger, leading to risks of pollution. The volume of effluents discharged is estimated at 2000 m^3/day.

The wastewater from dyeing units is estimated at 16,000 m^3/day. These informal and income-generating women's activities also contribute to the pollution of the environment; this is exacerbated by the fact that these activities are undertaken in compounds, districts and along the River Niger.

These untreated liquid wastes together with poor drainage of surface water create an unhealthy situation and seriously threaten the environment with the risks of contamination of water resources, soils and the air, and also risks for the health of the population, particularly children.

8.2.3. Responses to the challenges of wetland management

It seems clear that one of the major challenges to be met by national wetland policies is to reconcile conservation and socio-economic development: to maintain wetlands in their natural state would be difficult, given the expectations of the public.

The wise use of land and water must be part and parcel of any national policy for socio-sanitary economic development, and for the management of natural resources. Close international collaboration

Table 8.5. Volumes of wastewater produced per day and per annum by industrial units in Mali.

Sector	Industry	Volume (m^3/day)	Volume (m^3/year)	Main types of pollutants
Textiles	ITEMA (Industrie des Textiles du Mali	1,440	5,250,600	Alkaline waste, combined oils and greases, sulphates, colourants, suspended solids
Slaughterhouses	Refrigerated slaughterhouse in Bamako	300	109,500	Biochemical Oxygen Demand (BOD), suspended solids, oils and greases
Tannery	Tamali	150	54,750	Acid waste, alkalis, MES, chlorides, sulphides, chromium
Agro-business	Mali-lait	60	25,550	Oils and greases, biological matter, acid waste, hypochlorite
	Sada	10		
	Diallo Plant			
Pharmaceutical industries	UMPP (Usine Malienne des Produits Pharmaceutiques)	30	12,045	BOD, suspended solids
	Perfume	3		
Wastewater from cooling systems	TOLMALI (Tôles du Mali)	6	4,653.75	Nicotine, phosphorus, colorant metals, sulphides
	SONATAM (Société Nationale de Tabacs et Allumettes du Mali)	5		
	Paint manufacture	1.75		
Chemical industries	SOMAPIL	0.4	438	Acid discharges, sulphides, metals (Zn, Hg, Mn)
	Battery manufacture	0.8		
Domestic wastewater	SOMEPAC	5.2	1,898	Metals, sulphides, floating materials, colourants
Total			5,447,554.75	

is also required between governments and institutions. In Mali, national policy is to build, as a reference framework, on the Strategic Framework for Growth and Poverty Reduction and the Millennium Development Goals, as well as on the transboundary character of river basins. This requires a global vision and coordinated action for the sustainable management of wetlands.

Mindful of the problems involved in the management of wetlands and their resources and of the principles of international law and international commitments, the Republic of Mali is a member of the following sub-regional organisations and programmes:

- The Organization for the Development of the River Senegal (Organisation de Mise en Valeur du Sénégal - OMVS), since 1972;
- The Niger Basin Authority (NBA), since 1980;
- The Authority for the Integrated Development of the Region of Liptako Gourma (Autorité du Liptako Gourma - ALG), since 1970.

In addition, bilateral agreements link Mali with Guinea and Niger (in respect of the River Niger and its confluents).

8.3. The Government Action Programme

The Malian government has singled out the following actions:

- For the Senegal River Basin, building infrastructure for the regulation of the river (Manantali dam) and establishment of a national coordination unit for development activities related to the river.
- For the Niger River Basin, Mali has created the Agency for the River Niger Basin (ARNB) by Decree N°02 - 049/P-RM of 29 March 2002, with the mission to safeguard the River Niger, its confluents and watersheds and the integrated management of its resources, pursuant to the Water Code. A consultation and coordination body named the Committee of the Upper River Niger Basin was created by inter-ministerial decree N°02 - 878/MMEE/MATCL of 04 September 2002.
- For the Volta River Basin, Mali participates in recent initiatives such as the FEM - PDF/B project, Integrated Management of the Volta River Basin.

Mali has created a Water Code, with basin or sub-basin committees that are commissioned to ensure the coordinated management of the resources of the basin or sub-basin. A National Wetlands Policy was developed in 2003; it defines Mali's long-term vision for the management of wet ecosystems. Its Action Plan, whose implementation covers the period 2004-2008, will be supported by national, regional and local programmes.

Mali has also defined the roles of the state bodies in charge of the management of water resources: the National Hydraulic Division, Niger River Basin Agency, National Meteorology Division, National Rural Development Division, National Fishing Division, National Nature Conservation Division, National Agriculture Division etc.

In addition, a number of major projects or programmes are underway, notably:

- GIRE (Gestion Intégrée des Ressources en Eau: Component of the PNIR = Programme National d'Infrastructure Rurale): Project for the Integrated Management of Water Resources
- GIRENS (Gestion Intégrée des Ressources en Eau du Niger Supérieur) Programme: Integrated Management of Water Resources in the Upper Niger
- Hydro-ecological management of the Upper Niger (Gestion Hydrologique des

Eaux du Niger Supérieur - GHENIS) Programme, which is a sub-regional programme (Guinea, Mali) supported by the Netherlands
- Project to combat sand siltation of the River Niger in the regions of Timbuktu and Gao
- Implementation of a project to combat invasive plants

In the legislative and regulatory field, Mali has signed and ratified several conventions, agreements and treaties on the sustainable management of wetlands and water resources in general. Among these are the Ramsar Convention, Convention on Biological Diversity (CDB), United Nations Convention to Combat Desertification (UNCCD) etc.

Decentralisation legislation, which makes local governments accountable in their areas of responsibility, has promoted the establishment of local resource management tools for wetlands. The local governments are supported in this respect by national or international NGOs operating in this field.

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9. The Rational Allocation of Water Resources in Favour of Ecology and Prioritised Wetlands Conservation

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Abstract

With China's growing population and rapid socioeconomic development wetlands have been reclaimed extensively, and 'ecological water' *has been allocated to meet the fast growing demand of the socioeconomic sectors. Meanwhile extensive discharge of pollutants has resulted in the degradation of water quality. In order to restore wetlands in a scientifically sound way and ensure water security and ecological and environmental safety within entire river basins, human beings need to rationalise the allocation of water resources in favour of ecology and prioritised wetlands conservation, based on a combination of* 'natural and artificial' *factors and the associated wetland processes of wetlands within the basin. First, it is necessary to identify wetland conservation and the need for ecological water as an objective; second, to prioritise the water needs of wetlands by allocating water in favour of wetlands; third, to supervise the allocation of ecological water and perfect a plan for emergency water allocation; fourth, to improve the mechanism for licensing water abstraction and levying water resource fees to ensure that wetland conservation is prioritised*.

Key Words: China, wetland conservation, water resource allocation, ecological water, water resource management

9.1 Introduction

Wetlands are unique ecosystems and one of the most dynamic landscapes on the surface of the earth; they include marshes, peatlands, wet meadows, lakes, rivers, flood basins, estuarine deltas, mudflats, reservoirs, ponds, rice fields, and areas of marine water the depth of which at low tide does not exceed 6 m. Wetlands, forests and oceans are known as three global systems (Mitsch and Gosselink 2000). Wetlands, the *'kidneys of the earth'*, are one of the most important gene pools of the earth's terrestrial habitats and also store important resources for human economic, cultural, scientific and livelihoods needs. Wetlands play an extremely important role in providing ecological services, including regulating floods and climate, pollution control, reduction of soil erosion, environmental beautification, biodiversity conservation and productive assets. The value of ecological services that wetlands provide represents over 50% of the total value provided by all ecosystems. The value of ecological services per unit area created by wetlands is much higher than that of other ecosystems, e.g. 2-7 times higher than tropical rain forest and 45-160 times higher than agricultural ecosystems (Zhai 2007). However, due to global change and intensive human activities the area of global wetlands has shrunk by nearly 50% since 1900. At present wetlands cover only 573 million ha worldwide: 6% of the total terrestrial area. China has also suffered badly from wetland degradation; natural and semi-natural wetlands comprise only 3.77% of the country, well below the world average level of 6% (Marinus 2001). Therefore, in order to realise sustainable development, one of the key propositions is to prioritise wetlands and their scientific restoration by systematically understanding the mechanisms involved in the evolution and degradation of wetland ecology (UNESCO 2002). In 2005 the State Forestry Administration launched the China Nationwide Wetlands Conservation Programme aimed at systematic planning for and management of wetland conservation and restoration.

Water is a core attribute and a key driving factor of ecological evolution. The evolution of water cycles in river basins is driven by both *'natural and artificial'* processes, which have completely changed the hydrological properties of wetlands, thereby causing wetlands and their ecology to evolve (Zalewski and Wagner-Lotkowska 2004). Meanwhile, the change in the hydrochemical and runoff and sedimentation processes associated with the water cycle has altered the water quality and the runoff and sedimentation in wetland areas, resulting in a profound impact on the ecological evolution of wetlands. In this regard, the core of an integrated wetland conservation strategy is to prioritise wetland conservation through the allocation of water resources in favour of wetland ecology by identifying the mechanisms of water cycle functions within river basins that promote the evolution of wetland ecology.

This paper proposes technical methods for prioritising the ecological conservation of wetlands through the allocation of water resources to benefit ecology based on an analysis of the impact of the dual 'natural and artificial' water cycle and associated processes on wetland degradation.

9.2. The Impact of the Dual *'Natural and Artificial'* Water Cycle and Associated Processes on Wetland Degradation

Wetland degradation is a result of the impact of both global change and human activities. In terms of the impact of human activities, there are two aspects: direct reclamation of wetland and its resulting impact on the wetland water cycle and associated processes. With regard to wetland degradation caused by direct reclamation, integrated measures are called

for, the key to which is to consolidate land, including *'conversion of farmland to wetland'* and *'conversion of grassland to wetland'*. The impact of human activities on water cycles in river basins has two aspects: i.e. change of underlying surfaces and human needs for water (social water cycle). With regard to the impact of changes to the water cycle within a river basin on the evolution of wetland ecology, human needs for water have greater impact. This paper highlights the impact of social water cycle processes on wetland degradation (overuse of water upstream, extraction of excessive quantities of underground water, and drainage of wetlands), and discusses the impact of the evolution of hydrochemistry and runoff and sedimentation processes in river basins, associated with the water cycle, on wetland degradation.

9.2.1. Overdevelopment of upstream water resources

For wetlands located in the middle and downstream areas of river basins the water flow in the upper reaches is the key to the evolution of the hydrological regime. For instance, in Xianghai wetland, located in the middle reaches of Huolin River in Nenjang Region, the water from the upper reaches contributes 55.2% of its flow to the wetland (Wang and Zhang 2002). However, with population growth and socioeconomic development the upstream water resources have been developed extensively. Continued reductions in water flows have also accelerated the degradation of other wetlands, typical examples being Baiyangdian wetland and Liaohe River Delta.

Baiyangdian wetland, located in the middle of Hebei Plain, is a part of the Daqing River system, which is formed from eight tributaries. Since 1958 a total of 143 large and medium-sized reservoirs with a total storage capacity of 36×10^8 m^3 have been built in the upper basin to meet the upstream water requirements. With the increasing use of water resources in the upper basin, the inflow to Baiyangdian wetland has declined continuously although precipitation remains unchanged, thus resulting in severe degradation (Table 9.1) (Li *et al*. 2004). The area of Baiyangdian wetland declined from 560 km^2 in the 1950s to 360 km^2 in 2002. Consequently, great changes took place in terms of the population structure and distribution of the aquatic fauna and flora. The area of reeds has also reduced, from 8466.7 ha in 1949, when the People's Republic of China was founded, to 5200 ha in 1964. In 1988, when measures were taken to refill the wetlands, the area and production of reeds gradually increased, although the quality of the reeds declined significantly. In 1958 a total of 129 genera of seven phyla of phytoplankton were recorded in Baiyangdian wetland; in 1975 there were only 92 genera of seven

Table 9.1. Inflow, precipitation and evaporation at Baiyangdian Lake, 1952-2002.

	1952-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2002
Annual average inflow (10^8 m^3)	18.27	17.31	11.43	1.47	8.47	0.65
Annual precipitation for basin (mm)	694.70	582.20	545.00	506.60	504.10	306.40
Annual average evaporation (mm)	1163.50	1250.90	1032.80	972.00	1521.05	1599.47

phyla; in 1993, 104 species of 73 genera were recorded. Regarding birds, in the 1950s 26 species of 19 families of 11 orders were found, but in 1983 the wetland dried out and all the rarer species disappeared. Since 1988, when the wetland was refilled, waterfowl numbers have recovered gradually (Hou and Zhang 2007).

Liaohe River Delta is located in a semi-arid, semi-humid area. In its upper reaches are seven reservoirs with a total storage capacity of 71.9×10^8 m^3, taking 88.8% of the total runoff of water resources from the upper basin. The development of these reservoirs has resulted in reduced inflow to wetlands downstream (Table 9.2). At the same time, the area of ricefields has increased from 6.96×10^4 ha in 1980 to 1.76×10^5 ha in 2000, hence water used for agriculture is reducing the water flow to the reedbeds. Therefore the area of wetlands in the Liaohe River Delta has reduced by 14% - from 3.66×10^5 ha in 1984 to 3.15×10^5 ha in 1997, of which natural wetland has reduced by 10.3% (Wang and Li 2006).

9.2.2. Excessive extraction of underground water

The extraction of excessive quantities of underground water has reduced the water inflow to wetlands and thus caused wetland degradation. For example, one of the main reasons for the wetland degradation in Bashang area in Hebei Province is the extraction of excessive amounts of underground water. The Bashang area of Zhangjiakou City is a water-poor area, where average annual water resources amount to 614 million m^3, surface water available for use is 120 million m^3 and underground water available for extraction is 199 million m^3.

During the 1970s over 10,000 wells were constructed to irrigate maize cultivation, but these wells subsequently fell out of use because the underground water table declined significantly. Since the 1980s a great number of wells have been constructed in order to develop irrigation agriculture: 60,000 to date. The water table has fallen by an average 3-15 m due to the excessive extraction of underground water. In some places the water table has fallen by over 20 m. Before the foundation of the People's Republic of China in 1949 the area of wetlands in Bashang amounted to over 260,000 ha - over 22% of the area, but at present the wetland area is only 161,000 ha - 13.4% of the area. The degradation of wetlands is accelerating year by year; some 30,000 ha of reeds have been reduced to 13,333 ha. Angulinao Lake, located in Zhangbei County and known as the Pearl of Bashang, the largest inland plateau lake in northern China, dried up in autumn 2004, and the 6670 ha water surface became a salt flat (Hou and Zhang 2007).

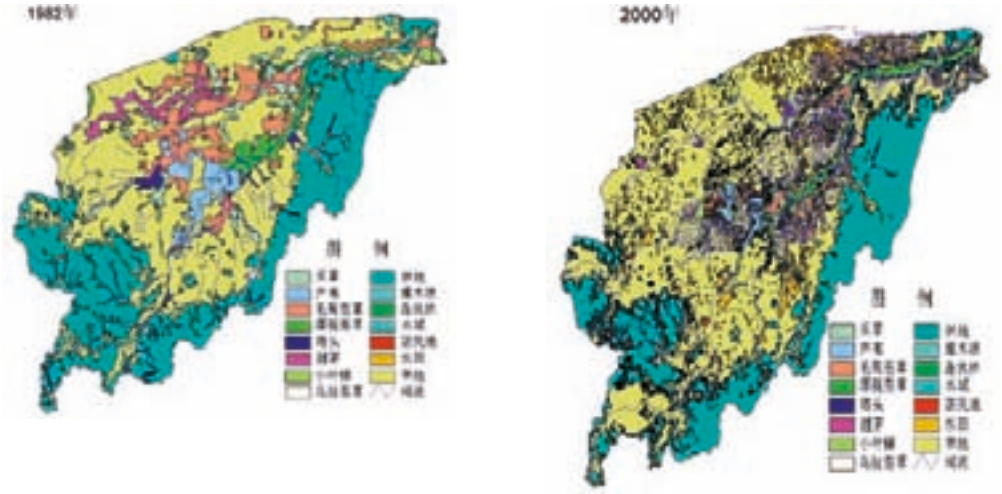
9.2.3. Drainage of wetlands

The complete drainage of wetlands leads to catastrophic degradation. China has two large wetland areas, the Sanjiang Plain and Ruoergai Plateau. The principal factor

Table 9.2. Comparisons of average runoff at monitoring stations in the upper reaches of the Liaohe River Delta 10^4 m^3.

River	Monitoring station	1956-1979	1980-2000	1956-2000
Daling	Chaoyang	88,193	49,621	70,193
Liaohe	Yubaotai	371,984	331,373	353,032
Hunhe	Xingjiawopeng	195,137	188,628	192,100

Figure 9.1. Wetlands of Sanjiang Plain and growth of canal system.



in the degradation of these two wetlands is wetland drainage. The Sanjiang Plain irrigation and drainage system had 1234 canals in 1983, but the number of canals had increased to 13,546 by 2000, and thus the area of wetlands has reduced by 80% (Figure 9.1)(Liu *et al*. 2007).

In order to expand the grazing area, people on the Ruoergai Plateau undertake large-scale drainage campaigns: Ruoergai County used Dongfanghong-75 caterpillar tractors for the drainage work. Over nine years a total of 380 km of canals were constructed for water drainage, and as a result the grazing area expanded by 80,000 ha.

Wetland drainage is a human intervention aimed at converting natural swamps, and it results in rapid degradation. In this area a total of 200,000 ha of swamps were drained and dried out, and about 1 billion m^3 of water was drained off. The original swamps suffered fundamental destruction. In the early 1980s an area of 1025 km^2 of swamp was not suitable for grazing, but by end of the 1990s this area had declined to 105 km^2 (Table 9.3)(Gao 2006).

Table 9.3. Changes in sizes of different wetland types in the core area of Ruoergai Marsh, 1975-2001.

Wetland type	Area in October 1975 (ha)	Area in November 1986 (ha)	Area in October 2001 (ha)	Change in area October 1975 - October 2001 (ha)	Average annual change in area (ha)	Average annual rate of change (%)	Total change (%)
Marshes	433,902.47	383,652.49	346,270.52	-87,631.95	-3,370.46	-3.85	-20.20
Lakes	2,507.63	2,175.53	1,643.05	-864.58	-33.25	-3.85	-34.48
Rivers	18,789.12	11,621.96	9,764.81	-9,024.31	-347.09	-3.85	-48.03
Desertified land	3,174.57	8,079.79	14,342.97	+11,168.40	+429.55	+3.85	+351.81

9.2.4. Changes in the hydrochemical processes in river basins

The growth of wetland organisms is closely linked with the hydrological regime, and is also dependent on hydrochemical conditions. Pollution and pollutant release may take place in association with the processes of the natural water cycle, and, in particular, more frequently with the processes of the social water cycle. Within the natural water cycle, pollutants entering a wetland are purified through natural processes. When the concentration of pollutants in a wetland exceeds the wetland's self-purification capacity, water pollution occurs; this influences the growth and development of wetland organisms, which may lead to wetland degradation. One cannot be optimistic about the water pollution situation in China. In 2006 the overall quality of surface water across China was *'moderately polluted'*. Of the 745 monitoring points for surface water (including 593 river monitoring points and 152 monitoring points in lakes or reservoirs) under the national environmental monitoring programme, 40% met Grade I~III National Surface Water Quality Standard (NSWQS), 32% met Grade IV~V Standard and 28% failed to meet Grade V standard. The major indicators of pollution are the indices for permanganate, ammonia, nitrogen and petroleum. Of the 408 points on 197 rivers in seven river systems monitored under the national environmental monitoring programme, 46% met Grade I~III NSWQS, 28% met Grade IV~V NSWQS and 26% failed to meet Grade V standard. Again, the major indicators of pollution are the indices for permanganate, ammonia, nitrogen and petroleum. In 2006, among 27 lakes and reservoirs monitored under the national environmental monitoring programme, 7% met Grade II standard, 22% met Grade III, 4% met Grade IV, 19% met Grade V and 48% failed to meet Grade V. The major indicators of pollution are total nitrogen and total phosphorus. The water quality of reservoirs is better than that of lakes, and reservoirs suffer relatively light eutrophication (State Environmental Protection Administration 2007).

9.2.5. Changes in the runoff and sedimentation processes in river basins

Water and soil erosion in the upper reaches of river basins results in sedimentation of downstream wetlands and leads to wetland degradation. The implementation of water and soil conservation engineering work upstream can increase the volume of water resources available for use upstream, but has an impact on the ecological status of downstream wetlands.

According to the statistics (Zhai 2007), the volume of Baiyangdian Lake was 225 million m^3 less in 1966 than it had been in 1924. The total sediment load of the Zhulong and Tanghe Rivers was 2,618.4 m^3 in 1955-1979. Since 1960 the upstream reservoirs have become heavily silted, thus reducing the sediment in Baiyangdian Lake. In 1970 a new pilot canal, the Baigou, became operational. Since then floodwaters of the northern tributary of the Daqinghe River have been allowed to flow into Baiyangdian Lake, thus leading once again to increased sedimentation in the lake. In 1970-1980 the Baigou canal transported a total of 3,170,000 m^3 of sediment, which exceeded the flood-control standard. A total of 2,150,000 m^3 of sediment was added to existing deposits in Baiyangdian Lake. At the river estuary, which is 1200 m long and 500-1500 m wide, sediment covers an area of 1.4 km^2 to an average height of 0.75-2.8 m. The annual average volume of sediment deposited is 290,000 t; this new source of sediment is threatening Baiyangdian Lake.

9.2.6. The combined impact of the water cycle and associated processes

A nature reserve aimed at protecting Relict Gull *Larus relictus* is located on both banks of a river in the middle and downstream areas of Jigou River Basin, Erdos City; this used to be a large wetland with an area of 12 km^2. In recent years an area of 2-3 km^2 of the wetland has suffered from degradation due to the establishment of grasslands, an enclosure project and a canal in the upper reaches. In order to halt water and soil erosion in the basin, the local government has constructed a series of sedimentation dams. Although these dams have reduced the flow that led to severe degradation of the downstream wetland, this wetland cannot be rehabilitated without external intervention.

9.3. Identifying Wetland Conservation Objectives and the Ecological Demand for Water, Based on Wetland Ecological Services

9.3.1. The objective of wetland conservation

The *'service'* function of an ecological system refers to the products of the system and how its functions benefit human survival and quality of life. Wetland systems play an important role in maintaining water security and ecological and environmental safety in the river basin. To identify wetland conservation objectives in a scientific way is a key task in prioritising the conservation of wetlands in river basins. During the development of traditional conservation objectives for a river basin, an emphasis should be placed on the important contribution made by wetlands to biodiversity conservation at basin or regional level. However, it is not enough simply to study the ecological services that wetlands provide by regulating the basin water cycle, runoff and sedimentation and hydrochemical processes. The possible impacts of global climate change on regional/basin water cycles and ecological evolution have not been taken into consideration in the identification of wetland conservation objectives. Ecological rehabilitation has been limited to restoring target wetlands that existed in the past.

In view of global climate change and the impact of highly intensive human activity, in the future the water cycle processes in river basins will be very different from how they were the past, so the key problem of sustaining the security of the whole basin will also change. At the same time the wetland ecological system will evolve further. To this end, to develop objectives for the ecological conservation of wetlands the security of the entire basin should be taken as a starting point and the basic requirements for the wetland to provide its ecological services should be clarified. Wetland conservation requires an understanding both of the hydrological regime and of how the wetland water sources will evolve in the future.

9.3.2. The ecological water requirements of wetlands

The study of the ecological water requirements of wetlands started as early as the 1940s, when the U.S. Fish and Wildlife Service undertook a study on streamflow requirements in river courses. To date, nearly 50 countries have undertaken such studies on the ecological water requirements of wetlands by using the Tennant Method, Wetted Perimeter and Penman Formula from the perspective of the runoff hydrological processes of a sustainable ecosystem, physical environment of habitats and biological evapotranspiration consumption. Measurement of the ecological water requirement is made based on the relationship between survival or habitat environment of key species in wetland and runoff; this is a common research method. A method has gradually become applicable for studying the ecological water requirement of wetlands. This is the biological-model method, which considers relations between

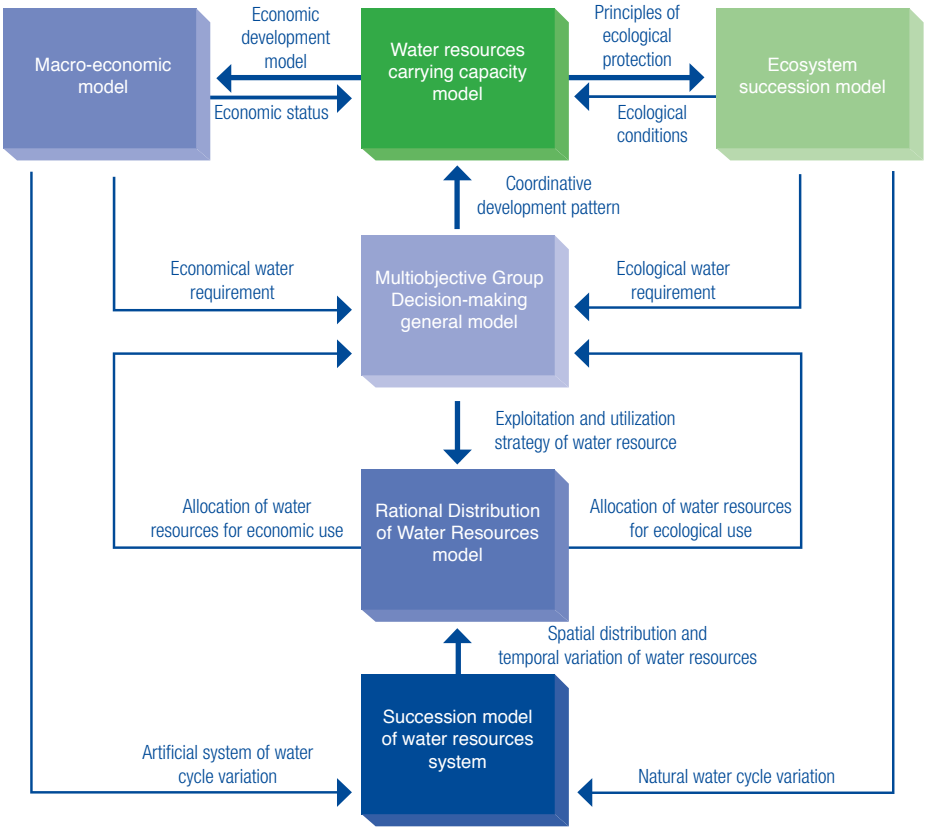
balance of wetland ecosystem and runoff under conditions of interrelations between various ecological factors of the wetland system. Due to the connectivity of aquatic ecological processes between the ecosystem types of neighbouring wetlands, the ecological water requirement has some compatibility, therefore a study of the ecological water requirement of wetlands from the perspective of aggregate analysis is required.

9.4. The Allocation of Water Resources for Ecological Use and the Ecological Water Requirement of Wetlands

9.4.1. The allocation of water resources for ecological use

Traditionally water has been allocated in response to the needs of macro-economic and water resource systems. The aim has been the economic use of the water resources in the region/basin and the full development of social benefits, and the key task was the allocation of water resources among users of various macro-economic

Figure 9.2. Technical framework for rational allocation of water resources for ecological requirements.



systems. With regard to the allocation of water resources for ecological purposes, an integrated analysis of the eco-environmental system, macro-economic system and water resources is required. It is necessary to allocate water resources appropriately between the socio-economic and eco-environmental systems and their users by balancing the resources in an integrated way between eco-environmental benefits and socio-economic benefits, based on the full development of these benefits, thereby promoting the harmonious development of man and nature, as well as sustainable development (Figure 9.2).

9.4.2. Strategy for prioritising wetland conservation in water resources allocation

In order to achieve the objective of prioritising wetland conservation it is necessary to monitor the ecological water flow in order to ensure the correct allocation of water resources in favour of ecology, particularly for riverine wetlands. The ecological flow of the monitored section should be considered a key factor in the allocation model. For other types of wetlands, water for ecological needs can be listed as a priority use (or unit), and its priority should be ranked after water for human consumption and integrated into the allocation model of water resources of the region or basin, based on spatial distribution and the properties of the water source. Where water resources are rich in a basin/region the allocation scheme can fully or basically meet the ecological water requirement. Where water resources are relatively poor in a basin/region the water allocation should make every effort to ensure the minimum ecological water requirement. Where the minimum ecological water requirement is not met, it is necessary to find unconventional water resources (such as flood resources). Where the available water resources fail to meet the ecological water requirement, the possibility of interbasin water transfer for selected wetlands should be considered, or such a programme should be developed.

9.5. Distributing and Supervising Water for Ecological Use and an Improved Contingency Distribution Scheme

9.5.1. Key technology for distributing and supervising water for ecological use

The distribution and supervision of water for ecological use within a basin/region falls into two categories: regular ecological distribution and contingency ecological distribution. The core task of regularly allocating water for ecological use is to prioritise ecological water for use in wetlands within the framework of a water resources allocation scheme in the basin/region taking into consideration the processes of water inflow and water needs. An integrated distribution of the water resources of a region is performed according to a general framework: *'the allocation is made according to a long-term distribution programme; a short-term distribution programme is combined with a long-term meteorological forecast, and the distribution programme is modified continuously according to the latest information'*. The integrated distribution of water resources should entail the comprehensive use of hydraulic engineering works. However, the formulation of an allocation programme is the key to performing and supervising the distribution. Measures for real-time monitoring and control are also necessary for supervising the water supply to wetlands. Contingency ecological distribution refers to ensuring the minimum needs of wetlands for water and is aimed at adjusting the water quality of wetlands in the event of extraordinary droughts and their contingent pollution through water transfer within basin or even interbasin. The main task of contingency ecological distribution covers: identification of contingency types, preparation of a contingency plan, development

and management of water sources for contingency use and contingency distribution command and supervision (Chen and Zhang 1988).

9.5.2. An analysis of typical examples of water transfer for ecological use in wetlands

To date, successful water transfer has been made for Baiyangdian and Zhalong wetlands; both these examples are of contingency ecological distribution. During the period 1981-2003 a total of 16 water transfers were made. The reservoirs in the upper reaches released 963,270,000 m^3 of water, and Baiyangdian received 501,500,000 m^3. Thus, the water surface area of Baiyangdian wetland increased and the water quality improved. Many fish species, including the cyprinid *Opsariichthys bidens*, Chinese False Gudgeon *Abbottina rivularis* and Mandarin Fish *Siniperca chuatsi*, reappeared in Baiyangdian Lake. Many waterfowl species reappeared in the reedbeds of Baiyangdian Lake, and waterbird numbers increased from 52 species in 1992 to 180 species. Some endangered hydrophytes recovered and began to flourish (Zhai 2007). With increased abstraction of water in the upper reaches during years of low flow (75%), Zhalong wetland normally has zero inflow. In the 1990s the water table at Zhalong wetland fell continuously. In 1996-1997 and 2000-2001 the water table fell by 1 m compared with a normal year, and the water surface area contracted from 2100 km^2 to 120 km^2. It was not possible to rehabilitate the wetland by natural means. On 12 July 2001 Songliao Water Resource Commission, which answers to the Ministry of Water Resources, decided to take contingency measures for water transfer (35 million m^3) to Zhalong wetland for first time. In 2002 and 2003 Heilongjiang Province continued water transfer to Zhalong wetland (450 million m^3). Thanks to three years of water transfer the water surface area expanded to reach 1000 km^2. However, water transfer has not yet solved the problem of water shortage, because the quantity of water transferred was not consistent, and by end of March 2004 the water surface had again shrunk to less than 500 km^2 (Deng *et al.* 2003).

9.6. Improving the Mechanism for Licensing Water Abstraction and Collecting Water Resources Fees in Order to Strengthen Prioritising Wetland Conservation

9.6.1. Constraints of prioritising wetland conservation

From the point of view of environmental economics, wetlands (especially natural wetlands, including mudflats, rivers and swamps) are seen as *'quasi-public resources'*; it is therefore not permissable to exclude the public from using wetland resources, which leads to pre-emptive use and overuse. An analysis, based on the theory of externality, indicates that behaviour of positive externality has no compensation, and behaviour of negative externality has no cost. The lack of both positive and negative externality compensation mechanisms is one of the main reasons for wetland degradation. The very nature of wetlands makes it difficult to ascertain wetland property rights. Wetland protectors are not in a position to own all the benefits provided by wetlands or to control the sustainability of benefits, therefore their inadequate efforts to conserve wetlands have resulted in wetland degradation (Cui *et al.* 2006). In order to halt the trend of wetland degradation it is necessary to further improve and complete management regulations in addition to strengthening the position of the State Forestry Administration as a mouthpiece for wetland conservation in order to ensure input to and achieve proper compensation for wetlands (Deng *et al.* 2005).

9.6.2. Prioritising wetland conservation in water resources management

Wetlands not only represent important water resources but also function as a regulator of the river basin water cycle and its associated processes, which plays an irreplaceable role in water security as a whole and the ecological safety of the basin (Li *et al.* 2007). Therefore, in activities related to the development of water resources, water resource users should, on the one hand, maintain the prioritised position of wetlands and guarantee that wetlands receive the ecological water that they require, but on the other hand also provide ecological compensation through establishing special funds that may supplement and guarantee inputs for wetland conservation, because all activities related to water resources have some impact on wetlands (Zhao 2005).

In order to strengthen the management and conservation of water resources and promote the saving and wise development and use of water resources, the State Council promulgated the *'Regulation on the Administration of the Licence for Water Abstraction and the Levy of Water Resource Fees'* in 2006. This regulation clearly specifies that implementation of the *'Licence for Water Abstraction'* must be integrated with planning for water resources and river basins, medium and long-term planning for water supply and demand, and water-function zoning. Implementation of the licence should also follow the approved water allocation scheme based on the *'Water Law of the People's Republic of China'*. The Regulation also specifies that the water resource fees must be wholly brought into the budget with the aim of using them for saving, conserving and managing water resources as well as for the wise development of water resources. It is suggested that the Regulation (or its implementing rules) should contain clear provisions as follows: fully guarantee the security of ecological water in the licence; ensure that projects concerning water resources specify appropriate plans for ecological compensation for wetlands if the project has an impact on wetlands; and ensure that a proportion of water resources are used for wetland conservation according to the situation on the ground in the relevant basin and region.

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10. Working Together for Wetlands and the Healthy Development of Mankind

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Abstract

Wetlands in China are degrading and declining faster than other habitats, yet the need for wetland conservation has not been not fully understood. In recent years the government has taken measures to address the issues and established regulatory and administrative departments from central to local levels under the leadership of the State Forestry Administration. This has resulted in a number of important actions that have been incorporated into the Five-Year Plan for National Economic and Social Development (2006-2010).

Key Words: wetlands, State Forestry Administration, protection, wise use

10.1 Introduction

The decision made by Wetlands International (WI) to hold this symposium in China shows that the world is paying attention to China's wetlands conservation and the increasing cooperation between international organisations and China. The theme of the symposium, *'Healthy Wetlands, Healthy People'*, is also that of World Wetlands Day 2008 and the forthcoming 10th Meeting of the Conference of the Contracting Parties to the Ramsar Convention.

The symposium demonstrates people's enhanced awareness of the importance of wetlands. In addition, it reflects the urgent need of the international community to conserve wetlands and rationally utilise the wetlands resource. Wetland conservation in China plays an important role in this seminar; China's progress and achievements in wetland conservation are discussed below.

10.2 China's Wetlands Today

As shown in the Millennium Ecosystem Assessment 2003, in China the degradation and decline in wetlands is more serious than in other types of ecosystem. On the one hand, the current wetlands are shrinking and the habitat is being further fragmented; on the other, the degradation of the wetland ecosystem and the continuous decline in wetland functions make it hard to satisfy public demand. In addition, the general public and the government have not yet fully understood the significance of wetland conservation. More time is still required for people to become aware of the scientific value of the functions of the ecological system. Furthermore, neither the general public nor the government values the conservation of wetlands as highly as they do the protection of forest, marine resources and other natural ecological systems.

10.3 China's Achievements in Wetland Conservation

On the basis of its national conditions and economic strength China has become a member of the large wetland conservation family, and central government has adopted a series of measures on the principles for wetland protection and rehabilitation and has registered certain achievements.

First, the Wetlands Protection Alliance was established by the joint efforts of the regional governments. Seventeen central government departments co-edited the China Wetlands Conservation Action Plan in 2000 and reached a consensus to provide protection for the wetlands of China. In 2007, the National Committee to Fulfil the Convention on Wetlands was set up by 16 domestic government departments under the leadership of the State Forestry Administration (SFA). Currently the wetlands protection team consists not only of the relevant government departments, officials, WI, WWF and other influential international organisations, but also private enterprise, non-governmental organisations (NGOs) and the general public.

Second, the SFA has made national strategies and plans for wetlands conservation and has closely linked wetlands conservation to specific national plans. A strategic study on wetland conservation and surveys of the national wetlands have been completed. In addition, the SFA has edited the Plan for National Wetlands Protection (2002-2030), and the State Council has approved the Plan for 2005–2010 and has incorporated it into the Eleventh Five-Year Plan for National Economic and Social Development (2006-2010) for implementation. In 2004, the General Office of the State Council issued the Notice on Enhancing the Administrative Management of Wetland Conservation and reiterated the state policy on wetland conservation. In the meantime, in addition to the protection

of wild flora and fauna, construction of nature reserves, comprehensive planning of water resources, construction of shelter-belt forest in coastal areas, protection of marine biological species, and prevention and control of water pollution, wetland conservation has also been included as an important task in national and regional planning. A 4-level wetland protection planning system (at state, regional, local area and project site levels) has now been established.

Third, the SFA has promoted wetland conservation at both state and local levels. The SFA fully recognises the importance of incorporating the conservation of wetlands and biodiversity in the relevant laws and systems of the state and local legislatures to better coordinate the regulations and systems of different areas for the sake of conservation and wise use of wetlands. In addition, special legislation for wetland conservation has been introduced to fill current gaps in China's laws and regulations. Guidance has been provided to the establishment of local legislation in wetland conservation, and to date some one-fifth of the provinces have issued local regulations on wetland conservation. It is hoped that by 2010 an initial basic legal framework covering wetland conservation and wise use will have been established.

Fourth, the SFA has taken a leading role in establishing a range of protective and biological recovery measures. Over the years, the Chinese government has taken a series of positive measures including strict protection, scientific rehabilitation, wise utilisation and awareness raising in order to give full play to the various functions of wetlands. Over 470 nature reserves for wetland protection have been established, 30 of which are designated as internationally important wetlands. The SFA has built over 50 wetland parks of different types and categories, and designated areas for the protection of waterbirds and biodiversity.

In addition, natural landscapes in wetlands and ecosystem parks have been carefully preserved. A natural wetland protection system, administered at different levels, has taken shape. At the same time, 200 wetland conservation and biological recovery projects are being planned by the state and approved by the government, with RMB 500 million allocated by central government. Furthermore, several environmental protection projects established to deal with sewage disposal through the use of artificial wetlands are starting to show benefits.

10.4 Conclusion

Over the years, the SFA has worked steadily to promote the development of wetland conservation in China. The SFA believes in *'cooperation and win-win opportunities'*. This involves constructive and effective cooperation amongst government offices, between central and local governments, between international and domestic organisations, and between NGOs and the general public. This will enable the SFA to establish a favourable environment for the protection of the country's wetlands so that they can better serve mankind, and benefit the general public in the long term. Although work is only at a preliminary stage, the initial achievements have already laid the foundations for wetland conservation within the sustainable development strategy of China, which has actively improved China's ecological system and supported the enhancement of regional and global ecosystems.

However, it is undeniable that China is still a developing nation at the stage of rapid industrial and urban development. As a result, the country is confronted by a severe challenge in protecting its wetlands, one of the fastest-degrading natural ecosystems. At the same time, there is an increasing demand from the people to utilise wetland services. There is still a long way to go before we can properly protect and maintain

the environmental services provided by wetlands and strike a harmony between mankind and nature.
On September 8 2007, State President Hu Jintao, while attending the 15th Economic Leaders Informal Meeting, made the following statement:

'China follows the scientific thinking on development, takes resource conservation and environmental protection as a basic state policy, gives high priority to achieving harmonious development of man and nature, and works to strike a balance between economic growth, population, resources and the environment. We are pursuing a sound development strategy that promotes production, makes life better for the people and protects the environment'.

With its new understanding of ecological sustainability, China can realise development opportunities alongside wetland conservation. However, the SFA still needs to carry on with its work of establishing a new order for the conservation and wise use of wetlands, coordinating the relationship between the two, and improving the level of scientific wetland restoration in order to steadily improve the service functions of wetlands for the benefit of mankind.

Over the years, while studying and borrowing experiences in wetland conservation and utilisation from other countries, international cooperation and communication have been strengthened, the development of China's wetland conservation has been promoted, and a contribution has been made to the conservation of internationally important wetlands. China is ready to further its cooperation with all countries and international organisations, and looks forward to their further support and participation in China's wetland protection and eco-construction. We would like to work with you to jointly promote global wetland conservation so that wetlands benefit not only the current generation but also our descendants, and guarantee the sustainable development of mankind.

11. Vulnerable People, Vulnerable Coastlines: Multiple Approaches

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Abstract
Fishers in developing countries often struggle to subsist on the harvests they can take from their lands or fishing grounds. They are also faced with an ever-prevalent risk of losing ownership or the right to access traditionally accessible land and water resources. Erosion, intrusion and environmental degradation make fishing even harder. Basic tools (nets, fuel etc.) are becoming more expensive, and fishers have to compete with cheap imports that force down their own selling prices. This affects whole households, e.g. wives and children have to resort to exploitative employment on large plantations in order to bring some income into the household.

Good health is intrinsically linked to this poverty equation and, in its broadest sense, good health is fostered by human well-being - which requires that people are able to enjoy their rights to sustainable livelihoods, essential services, security, to be heard and to their identity.

In wetland areas and, especially, in coastal zones, healthy and viable wetlands are essential if people are to realise these rights. Wetlands provide a broad range of services on which the poor depend, from food and water to building materials and medicines, and even protective buffers against environmental disasters.

Thus a multi-faceted approach to poverty reduction is needed. The paper describes how Oxfam Novib addresses this need in its work in coastal areas of Indonesia and the Philippines. Oxfam Novib supports local partners in the development of community-based coastal resources management, which helps to restore opportunities for fisherfolk to access and use coastal fishing grounds. Oxfam Novib and partners work together to try to influence international trade debates, between governments and between private-sector players, so that small-scale producers can also play a viable role in the market economy. At the same time, Oxfam Novib supports the work of Wetlands International, and others, to restore degraded ecosystems and ecosystem services to poor people and to provide the conditions essential for good health and poverty reduction.

Key Words: fishers, coastal, poverty, Oxfam, healthy, livelihood

11.1 Introduction

Fish is an important commodity globally. The world's fisheries produce approximately US$ 120 billion a year. Fishery products are also heavily traded on the international market, with an estimated annual trade value of US$ 58 billion. Developing countries account for half of the total volume of this traded fish, but only a third in terms of value. Much of the fish is traded as fishmeal or fish-oil. None the less, fishery products represent the single biggest food item from which developing countries earn their export income (FAO 2005). This contribution to the economy is higher than that of rice, coffee, sugar, tea and bananas combined (World Bank 2004).

The fisheries sector is also domestically very important in developing countries. Consumption levels are typically 3-4 times higher than in developed countries, and almost 500 million people find direct and indirect employment in the sector. Yet 95% of the labour force survives on US$ 2 a day or less (World Bank 2004), and for some 2.6 billion people fish provides at least 20% of the per capita protein consumption (Kelleher & Weber 2006). Also, in comparative terms, the total value to human welfare of marine and coastal ecosystems is about double that of terrestrial ecosystems (FAO 2001).

In Southeast Asia, there are an estimated 12-20 million fishers; almost all are small-scale, artisanal fishers (1 million fishers are connected to commercial fisheries). The region produces over US$ 11 billion in fishery products annually, and earns around US$ 7 billion from fishery exports. In Southeast Asia, the small-scale fisheries contribute to domestic food security, provide employment - especially in rural areas - and generate export income. Roughly 15% of the people depend on fishing as a significant source of income. The average per capita food supply of fish in Association of Southeast Asian Nations (ASEAN) countries in 1997 was estimated at 22.9 kg, with the average contribution of fish to animal protein intake estimated at 45%. More than 300 million people in the region depend significantly on fish as a source of protein (SEAFDEC 2001).

Yet fisheries management is very weak. Resource-use conflicts between small-scale fishers and commercial fleets abound. Illegal and unreported fishing is estimated to be 15% of total catch volume. Over the past 40 years, standing fish stocks in Southeast Asia have been reduced to less than a quarter of their former levels (Pauly *et al.* 2002, 2005).

An important factor in the diminished fish stocks is the loss of the mangrove areas that are such important breeding and feeding grounds. Mangrove cover in the region has declined to 50% of former levels, and 70% of coral reefs are heavily damaged (UN 2005).

Healthy and viable wetlands are essential if people want to realise their rights. Wetlands provide a broad range of services on which the poor depend, from food and water to building materials and medicines, and even protection against environmental disasters (IUCN 2007). Ecological economists have estimated wetland value ranging from US$ 10,000 to US$ 65,000 ha/year (Costanza *et al.* 1997; Barbier 2007).

These factors may make it clear why Oxfam Novib has chosen to make coastal areas a priority in its livelihoods work.

There are many reasons for high poverty levels in coastal areas: degrading natural resources, diminishing access to these resources, disasters, barriers to profitable production and trade, insufficient governmental assistance etc. All these causes often work simultaneously on households in coastal villages, driving people to desperate measures that may make their problems even worse. Figure 11.1 illustrates this from the perspective of an individual fisher and his household, and summarises what Oxfam feels it is *'up against'* when trying to alleviate coastal community poverty.

Figure 11.1. Oxfam Novib's view on the multitude of problems affecting coastal poor households.

Oxfam Novib view on the multitude of problems affecting coastal poor households

- You are a subsistence fisher in country X
- You can't make a decent living off your land or fishing ground
- You constantly risk losing access to these resources
- Erosion, intrusion and environmental degradation seem to make fishing even harder
- Input costs are becoming prohibitive and more and more time is needed for the same amount of catch
- Cheap imports are forcing your selling prices down
- Your wife or husband faces the same problems
- You face a lot of health problems, your children suffer from malnutrition
- You and your family members feel forced into exploitative jobs on big plantations, sweatshops or the aquaculture farm that displaced you
- You are now more vulnerable to disasters then ever before

There seems no way out of poverty……

Oxfam Novib

Oxfam Novib aims to contribute to sustainable livelihoods through an approach that simultaneously tries to address several of these problems affecting the coastal households. Its contributions, so far, lie in:

- providing assistance to improve livelihood opportunities in community-based coastal resource management projects;
- lobbying against negative impacts on the livelihoods base of the communities and diminishing the risks they face;
- supporting rehabilitation after disasters.

This paper illustrates Oxfam Novib's contribution with examples mainly from the two island-rich countries in Southeast Asia.

11.2. Contributing to Coastal Livelihood Opportunities

In Indonesia and the Philippines up to 7 million people are active in small-scale fishery, which implies that around 30-40 million people depend, fully or partially, on fisheries as a source of livelihood. Yet poverty rates in the coastal communities are high, possibly as high as 80% in both Indonesia (FAO 2007) and the Philippines (Green *et al.* 2003). This is all the more striking when one considers that fish are supposedly freely accessible to all. However, it is known, from various non-governmental organisation (NGO) reports, that average catches in the small coastal fishery have declined to 25-30% of former levels. From the same NGOs there are stories about fisher wives losing their fish-vending businesses and, consequently, having longer working hours and fewer options for combining making a contribution to household income generation with their usual household and child-care tasks (Tambuyog 1999).

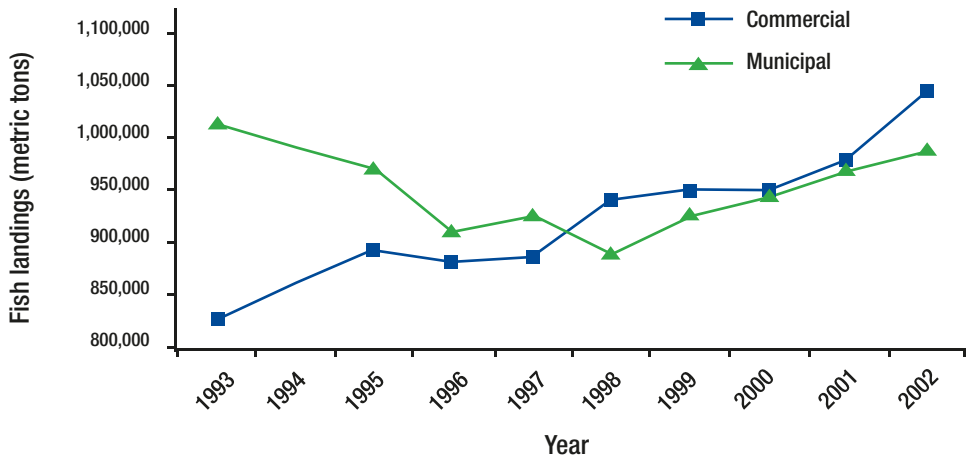
Oxfam Novib supports local organisations in developing Community-based Coastal Resource Management (CBCRM), i.e. the development of decentralised fishery

management systems wherein fishers and coastal communities play an active role in the management as decision makers and implementers (Pomeroy & Carlos 1997; Ferrer *et al.* 2001). In essence CBCRM development is about empowering fishing communities by giving them, both men and women, control over their resources. CBCRM projects typically include both technical assistance in the form of mangrove and reef rehabilitation projects, as well as political *'negotiations'*/lobbying on laws, essential services and access rights over fishing areas. CBCRM development mixes long-term strategies (empowerment, equity) with short-term strategies (livelihood, income) and capacity building (pilot projects in resource rehabilitation, livelihoods, cooperatives).

In the Philippines, CBCRM really gained ground and became a cornerstone of government policy. In 1998, the Philippines enacted a fisheries law that established localised coastal resource management councils with mandatory representation of small fisherfolk. In 2003, a total of 94% of all coastal towns and 67% of all coastal villages had such councils in operation (Grutas 2003). Supported by various Oxfams, NGOs played an important part in achieving this (Ferrer *et al.* 2001; Formilleza & Nightingale 2003). Official government statistics did indeed show a reversal in the decline in small-scale fishery catches (BFAR 2003; Figure 11.2).

In Indonesia CBCRM is not yet as advanced as in the Philippines. Oxfam Novib supports traditional fisheries management and trading associations in the Moluccas, credit provision to fisherfolk on Sumatra, and resource rehabilitation and combating the intrusion of illegal fishery in Sulawesi. Reef improvement and mangrove planting have led to increased stocks and species diversity. At the national level Oxfam Novib supports advocacy for CBCRM and draws government attention to small-scale fisheries and coastal environmental management. NGOs involved in CBCRM are now at the stage of engaging in a dialogue with the government. These and other efforts have influenced the government to start revising the fisheries law. Oxfam Novib also believes that CBCRM experiences gained elsewhere will help the country in its efforts to decentralise its government structures.

Figure 11.2. Fish landings in Philippine ports, 1993-2002 (BFAR 2003).



Deriving a livelihood from fishing involves more than just catching fish, and Oxfam Novib is concerned that CBCRM alone may not alleviate poverty in coastal communities in the long term (Formilleza & Nightingale 2003). However, it is also pointed out that CBCRM is basically about the right to utilise natural resources, and this also results in intangible benefits, such as self-confidence and empowerment among fishing communities (Van Mulekom & Tria 1999; Pomeroy & Ahmed 2006). However, Oxfam Novib recognises that more could be done in terms of gender equity; there appears to be a need for more work in this area within CBCRM.

11.3. Safeguarding Resources

Oxfam Novib's second approach focuses on *'safeguarding resources'* or protecting poor people from negative impacts on the resources they rely on. It is very much an approach of advocacy, lobbying and campaigning on what *'non-fishers'* can do to affect the coastal resource base.

Oxfam is a member and funder of SEAFish for Justice, a network of 14 NGOs from Southeast Asia cooperating to influence international debates in fisheries management. The network prioritises sustainable and equitable development in fisheries management and trade. It advocates for protection against over-rapid trade liberalisation. SEAFish has campaigned on this issue to the World Trade Organisation (WTO), specifically on removing fisheries subsidies in northern countries while allowing developing countries to build up (with subsidies) the economic resilience of their own small-scale sector (SEAFish for Justice 2005). The WTO currently has draft agreements in place to limit subsidies in the *'north'* yet provide space for subsidies in the *'south'*. Paragraphs in submissions to the WTO of six countries (Pakistan, India, Brazil, Argentina, the Philippines and Indonesia; see *http://www.trade-environment.org/page/theme/tewto/para28.htm*) refer directly to the position of small and artisanal fishers in *'southern'* economies.

Simultaneously, Oxfam International (OI) ran a campaign on international trade negotiations, the *'Make Trade Fair'* campaign. This campaign was also directed at the WTO membership and aimed to expose the rigged rules and double standards in ongoing trade negotiations (Oxfam International 2002). OI reports have been quoted by various governments and WTO negotiators and contributed to exemptions and special measures for developing countries being discussed.

An example of the trade and export of shrimps produced by aquaculture is highlighted below.

Shrimp aquaculture is a rapidly growing industry in Southeast Asia, with over 9% annual growth over the past few decades. In Indonesia the registered production of shrimp aquaculture amounts to 280,000-327,000 tons a year (MAFF 2007). This production comes from 70,000-80,000 farms, of which an estimated 85% are considered small-scale (less then 2 ha). However, over 90% of the shrimp export volume is taken by just 3-5 companies (Siregar 2003). This export is valued at around US$ 1 billion a year, or close to 25% of the total Indonesian agri-food exports (Oktaviani & Erwidodo 2006).

The question is whether this trade should be regarded as ameliorating or exacerbating the issues of poverty.

In Southeast Asia over half of the original mangrove forests have gone, with losses specifically caused by shrimp aquaculture estimated at almost 700,000 ha. (van Mulekom *et al.* 2006). In Indonesia the total decrease in mangrove area has been estimated at over 2 million ha, much of which is attributed to all forms of coastal

aquaculture (Damanik 2006). Yet 70% of the ponds intended for shrimp cultivation are not productive for various reasons: salinisation, disease and land speculation (Konphalindo 2001). It is simply very difficult to keep shrimp aquaculture ponds in good condition for more than a few years. Coastal communities suffer negative impacts from this: directly and indirectly, aquaculture is costing them not only fish and land but also other livelihood opportunities. Table 11.1. gives an example, a summary of an analysis made by one NGO concerned about shrimp aquaculture (Wistrand 2003).

At ASEAN-level, using estimates provided by ecological economists, the direct costs of shrimp aquaculture for local communities in terms of impacts on coastal ecosystems are possibly US$ 5.5-7.7 billion a year (van Mulekom *et al.* 2006), yet further growth of aquaculture areas is planned.

On the other side of the supply chain, in Europe and the US, there is clearly a growing market for tropical shrimps at prices that are similar to or lower than they were several decades ago (Josupeit 2004), which made Oxfam Novib realise that there is quite a difference between negative impacts incurred in producing developing countries and positive benefits in consuming developed countries.

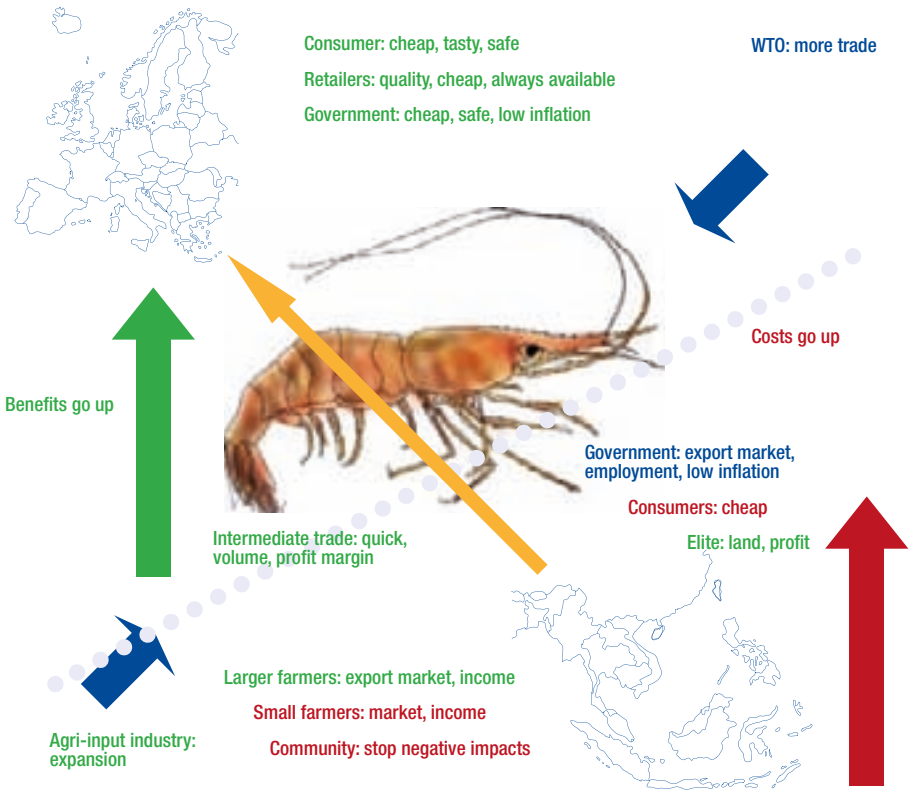
Governments in receiving countries aim at safe food and low food prices for consumers. Governments in producing countries are interested in export markets and employment. Consumers, in both producing and receiving countries, want to have a cheap, tasty and safe product. Retailers are looking for low prices, high quality and a predictable, stable availability. Larger farmers and local elites benefit from land grabbing. Small farmers are competing to gain access to markets and to gain an income. And communities are suffering the negative impacts. The effect, throughout the supply chain, is that net benefits at the receiving side rise, while the net costs for

Table 11.1. Demonstration of diminished livelihood options as a result of mangrove conversion into aquaculture ponds.

Activity	Previous	Present
Agriculture	Own agricultural land available	Vastly reduced area available
Cattle raising	Cattle were kept by almost all households	Shortage of grazing land, straw and fresh water
Poultry farming	Poultry farming	Ban on poultry keeping because they *'eat the shrimps'*
Domestic vegetable growing	Most households used to cultivate vegetables on their homestead land	Due to salinity of the soil, vegetables cannot be cultivated
Fishing	Fishing	Fish have disappeared
Rice growing	Small wet-rice patches cultivated	Salinity in irrigation water reduces growth or prohibits rice cultivation altogether

Source: Adapted from Munjo, in Wistrand 2003

Figure 11.3. The supply chain in shrimps: current stakeholder interests.



producers and surrounding communities also rise (see Figure 11.3).

Oxfam Novib works together with SEAFish for Justice on both sides of the supply chain. It supports the network and its individual members to influence the production side of the supply chain to take better care of impacts on surrounding communities, while Oxfam Novib itself also campaigns in the *'north'* to influence the private sector, in cooperation with the IUCN-Netherlands (IUCN-NL) Committee. The main component of Oxfam Novib's campaign is to influence European retailers directly via the GLOBALGAP (good agricultural practices; previously known as EUREPGAP) food quality standard.

GLOBALGAP started as an EU-wide certification system for quality and safety of agricultural food products. It aims to provide the EU consumer with safe, hygienic, trusted products. It is a business-to-business initiative with no labels that has at present 51 members which, together, hold 10% of all food trade in the world (although not all of this is yet GLOBALGAP certified). GlobalGAP has decided to adopt a shrimp aquaculture certification standard, due to be launched officially in April 2008, that includes most of Oxfam Novib's and IUCN-NL's recommendations on criteria. In this set of criteria Oxfam Novib and IUCN-NL would like GLOBALGAP to develop a direct involvement with a broad set of

Table 11.2. The four main points in Oxfam Novib and IUCN-NL advocacy to GLOBALGAP.

Include non-industry stakeholders	Towards a Multi Stakeholder Initiative
Open up the certification processes	Towards transparency
Co-finance the management of supply chains	Towards equity within the supply chain
Include social and environmental criteria	Towards management of *'external cost'* issues A key criterion is to have participatory assessments of impacts and what to do about them

stakeholders, including the communities surrounding the farms. Furthermore, Oxfam Novib and IUCN-NL are advocating for additional social and environmental criteria to become compulsory rather then voluntary (see Table 11.2). It is expected that certification on social and environmental criteria will work to decrease further negative impacts on the poor.

GLOBALGAP is due to make decisions on this in the first few months of 2008, and indeed a proposal is on the table that includes most of Oxfam Novib and IUCN-NL's recommendations on criteria. Also there have been other gains in the dialogues with GLOBALGAP. Some companies have improved farming practices, e.g. by improving contract farming arrangements, whereas others have initiated pilot projects to arrive at socially and environmentally certified shrimp production. However, it is also realised that, while knowledge and understanding of these concerns are growing in the industry, higher quality standards in shrimp aquaculture may possibly also drive a deeper wedge between large farms with international market access and small farms without such access. It is also still necessary to put arrangements in place that ensure that small farmers are being supported in the investments needed to improve their farming practices.

11.4. Support to Rehabilitation and Disaster

A third approach that Oxfam Novib takes to alleviating coastal poverty is that it supports rehabilitation after disasters. Natural disasters affecting poor people in coastal areas are becoming more frequent (Sudmeier-Rieux *et al.* 2006). Global trends in natural disaster occurrences and impacts suggest that several important patterns of vulnerability among people and places are emerging. However, these patterns mask considerable geographic variation. Asia is disproportionately affected by disasters, with more than 40% of all natural disasters in the last decade of the twentieth century

Table 11.3. An overview of mangrove losses in Aceh due to the tsunami.

Area	Percentage lost	Area lost
Aceh Besar	100%	26,823 ha
Banda Aceh	100%	<500 ha
Pidie	75%	17,000 ha
Aceh Utara and Bireun	30%	26,000 ha
Aceh Barat	50%	14,000 ha

Source: WI 2005

occurring in this region. During the same period, Asia accounted for almost 70% of all lives lost due to natural disasters (IFRC 2002).

In Indonesia, the vulnerability of coastal communities to disasters is amply illustrated by some key data provided by Walhi, the Indonesian Friends of the Earth. In 1999, 7000 coastal villages were affected by floods. In 2003 this figure had risen to 12,000 coastal villages affected. Coastal erosion (the loss of coastal land) also occurs regularly in a great number of villages. It affected more than 750 coastal villages during the years 1996-1999 (Damanik 2006).

On 26 December 2004, a tsunami hit Aceh, India and Sri Lanka, the single greatest disaster in recent history. It resulted in Aceh (northern Sumatra) in the death of 170,000 people; more than 600,000 people were displaced and many are still missing. Over half of all the households in the province were affected. The estimated losses and damage to infrastructure and houses totalled US$ 4.5 billion; of this, US$ 700 million related to damage to aquaculture and fisheries alone (CGI 2005).

A post-tsunami assessment of mangrove damage indicated a loss of about 85,000 ha (see Table 11.3, below), however deeper analyses of where and how the tsunami struck hardest indicated that healthy mangrove areas had been important in diminishing the impact of the tsunami in some areas; subsequent experimental research confirmed this (Danielsen *et al.* 2005; EJF 2006).

Soon after the tsunami hit Aceh, NGOs working in the affected areas appealed for support for their efforts to recover damaged coastal ecosystems and to reform coastal policies. Following urgent pleas from their local partners, four international organizations together developed the Green Coast programme: Wetlands International, IUCN-NL, WWF and Both Ends. Oxfam International also decided to support this initiative as part of its tsunami response. Support given by Oxfam Novib, through donations provided by the Dutch public, also included housing, schools, water and sanitation.

The Green Coast programme brings together work on environmental and social justice by *'marrying'* the restoration of ecosystems with poverty alleviation in coastal communities. This idea is captured in the *'bio-rights'* approach that the programme takes. The Green Coast programme includes three closely inter-linked components. In Indonesia, Sri Lanka, India, Thailand and Malaysia partner organisations are working together on:

- Assessing tsunami impacts on ecosystems and livelihoods, as well as on local communities views and rights;
- Influencing governments, aid agencies and the corporate sector to manage and restore coastal natural resources sustainably; and
- Facilitating small grants for community-based restoration projects combined with livelihood activities.

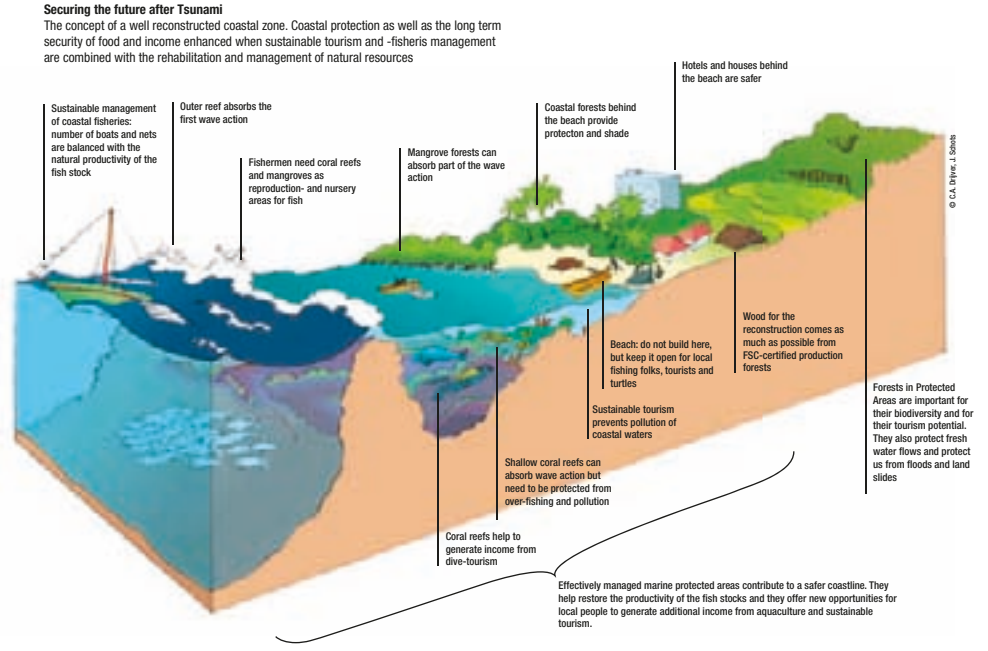
Oxfam Novib supports this important initiative because the actual restoration of coastal ecosystems is crucial to regain sustainable livelihoods for the future for the people in coastal areas in Aceh. Oxfam Novib itself and its partner network did not have the same capacity and depth of experience that the four implementing international organisations have. Oxfam Novib considers the Green Coast programme an important addition to complement other rehabilitation activities that are focused mainly on infrastructural and economic rehabilitation. The combination of environmental restoration and livelihoods support as applied by the programme is innovative and promising.

Some results from the first phase of the programme in Aceh, June 2005 - March 2007, are shown below:

- 59 coastal rehabilitation projects combined with livelihood activities implemented
- Total coastal area rehabilitated: 600 ha
- 206 ha planted with 1,500,000 mangrove saplings
- 394 ha rehabilitated with beach trees and other coastal vegetation
- 40 ha of coral reef rehabilitated
- 3405 individuals participated and benefited from livelihood activities
- More than 40,000 individuals benefit from better ecosystem conditions

In addition, the Green Coast programme has had qualitative outputs - providing trainings, ecological assessments and information delivery to government officials and development organisations. It also introduced the *'bio-rights'* approach to Aceh (van Eijk 2007). In essence, this is a payment mechanism wherein local communities offer ecological management services for a payment (grant or micro-credit) provided by a donor. The Green Coast *'bio-rights'* approach has proven to be a successful and cost effective approach to create resilient communities with technical capacities to restore and manage coastal ecosystems as a buffer zone and as a basis for their sustainable livelihoods. The key ingredients have been a sound understanding of the environmental and social conditions along the coast, support to community-led ecosystem restoration, and the use of findings at the community level to influence development plans and policies.

Figure 11.4. The basic vision for sustainable coastal development in the Green Coast programme (courtesy Carel Drijver, WWF Netherlands.



To illustrate this, a village leader is quoted as saying: *'The land and soil have changed because of the tsunami. Before, many trees could grow here, but now we need to plant other kinds of trees. Green Coast teaches us which species to use and other ways of working'.*

11.5. Conclusion

With reference to the description, shown at the beginning of the paper, of an individual fisher and his household affected by a multitude of problems and driven into a spiral of diminishing livelihood opportunities, it is hoped that this paper has illustrated how Oxfam Novib aims to achieve sustainable livelihoods through a multi-level approach directed at several of these problems simultaneously.

As coastal livelihoods are crucially important, so are the coastal ecosystems that people depend on for livelihood, health and well-being. Effective assistance to alleviate poverty in coastal and natural resource-dependent communities must include:

- finding livelihood opportunities
- avoiding negative impacts and threats
- assisting in rehabilitation after disasters

From Oxfam Novib's developmental perspective, the health of coastal ecosystems and the health and well-being of coastal people are intimately related. Although Oxfam Novib focuses on the latter, it is well aware how important the former is for its success, and for coastal people's well-being.

11.6. About Oxfam

Oxfam Novib is a member of Oxfam International (OI). OI is a confederation of 13 Oxfams working together with over 3000 NGOs and their networks in more then 100 countries. Oxfam Novib and OI want to find lasting solutions to poverty, suffering and injustice. Oxfam works with poor people, we create awareness among richer people, and we influence powerful people: governments, the private sector and (when it comes to trade) also consumers. The authors work in the SE Asia Bureau of Oxfam Novib as Bureau Head and Indonesia Program Coordinator; they are based in The Hague, Netherlands.

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12. Managing Wetlands for People and Nature to Minimise the Risks of Disease - an Example of Avian Influenza

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Abstract

Migratory waterbirds have served as natural hosts for low pathogenic avian influenza (LPAI) viruses for many thousands of years. Land-use changes resulting in farms and wetlands being closer to one another, and open grazing of poultry in post-harvested rice fields and wetlands shared amongst wild birds and domestic birds, create sources for transmission of viruses amongst these sectors. With production intensification, over-crowding and increased stressors on poultry, LPAI can mutate into highly pathogenic avian influenza (HPAI) in domestic poultry flocks, causing a high mortality rate - this being one hypothesis to explain the emergence of the HPAI H5N1 virus in Asia. Also, spreading of infected manure as fertiliser and water run-off from farms into natural habitats may be mechanisms by which disease moves from agriculture into wild birds.

Although it is unclear as to the mechanism by which HPAI H5N1 virus arrived at Qinghai Lake, China, in 2005, thousands of migratory birds have died there. Later that year and into 2006, Qinghai strains of HPAI H5N1 were found in West Asia, Europe and Africa with movement of the virus linked to the trade of infected poultry and poultry products as well as to wild birds. Through surveillance, awareness raising and capacity building worldwide, the Food and Agriculture Organization, the Wildlife Conservation Society, Wetlands International and a wide range of additional stakeholders are working together to elucidate the role of wild birds in the spread of avian influenza. Improved biosecurity is a key measure in reducing the risk of spreading HPAI. Killing waterbirds and destroying their habitats unfortunately still seem to happen, but such measures are ineffective at controlling or preventing disease and violate international law related to migratory species.

Key Words: wetlands, avian influenza, H5N1

12.1. Introduction: The Ecology of Avian Influenza

Avian influenza (AI) viruses are highly contagious, extremely variable viruses that are widespread in birds, particularly wild waterbirds and shorebirds. Many of these viruses, which are usually carried asymptomatically by wild birds, cause only mild disease in poultry. Others, the highly pathogenic avian influenza (HPAI) viruses, can kill up to 90-100% of a poultry flock.

The disease emergence pattern of AI is determined by a complex of factors including epidemiology, livestock production systems and cultural practices.

Looking at the ecology of the virus, aquatic birds, both migratory and resident, and particularly ducks, have served as natural hosts for low pathogenic avian influenza (LPAI) viruses for many thousands of years. They are a 'benign reservoir' for LPAI. These viruses do not make the ducks sick: such viruses can be spread more easily if they do not make their hosts sick. Ducks infect the water they live in and others become infected from that water, mainly as juveniles. The virus lives almost exclusively in the intestinal tract of the birds, which are infected for only a short period, shedding the virus for a few days. It is believed that the virus occurs in such high concentrations in the water, and that the faecal-oral transmission is so effective, that virtually every duck in the world becomes infected at some stage in its life by these LPAI viruses. This cycle of infection and re-infection has been in place for many thousands of years, and humans have not succumbed to AI. The parasite and host coexist in an optimally adapted system, and the virus is in evolutional stasis, remaining unchanged despite its potential to change rapidly through mutation.

The domestication of ducks and livestock production systems in general have changed this situation. Humans have altered the natural ecosystems of birds by keeping them in captivity, domestication, industrial agriculture and non-traditional husbandry.

LPAI viruses can become highly pathogenic (HP) through mutation. AI viruses become dangerous only when they pass from wild birds to poultry (Honingsbaum 2005). Once LPAI viruses penetrate poultry facilities, they can progressively gain pathogenicity in domestic birds until they become HPAI, and it is the 'high density confinement rearing methods' that best facilitate this (Suarez et al. 2003), removing the natural obstacles to transmission that prevent the virus from becoming too dangerous (Greger 2006).

Presented with a new host and new survival and reproduction challenges the selection for successful mutants starts to drive change. Mutating is what influenza does best, and given enough time and enough hosts within which to mutate some AI viruses can 'learn' how to invade other organs in search of new ways to spread themselves. In the natural situation the virus needs a healthy host to transmit (fly) it from wetland to wetland: making the host sick would limit the spread, and the virus has evolved to limit itself to the intestinal tract. In a new host (chicken) this is different and other organs are also infected (Greger 2006). The H5N1 virus seems to have entered chicken populations as an intestinal virus and has now become a more respiratory virus (Sturm-Ramirez et al. 2005; Keawcharoen *et al.* 2008).

12.2. Wetland Loss

At the global level, wetland losses over the past two centuries have been severe. It is estimated that between the 1780s and 1980s a 53% decline occurred in the wetlands of the conterminous USA (Dahl 1990). In Africa, losses in wetlands varied considerably in different parts of the continent. For example, in Natal (Southern Africa) the Tugela Basin has seen the loss

of over 90% of its wetlands, while in the Mfolozi catchment approximately 58% of the wetlands have been destroyed (D.J. Rapport, Ecohealth Consulting, personal communication). The situation in densely populated regions of Southeast Asia differs from that in much of the rest of the world in that extensive wetland loss has occurred over a very long period of time, as lowland rice cultivation was established about 6500 years ago (Moser *et al.* 1996). Indeed, over the millennia vast areas of wetland in southern and eastern Asia have been converted into rice fields or drained for other forms of agriculture and human settlement. As a consequence, for example, no trace remains of the natural floodplain wetlands of the Red River Delta in Vietnam, which originally covered 1.75 million ha. Similarly, virtually nothing remains of the 1 million ha of natural floodplain vegetation that once covered most of the Sylhet Basin in Bangladesh and the 6 million ha of floodplain wetlands in the lowlands of central Myanmar. It is also assumed that almost all of the 40 million ha of rice cultivation in the central plains of India were developed at the expense of natural wetlands, as were the 1.9 million ha of rice cultivation in the central plains of Thailand. In all of these regions, very little natural wetland vegetation survives (Scott 1993; Moser *et al.* 1996).

12.3. Agricultural Intensification

The loss and degradation of wetlands and the domestication of waterbirds, intensification of livestock production systems for ducks, poultry, fish and pigs and habitation by man have gone hand in hand. This has created new niches for AI viruses (Steneroden *et al.* 2007). It is now recognised that some of the agricultural production systems, such as *'pig-hen-fish aquaculture'* create considerable potential (human) health hazards (Scholtissek and Naylor 1988).

More generally the issue is that (agri)cultural practices and environmental change have resulted in more commingling and contact, either directly (e.g. by wild migratory birds having open access to watering and feeding areas) or indirectly (e.g. through flows of wastewater), between domestic poultry and wild birds at (the edge of) wetlands. In Southeast Asia the large-scale and ongoing loss of natural wetlands will further increase the mixing of wild migrating birds with domestic fowl. This may be of particular concern in the lowlands of China, where the loss of natural wetlands over hundreds of years has created vast agricultural areas providing food and water for both domestic and wild birds. Such situations provide ideal conditions for AI to move between migrating wild birds and domestic flocks. Furthermore the farming of free ranging domesticated ducks in rice fields in Thailand has been shown to be very closely correlated to outbreak patterns for H5N1 (Gilbert *et al.* 2006).

12.4. The Emergence of HPAI H5N1

Practices like those described above seem to have played a key role in the emergence of the recent HPAI crisis. As a result of analysing the genome of H5N1, it is believed that in 1997 an H5 domestic goose virus from Guangdong, China, combined with an N1 domestic duck virus, with domestic quail acting as the mixing vessel, subsequently jumping to chickens and then to humans. In a separate emergence in 2001, the same H5 goose virus combined with an N1 duck virus in a duck, then jumped directly to chickens (Webby & Webster 2001).

Live (or *'wet'*) markets in Guangdong and Hong Kong seem to have played a crucial role in allowing the goose H5 to *'find'* the duck N1 in quail and thence to chickens in Hong Kong (Greger 2006). There is mass production of ducks for human consumption in China, and Guangdong Province has long held the largest concentration of poultry,

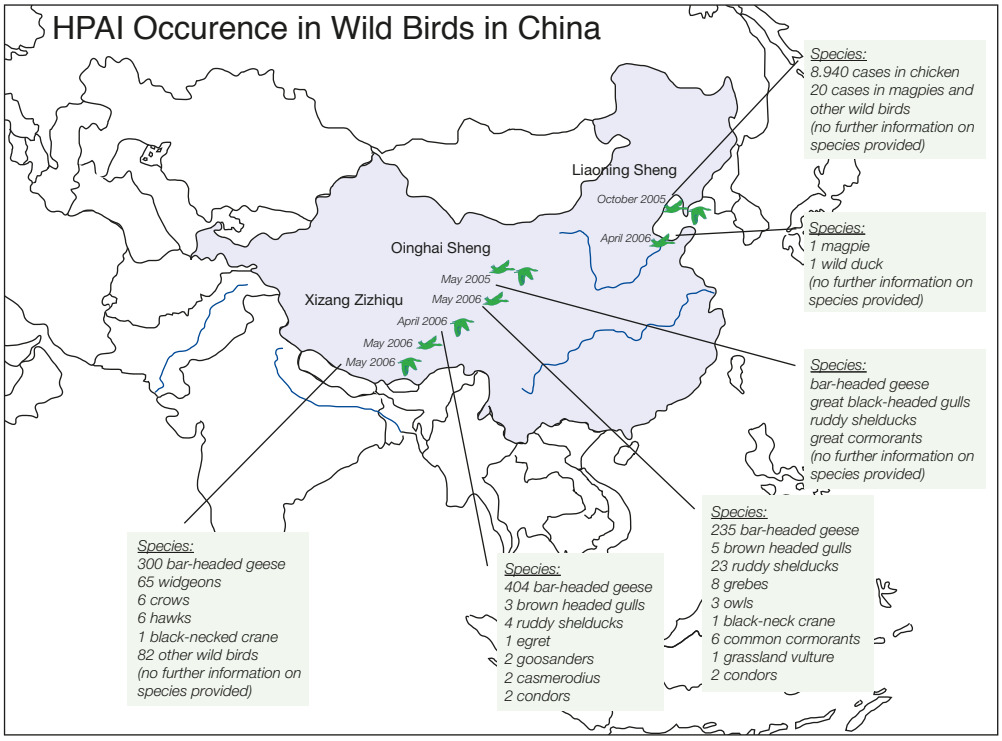
pigs and people in the world (CDC 2005). Many of the birds are traded in the Hong Kong wet markets: 100,000 live chickens flow into Hong Kong every day, and it is considered to be an AI virus melting pot with chickens, ducks, geese and quail all in close proximity (Shortridge *et al.* 2003). It is the cultural preference for eating warm, freshly slaughtered meet that drives this live trade, and the mass outbreaks of H5N1 in early 2004 (resulting in the culling of over 100 million chickens across eight countries in Southeast Asia) was traced to the trade in live birds (FAO 2005). The initial spread of H5N1 seems to have taken place via railways and highways, not the flyways of migratory birds (Greger 2006).

12.5. The Spread of H5N1 from China to the West

In the spring (late April) of 2005, Bar-headed Geese Anser indicus started showing signs of HPAI H5N1 at Qinghai Lake in China, and the first deaths were reported in early May 2005, involving four bird species (see Figure 12.1). Later, in early summer 2005, domestic and wild bird infections of HPAI H5N1 were encountered along the Western Siberian Lowlands and also in Mongolia and Kazakhstan.

In May and June 2006, new cases of HPAI in wild birds were confirmed in Qinghai and Tibet Provinces in China. Given the low poultry densities in these provinces it is proposed that the virus arrived at Qinghai and in Tibet through wild birds - either migratory birds stopping along their

Figure 12.1. Outbreaks of HPAI at Qinghai Lake (2005-2006).



migration route, acquiring disease, and travelling shorter distances to arrive at Qinghai Lake, or migratory birds bringing the disease over long distances (from their overwintering grounds). It is not known whether wild birds are able to undertake long distance migration while infected with HPAI H5N1.

Since no numbers were recorded for the wild bird die-off at Qinghai Lake in 2005, it is difficult to know whether the die-off in wild birds in 2006 represents an increase or decrease in mortality. It is known that the 2006 outbreaks caused mortality in many more species (15) than did the 2005 outbreaks, which killed wild birds of four species.

The disease pattern during summer 2005 showed major clusters of domestic and wild bird H5N1 infections in the Novosibirsk-Omsk area. This is an important area where large numbers of waterbirds congregate to moult during July and August, just before their departure for migration, primarily to the south and west to reach wintering areas farther along the Central Asian and African Eurasian Flyways. It has been suggested that the spread of the disease is associated with the migration of waterbirds, but other means of spread cannot be excluded.

The spread of H5N1 continued in Russia through August and September 2005, primarily in the form of outbreaks in poultry; it moved progressively west beyond the Ural mountains and southwest to reach the Black Sea and Mediterranean basins and other parts of Europe.

12.6. The Role of Wild Birds in the Spread of HPAI H5N1

Movements of poultry and poultry products and the wild-bird trade are known to be the main routes for the spread of H5N1, locally and across national and continental borders. There have been instances, including in Mongolia (2005 and 2006), Europe (winter, early 2006; summer 2007) and Turkey (2008), where wild-bird movements are considered to have been the most likely means of transmission of the virus. Since the large geographical expansion of HPAI H5N1 from eastern Asia in 2005 to Europe and Africa, millions of wild birds have made multiple intercontinental migrations through infected countries to and from their breeding grounds, moving to every country in the world. Yet, to date, there have been outbreaks of HPAI H5N1 in only 60 out of 192 (31%) countries worldwide (FAO: Frequently Asked Questions HPAI, in preparation). Not enough is known about the migratory routes of waterbird species, the sites they use on their journeys and the occurrence of HPAI H5N1 in healthy wild birds. Together with other stakeholders, FAO, the Wildlife Conservation Society and Wetlands International have collaborated on surveillance for AI in wild birds, on satellite tracking of wild birds and on organising censuses of wild waterbirds in order to have a greater understanding of these important facts and thus be able to address the issue of HPAI H5N1 strategically.

Approximately 350,000 samples from healthy wild birds from Africa, Asia, Europe and the Americas have been gathered and analysed in 2005-2008. The results have been negative for HPAI H5N1, with only a few instances reporting positive, including six migratory ducks at Poyang Lake, China, in 2005. Four viruses were recorded in Tree Sparrows Passer montanus in Henan Province, China; one in Great Crested Grebe Podiceps cristatus in Novosibirsk Province, Russia in 2005; and one in Common Pochard Aythya ferina in Lake Sempach in Switzerland in 2008 (FAO: Frequently Asked Questions HPAI, in preparation).

12.7. Healthy Wetlands, Healthy Birds, Healthy People

Clearly, the loss of wetlands and the severe pressures placed on remaining wetlands by cultivation and conversion for agricultural production, which results in greatly intensified intermingling of domestic and wild birds, plays an important role in the emergence and spread of HPAI H5N1.

The Ramsar Convention on Wetlands identified the importance of the emerging issue for wetlands and waterbirds and at its 9th Conference of the Parties (COP9) (November 2005) passed its first ever emergency resolution on the issue. Key points include:

- A call for fully integrated approaches, at both national and international levels, to address HPAI by bringing ornithological, wildlife, and wetland management expertise together with those traditionally responsible for public health and zoonoses, including veterinary, agricultural, virological, epidemiological, and medical expertise;
- Support for the conclusions of WHO, FAO and OIE that attempts to eliminate HPAI in wild bird populations through lethal responses such as culling are not feasible and may exacerbate the problem by causing further dispersion of infected birds (Ramsar Convention 2005).

Similar points were included in resolutions passed by the 3rd Meeting of the Parties to the African Eurasian Waterbird Agreement (MoP3) (AEWA 2005) and 8th Conference of the Parties to the Convention on Migratory Species (CoP8) (CMS 2005) both in October 2005, shortly after the virus had begun to move westward.

In the Conclusions and Recommendations of a Scientific Seminar on Avian Influenza, the Environment and Migratory Birds, held in Nairobi, Kenya, from 10 to 11 April 2006, the Scientific Task Force on Avian Influenza and Wild Birds clearly highlights the link between healthy wetlands, healthy birds and healthy people, stating:

'The degradation of the health of ecosystems as documented by the Millennium Ecosystem Assessment and a review presented to the Seminar, and especially in the decline in extent and condition of wetlands, has had a role in the evolution and spread of HPAI H5N1. It has created the conditions where there is closer contact and mixing between people, domestic poultry (including ducks), and wild waterbirds. This encourages cross-infection with the potential of causing genetic changes which may result in higher viral pathogenicity. Reducing the opportunities for such contacts through preventing further loss of wetlands, improving mechanisms for the maintenance and wise use of wetlands is an important long-term requirement.

To this end it would be valuable to develop and disseminate practical guidance, inter alia in collaboration with the Ramsar Convention. It would also be desirable in collaboration with FAO to develop and disseminate practical guidance in restructuring agricultural production systems with the goal of reducing stress on the environment and risks to human health. Agro-ecosystem health is viewed as a key to sustainable human health and well-being'.

Well-being is about more than human health: it reflects a more holistic approach, which importantly includes wetland-ecosystem health. In order to continue to improve human health, it is necessary to work to (re-)create healthy ecosystems as a part of sustainable development, meaning ecosystems that deliver services to people and biodiversity sustainably. Maintenance and restoration of the health of wetlands is key to preventing the spread of HPAI and other diseases.

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13. Wetland Conservation and Its Strategic Goals in China

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Abstract
China has extensive, biodiversity-rich wetland systems that are in rapid decline. Despite the recognised values of wetland services, water security is weak. Medium- and long-term strategic plans and associated legislation for wetland conservation are now in place, with the responsibility for wetland management given to the State Forestry Administration.

Key Words: China, wetlands, water security, legislation, management plan

13.1. The Current Status of Wetlands in China

China is a country with diverse wetland ecosystems and large wetland areas. All the 31 types of natural wetlands and nine types of human-made wetlands as classified by the Ramsar Convention on Wetlands can be found in China. According to the national wetland resources survey, China's wetlands cover a total area of 38.48 million ha (excluding the 38 million ha of paddy fields), and comprise 36.20 million ha of natural wetlands and 2.28 million ha of reservoirs and ponds. China also supports a rich wetland biodiversity. As many as 272 species of birds live in the wetlands in China, which are key areas for protecting globally rare and endangered waterbirds. The survey also shows that the area of wetlands in China is declining, and the wetlands themselves are becoming degraded and are no longer able to function effectively. This is due mainly to the following factors:

- natural factors, including climate warming, reduced rainfall, desertification, natural shrinkage and siltation;
- human-induced factors, which are the underlying causes for the decrease of wetland areas and functions, such as unsustainable reclamation and conversion, pollution, over-exploitation of resources, water and soil loss, and unwise use of water resources;
- institutional and administrative factors. Lack of policy and legislation, gaps in the administrative system and insufficient investment have largely constrained the healthy development of wetland conservation efforts in the country.

13.2. Wetland Functions and Values - Safeguarding water security

China is one of the 13 countries in the world with the poorest water supply, and the per-capita freshwater capacity is only 2200 m^3 - a quarter of the world average of 8840 m^3. Fast expanding socio-economic development and population growth are placing ever greater pressure on water security, posing a direct threat to maintaining ecological security and resulting in the need to implement a sustainable development strategy in China. Wetlands are often described as the *'kidneys of the earth'* because of their ability to remove pollution and purify water. They do this by filtering and absorbing the pollutants through the micro-organisms and aquatic plants within the wetland. Wetlands are, therefore, the source of clean freshwater. They also play a significant role in the hydrological cycle and in water regulation, being able to retain rainfall and land surface run-off, and replenish ground water. Many rivers in Asia originate in the Sanjiangyuan (Source of Three Rivers) area in China, with 25%, 49% and 15% of water in the Yangtze, Yellow and Lanchang (Mekong) Rivers respectively generated from this area, which is considered the lifeline of China and other Asian countries. Approximately 2.7 trillion tons (96%) of the freshwater resources available in China are held in its wetlands. As a result, protecting and exploiting wetland resources and maintaining the health of wetland ecosystems are fundamental to maintaining the water security of the country.

13.3. Controlling or mitigating global warming

The significant role of wetlands in regulating climate change has been gradually recognised by the world's governments and scientific community. The Ramsar Convention's resolution on wetlands and climate change emphasises the importance of good wetland management.

An estimated 2.48 trillion tons of carbon are now sequestrated in the global terrestrial ecosystems, with 500 billion tons of carbon being stored in peatlands, which comprise less than 4% of the land area. In China, palustrine wetlands store a total of 4.7 billion tons of carbon, 1.9 billion tons of which are located in the Ruoergai marshes. The study indicates that the carbon sequestration capacity of palustrine wetlands is 343 tons per hectare, twice that of forests of the same area. Compared with forest resources, wetland plants can be repeatedly harvested and easily maintained. With the increasing recognition by the international community of the important functions and benefits of wetlands, the great potential of wetlands in combating global climate change has been emerging.

13.4. Maintaining biosecurity

Naturally functioning wetlands, with their seasonal patterns, complex ecosystems and rich biodiversity, provide the staging, migratory, wintering and breeding sites necessary for a wide range of rare and endangered wild animals, in particular waterbirds. For example, Red-crowned Cranes *Grus japonensis*, which enjoy Grade 1 protection at national level, often feed and stage in 24 natural wetlands along their migratory route from Russia to southern China. If any of these wetland sites are damaged a fatal threat could be posed to the Red-crowned Cranes and other rare and endangered wild animals. China is rich in wetland biodiversity, being home to over 2200 species of wild plants and 1770 species of wild animals. The wetlands in China serve as the only over-wintering sites or important migratory passage sites for many rare and endangered waterbirds. Meanwhile, the genetic qualities of many wild plant species are maintained in natural wetlands, and this enables these species to survive and reproduce undisturbed. The highly productive rice developed by Yuan Longping, an academician with the Chinese Academy of Engineering, generates a total economic benefit of RMB 600 billion; it was developed genetically from wild rice found in natural wetlands. In this respect, wetlands are essential to maintaining the national biosecurity of China.

13.5. The provision of material support

Wetlands are called the *'treasury of natural resources'* for the food, meat, medicine, energy and industrial materials they provide for human beings. The food and fibre provided by the wetland plants are important sources for the livelihoods and productivity of the people. They also provide industrial materials (e.g. salt, alkalis, precious metals and fossil fuels) and support industrial development and energy generation. Moreover, the inland lakes and coastal marshes function as natural aquaculture areas, with fishery production supplying an important source of protein. In China, more than 300 million people depend directly or indirectly on wetlands for their livelihood and development; this figure reaches 1.5 billion globally. With the gradual exploitation of the economic functions of wetlands, the environmental services provided by wetlands will play a more significant role in human socio-economic development.

13.6. Cultural services

The aesthetic, educational, cultural and spiritual values provided by wetlands have produced folk customs, and have inspired writers, musicians, artists and photographers. In the ethnic areas, many lakes are considered to be holy and are important places for religious activities. All the four most famous ancient towers in China are located in and around wetland areas, and many literary masterpieces created on these towers have been handed down. In today's world, most modern urban areas are located around wetlands, while the economically developed areas occur mainly

in the delta and coastal regions. Wetlands have thus become the ideal destination for recreation and tourism, demonstrating the harmony between humans and nature, and promoting ecological culture through their beautiful natural landscape and attractive wildlife. According to IUCN, the total value of global ecosystems is estimated to be US$ 33 trillion, of which the wetland ecosystems - only about 6% of the total land surface - have a value of US$ 5 trillion. In China, the values of various ecosystems are calculated to be RMB 7.8 trillion. Although wetland areas in China account for only 3.77% of the total land area of the country, they are valued at RMB 2.7 trillion, with high individual values.

13.7. Major Achievements in Wetland Protection and Management

The Chinese government has always placed a high priority on wetland conservation. National leaders such as President Hu Jintao and Premier Wen Jiabao have made inspection tours to the wetlands. As President Hu pointed out, China should continue to implement a forestry strategy with a particular focus on ecological development, promoting the six key forestry programmes, further controlling desertification and protecting the wildlife resources, and preventing the ecological conditions from being degraded. Premier Wen also noted that legislation and integrated measures should be introduced to strengthen wetland conservation. He requested that wetland restoration should be enhanced following the water pollution in Taihu Lake. Furthermore, wetland conservation is listed as an important action to *'protect well the natural ecological conditions'* in the Eleventh Five-Year Plan for National Economic and Social Development (2006-2010), which integrates the coastal shelter forests and Sanjiangyuan conservation programmes. At the present time, a system of governmental leadership and public participation is being implemented for wetland conservation in China.

13.8. A medium- and long-term strategic plan for wetland conservation has been developed

After the catastrophic flooding of the Yangtze River in 1998, the State Council of China released guidelines for integrating flood control and wetland restoration (e.g. *'removing lakeside embankments for releasing floods, and returning cropland to lakes'*), which marked a new stage for wetland conservation policy in China. In early 2000, the central government launched six key national forestry programmes, listing wetland conservation as one of the major components of wildlife conservation and nature reserve development. In 2003, the National Wetland Conservation Programme was approved by the State Council. In 2004, the General Office of the State Council issued the Notice of Enhancing Wetland Protection and Management. In 2005, the State Council sanctioned the National Wetland Conservation Programme Implementation Plan prepared jointly by the State Forestry Administration (SFA) and other agencies, which is being implemented with the Eleventh Five-Year Plan for National Economic and Social Development. To date, the central government has earmarked a total of RMB 800 million for carrying out the national wetland conservation programme. In addition, other wetland-related national plans, such as the National Marine Function Zoning, National Water Resources Conservation Comprehensive Plan and National Land Use Master Plan, are being implemented as scheduled. The Chinese government has also enhanced its pollution control in a number of major river and lake basins, e.g. Huaihe, Haihe, Liaohe Rivers, and Taihu, Chaohu and Dianchi Lakes, having improved the water quality of these wetlands.

13.9. Legislation on wetland conservation has been launched

Since the late 1990s, the SFA has brought together experts to conduct systematic studies on legislation for wetland conservation. A general guideline on *'all-round protection and wise use, prioritising ecological conditions, and focusing on some key areas'* has been defined in the light of current conditions, focusing on wetland conservation and highlighting the overall protection of wetland as a special ecosystem. The basis for protection is that wetlands should be used wisely to control unregulated exploitation activities. The National Regulation on Wetland Conservation has been drafted for approval. At the provincial level, seven provinces and autonomous regions including Heilongjiang and Inner Mongolia have already formulated their local regulations on wetland conservation. Other wetland-related national laws, such as the Forest Law, Law on the Protection of Wildlife, the Environmental Impact Assessment Law, Law on the Administration of Marine Areas, Water Law and the Law on Water Pollution Control, have all played their role in protecting wetlands and restoring their functions.

13.10. The relevant institutions have been established and strengthened

In 1998, the State Council designated the SFA to be responsible for organising and coordinating national wetland protection and management, as well as for implementing relevant international conventions. In 2005, the central government approved the establishment of the Wetland Management Center of the SFA (the Ramsar Convention Implementing Office of China). The Chinese National Commission on Implementing the Ramsar Convention, consisting of the SFA as the lead agency, the Ministry of Foreign Affairs and other 14 agencies, was also set up, and, as a cross-sectoral organisation, will play a crucial role in involving and supporting wetland conservation. The wetland management institutions at provincial level have been strengthened, with more than 10 provinces, municipalities and autonomous regions having established their own organisations for wetland conservation. The capacity of the administrations of some wetlands of national and international importance has also been strengthened in the process of implementing the wetland programmes and other projects.

13.11. The wetland protection and management system has been reinforced

To date, China has designated more than 470 wetland nature reserves as major areas for protecting and maintaining the ecological functions of wetlands. The establishment of wetland parks has also become a major method for conserving and using wetland areas wisely. To date, 18 national wetland parks have been established, covering a total area of 270,000 ha. Measures such as strengthening management and setting up demonstration activities have promoted scientific studies, monitoring, public education and eco-tourism in these wetland parks. A network of combined wetland nature reserves, wetland parks and wetland protected zones is being made available in China.

13.12. Public education and training activities have been conducted

Each year on World Wetlands Day, the SFA and other wetland-related agencies organise campaigns to raise public awareness of wetland conservation. In the past, the SFA worked with the China Agricultural Film Studio to produce the film '*Protecting the Wetland Ecological Barrier*', which won the prize for Best Documentary in the China Movie Awards. The SFA also collaborated with relevant international organisations to hold the first photo exhibition on wetlands in China, which will be used as one of the

brochures for the Tenth Conference of the Contracting Parties (CoP) of the Ramsar Convention. Through the Exhibition on the Major Outputs of Wildlife Protection, the SFA presented the major achievements in wetland conservation in China to the general public. The first China Wetland Museum, approved by the SFA, is being established in Hangzhou. A number of scientific journals on wetlands, including The Wetland Newsletter and Wetland Science & Management, have played a significant role in disseminating general knowledge on wetlands and wetland conservation to the public.

13.13. Great efforts have been made in implementing the Ramsar Convention and in international cooperation

On 3 January 1992, China ratified the Ramsar Convention on Wetlands. To date, 36 sites in China have been listed as Ramsar sites, covering a total area of 3.80 million ha. At the ninth meeting of the CoP of the Ramsar Convention, in 2005, China was elected as a member country of the Standing Committee of the Convention. Over recent years, China has leveraged the international collaborative mechanism of the Ramsar Convention to raise international funding for wetland conservation. Almost RMB 200 million has been attracted and used for wetland protection, restoration, wise use and capacity building, which has contributed substantially to the full development of wetland protection and management in China. A number of pilot monitoring sites have been established at the Ramsar sites in China. China is also actively involved in implementing some key international projects, such as the programme on ecological water supply, and contributed to the UN Millennium Ecosystem Assessment. Meanwhile, China plays a leading role in promoting the protection of high-altitude wetlands, with three successive international workshops on this topic being held in China, in Urumqi, Sanya and Kunming. As a result, the great achievements of the Chinese government in wetland conservation have been widely acclaimed by the international community. In 2002, the annual prize of Gift to the Earth was awarded by WWF to Mr. Zhou Shengxian, the former minister of the SFA. In 2004, China was honoured by Wetlands International with the prize for Global Recognition for Wetland Conservation and Wise Use. Prof. Cai Suming together with the Chinese Academy of Sciences also won the Wetland Science Prize in 2005.

13.14. The Mission and Objectives of Wetland Conservation in China

The overall objective is to:

- maintain the ecological properties and functions of wetland ecosystems to halt the degradation of natural wetlands in China, through such measures as protecting and managing wetlands and their biodiversity, developing wetland nature reserves, controlling pollution and restructuring land use;
- secure intact and extensive wetland ecosystems in the natural ecological system, and maximise the various functions and benefits of wetland ecosystems to contribute to human health and well-being;
- under the overall strategic goal of wetland conservation and wise use, the nation will focus on wetland conservation in the short and medium terms.

Priority will be given to protecting the natural wetland ecosystems, supported by the ecological restoration and rehabilitation of degraded wetlands and demonstration of wetland wise use.

The immediate objective is to:

- secure the effective protection of 50% of natural wetlands and 70% of wetlands of national and international importance, and preliminarily establish a natural wetland conservation network-based system by enhancing wetland nature reserve construction and management;
- initially halt the shrinking and degradation of the natural wetlands through restoration demonstration projects; and
- significantly improve capacity in terms of wetland resources monitoring, governance, research, public education and wise use.

The long-term objective is to:

- designate 713 national wetland nature reserves and 80 Ramsar sites to secure the effective protection of over 90% of natural wetlands;
- complete wetland restoration projects over 1.40 million ha, and establish 54 national demonstration sites on wetland conservation and wise use;
- develop a relatively sound system for wetland protection, management and wise use in legal, policy and scientific research aspects; and
- establish a complete system for wetland site protection and management so that China takes a lead in this regard.

The strategic focus is to enhance the protection of natural wetlands, further promote the ecological restoration of degraded wetlands, facilitate the wise use of wetland resources, increase the capacity of sustainable development in terms of wetland conservation and wise use, and implement the national wetland conservation programme.

The strategic measures are intended to:

- integrate wetland conservation into land-use planning, achieving *'zero-growth'* in the conversion of natural wetlands. Land-use planning should meet the needs of national ecological security; land used for ecological protection will be delimited to regulate its special use; and a licensing system for converting the natural wetlands will be established;
- combine wetland conservation and integrated river basin management. In particular, the environmental impact must be considered when implementing and assessing water control and diversion projects. Efforts should be made to reduce the negative impact of water development projects on wetland health, while implementing a comprehensive management system for integrating wetland conservation and river basin management. Furthermore, a national plan for safeguarding environmental flows will be developed;
- take account of the economic values of wetlands in policy making. In developing sustainable wetland management strategies, particular focus should be placed on economic values, including incentives and fines, and both market-based and contractual valuations. A suitable eco-compensation system should also be established to promote the integration of the rights and interests of wetland resources; and
- build wetland protection and management structures under the goal of sustainable development. A legal framework will be formulated to grant special protection status to natural wetlands. Management rules and ecological risk assessment mechanisms will also be put in place.

14. Wetlands, Food Security and Nutrition in the Mekong - Lessons and Practical Implications

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Abstract

This paper draws on the author's experience working on livelihoods, policy and wetlands issues in the Mekong region for the last fifteen years, providing both a personal reflection and an analysis of project implementation strategy[1]. During this time there have been important shifts in the thinking and practice of wetland resource management, most significantly represented by a shift in emphasis from conservation to livelihoods, and more recently to considering issues of food security, nutrition and health. The paper presents an overview of these conceptual shifts before outlining a process of livelihoods assessment drawn largely from experience in Lao PDR and to a lesser extent Cambodia that helped build an integrated wetland resource and livelihoods strategy. The paper then discusses some of the lessons that emerge from this experience.

Key Words: Mekong, wetland, health, nutrition, poverty reduction

[1] In particular this paper draws on experience of two Mekong regional wetlands projects - i) The ongoing Wetlands Alliance Programme (WAP), a partnership of the WorldFish Center, Asian Institute of Technology (AIT), Coastal Resources Institute (CORIN) and WWF, funded by SIDA., and ii) the completed Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP), funded by UNDP and the Royal Dutch Government, implemented by IUCN, UNDP and the Mekong River Commission.

14.1. Historical Overview

14.1.1. Birds, baskets and food: moving from conservation to livelihoods

Over the last two decades, the thinking and practice of wetlands conservation and livelihoods has shifted dramatically. Twenty years ago the principal interest in wetlands as a specific resource type was driven by conservation objectives, and largely bird conservation interests, with a focus on fencing and protection. When wetland conservationists showed an interest in people, their interest, as was the case with the conservation sector in general, was driven by a recognition that conservation could not be achieved without considering at least some of the socio-economic needs of people dependent on wetland resources. People and their poverty were seen largely as threats to rather than opportunities for wetland conservation.

At this stage, within the wetland conservation sector poverty reduction was seen in terms of how wetlands in their conserved and *'natural'* state could contribute to livelihood improvement, and thereby overcome the choice between conservation and development. The main interests were in promoting wetland conservation livelihoods and in activities that were identified in terms of how they could utilise wetland resources. Such activities included generating income through promotion of basket weaving and other wetland handicrafts, and promoting eco-tourism. But the starting point for these types of approaches remained the natural resource base itself, identifying what it had to offer in terms of people's livelihoods to meet conservation objectives. The extent to which these kinds of approaches fitted with the context of local livelihoods and addressed more fundamental livelihood needs and broader issues of equity and marginalisation was questionable.

During the last two decades there have also been significant shifts in development thinking about poverty, vulnerability and livelihoods. This itself has been driven by the failures of the past, and has generated a growing interest in people-centred approaches to understanding environmental challenges, and in promoting sustainable livelihoods and participatory approaches to poverty and vulnerability. Development thinking was also driven by a growing realisation that much of the effort from development interventions had failed to meet poverty reduction objectives, and in many cases development interventions had made people poorer, promoting activities that did not fit with local needs, and were unsustainable beyond the life of funded interventions. A common theme emerging in development thinking was the need to put people first (Chambers 1983), and to understand the many dimensions of vulnerability and poverty based on how people manage a portfolio of resources, whether natural, economic, cultural or social, in the context of community, markets and states (Lewis and McGregor 1992; Carney 1998). Analyses of famine through the lens of entitlements revealed why some people rather than others become susceptible to famine and starvation, clearly illustrating that vulnerability is not determined solely by failures in food production (Sen 1981; Swift 1993).

Through these kinds of approaches has arisen a greater understanding of the food security, nutrition and health dimensions of vulnerable livelihoods. The recognition of the environment as a source of natural resources and assets brought these issues more clearly into the realm of development studies and stimulated a greater interest on the part of the rural development sector in how natural resource management might contribute to other developmental objectives. As vulnerable people living on vulnerable, marginal resources, people living in wetland systems become increasingly an interest for development specialists as well as conservationists.

14.1.2. Putting people first - from conservation to livelihoods in the Mekong

These shifts in thinking about livelihoods have helped reveal the complexity of rural livelihoods and of the importance of understanding poverty and vulnerability from poor people's own perspectives (Carney 1998; ActionAid 2005). Such people-centred approaches have provided important insights into our understanding of the livelihoods of people who live in wetland areas and utilise wetland resources.

By focusing first on human needs before considering the available resource base, the significance of wetland livelihoods is more easily appreciated. The significance of drinking water, viable sanitation, food security and nutrition, which are provided by wetlands, becomes apparent, although the capacity of people to convert these assets into livelihood benefits is influenced by a range of broader socio-economic factors - markets, institutions and policy, and power. These approaches, broadly termed Sustainable Livelihoods Approaches (Carney 1998), share common themes and values, which should guide the way that development should work - with an emphasis on participation, empowerment, overcoming marginality and promoting rights-based approaches. This has important lessons for the wetland sector, highlighting the need for process-driven partnership approaches to planned interventions.

For many years, in common with other wetland interventions elsewhere in the world, there has been a persistent argument in wetland conservation in the Mekong that the main threat to wetlands came from local people themselves. It was frequently argued that local people did not understand wetlands or appreciate wetland values, and that this ignorance, exacerbated by poverty, led to resource degradation which in turn led to further poverty. The interventions that were proposed invariably centred on a strong element of awareness-raising, with conservation of the resource as the main goal.

Wetland terminology has remained problematic in the Mekong region. The direct translations of 'wetlands' in the languages of the Mekong countries are highly technical. They are often confusing for non-specialists, and thus poorly understood. But there is a wide lexicon in local languages and dialects for a range of wetland resources, and the resources that we define as wetlands are in fact often better understood by local people than by wetland specialists. From this perspective - that people and their practice and knowledge constituted the main obstacle for wetland conservation - there has been a shift towards recognising the value of local knowledge and practice, with rural livelihoods in many parts of the Mekong region being intrinsically linked to wetland resources and seasonal patterns of flooding and recession. Increasingly it is argued that local people's understandings of natural resources are intrinsically linked with the food and medicinal resources that they provide.

The fundamental importance of wetland resources and the seasonal patterns of flooding and recession have led to a representation of Mekong livelihoods as being fundamentally *'wetland livelihoods'* (Friend 2001), being diverse (depending on a wide range of resources and assets), dynamic (changing in response to the seasonal patterns of flood and recession) and adaptive (displaying a capacity for changing livelihood activities, resource use and management, both responding to change and generating change). Other writers have referred to river-based and fisheries-based livelihoods (Shoemaker *et al.* 2005) but have also emphasised local knowledge and traditional management regimes.

14.1.3. How the health sector has become interested in natural resources

The interest in natural resources as sources of food security and nutrition has also influenced the health sector, with a growing recognition that natural resources are of fundamental importance in rural people's health and nutrition and that these resources must be managed and be viable.

Past investments in health service delivery have come under closer scrutiny with a growing sense that such investments have had only limited impacts. The focus of these investments has been on a medical approach to treatment and prevention of illness, particularly through the strengthening of health care service delivery, supporting the service delivery infrastructure.

There is now a shift away from focusing solely on the supply side of health care service delivery (Standing 2004). This has been influenced partly by the failures of state health service providers, particularly in poor countries and for poorer, marginalised people. This has led to an emphasis on strengthening the voices of both development agencies and their intended beneficiaries to promote the need for health services, so as to be better able to identify, assess and manage health needs, and stake claims on health service provision. However, the need for both the supply and the demand side to be addressed continues to be recognised as fundamentally important.

Many of the marginalised people excluded from health service provision are often physically remote and more dependent on natural resources. There has also been a recognition that good health and well-being for marginalised rural people is significantly influenced by the natural resource base upon which many poor rural people depend, and the need to ensure that it is able to meet food security and nutrition needs, and provide safe drinking water. This requires guaranteeing the productivity of the resource base, but also ensuring that poor people have both access to the resources and the capacity to convert these resources into tangible benefits, and are able to engage effectively in making decisions about the management of these resources and the distribution of the benefits that derive from them.

This comprehensive approach is displayed in current thinking on the connections between health, food security and nutrition (Sen 1981; Standing 2004; Geheb *et al.* 2007). Concerns regarding food security have moved away from simply focusing on volume of production. From a nutritional perspective, food security requires a variety of different types of food, not a mono-nutritional diet. Food security is increasingly concerned with availability, access and utilisation (and also what Kurien (2004) calls food absorption such as safety), shaped by Sen's (1981) work on entitlements and famines.

Using such a capabilities and rights approach (Standing 2004) emphasises people's knowledge, practice and values as a starting point for understanding and addressing how they use food, and how they obtain nutritional and health benefits from the food they use. From the rights perspective, health care, food and well-being are seen as a fundamental human right, and enabling poor people excluded from health care services to exercise their rights to these services becomes a goal of good development.

Within the food security sector there continues to be an interest in addressing food behaviour - how people use food - but with a more nuanced shift in order to accommodate the social and cultural context in which people make decisions about how to use food and how different people use food resources differently. As well as considering the individual psychological

and broader cultural dimensions of food use, there is an interest in the political-economy context in which people have control and access over resources and the benefits that they can derive from these resources.

From these perspectives, as with the conservation sector, the interests in education and awareness raising have also shifted, with a greater appreciation of basing development interventions on current understanding and capabilities, and grounding actions more firmly in the social, cultural and economic worlds in which people live.

14.1.4. Similarities between health and natural resource sectors

This overview of shifts in thinking within the health and food security sectors reveals some common themes and approaches emerging from the perspectives of conservation and livelihoods.

First, there is a clear shift towards a more holistic livelihoods assessment of vulnerability and poverty, building on people's knowledge, practice and capabilities. This involves moving from programmes of awareness raising based on assumptions to responsive, adaptive management approaches starting from the people's own knowledge, values and capabilities.

In this sense the emphasis is not solely on addressing production and resource availability, whether that be health service provision or natural resource productivity, but also on recognising the political (including power), economic, social and cultural dimensions to resource availability, access and use.

This also leads to an analysis of policy interventions such as the promotion of rice agriculture, to ensure that food security (volume of production) and nutritional security (quality of production) are addressed, and that these are translated into livelihood benefits. Similarly, starting with an understanding of HIV/AIDS and nutrition as inter-related causes of vulnerability has identified the development of small-scale aquaculture as an appropriate response for generating nutrition and income benefits in Malawi (WorldFish Center/World Vision 2007).

14.2. Putting People First in Practice

14.2.1. Making the invisible visible - people and food first

In Attapeu Province, as in many other parts of Lao PDR and the Mekong region, wetland resources are fundamental to the livelihoods of lowland rural people. Bordering Vietnam and Cambodia, Attapeu is considered a remote, poor province with poor infrastructure and communications. Sparsely populated by a diverse mix of ethnic groups, Attapeu is, however, rich in natural resources. Much of the lowland area supports rivers, streams and smaller seasonal wetlands, and the area is well known as a source of fish and other wetland products, with growing trade links to neighbouring provinces and Thailand.

Despite the apparent abundance of natural resources, incidence of poverty by virtually all poverty-measurement criteria is high, with a high degree of food insecurity, poor nutrition and poor health. This highlights one of the many challenges for those who argue for conservation as a means to reduce poverty - biodiverse-rich areas often correspond to high incidence of poverty (Fisher *et al.* 2005). In many villages rice production is unable to meet consumption needs, with many households being short of rice for several months a year. Harvesting seasonally available wild foods, in particular non-timber forest products and aquatic resources, is an essential component of food strategies and an essential coping mechanism for periods of rice deficit and for years when there is total harvest loss.

14.2.2. Participatory assessment, planning and management

Pulling together the principles of sustainable livelihoods and a more people-centred ecology, the practical starting point for wetland projects with a commitment to poverty reduction and conservation is strengthening the capacity of local people and government stakeholders to assess, plan and manage their resource base.

The initial assessment and planning of the Attapeu project were based on a series of participatory assessments, supplemented with village participatory planning process with a team representing different government agencies' interests (Meusch *et al.* 2003; ActionAid/IUCN 2005). This was more than participatory research: multi-disciplinary teams consisting of key provincial and district government agencies and villagers made their own assessments of the local situation and identified workable interventions. In this way, the interrogation, analysis and solutions remained with those involved. These teams were also responsible for writing the final reports and recommendations (ActionAid/IUCN 2005).

It was through this process of participatory assessment that food security, health and nutrition became identified as a central livelihood and wetland management issues. The Participatory Poverty Assessments (PPAs) revealed a range of health issues and how poor health can trigger economic shocks for households who can then find it difficult to recover (ActionAid/IUCN 2005).

Poor health and nutritional status are both a cause and characteristic of poverty in many rural areas of Lao PDR. People who are poorer tend to suffer from poor health, and, equally, coping with poor health can be a factor in increasing people's vulnerability. Health services are poor and inaccessible for the majority of rural people. The loss of household labour due to chronic ill-health, immobility or death and the costs of dealing with ill-health can have a devastating impact on household economies. Health care for many people is based on traditional healers and a wide variety of traditional medicines. In subsistence economies with a high degree of dependence on natural resources as direct sources of food and water, there are strong linkages between health, food security, nutrition, and water and sanitation.

Many of these health issues have a clear relationship with wetlands and water. For example, in many villages there is a high incidence of waterborne diseases and malaria. The main source of water is the river. While there are traditional approaches to taking water from cleaner parts of the river and floodplain system, this is often difficult, particularly in the extremes of the rainy and dry seasons.While many people are aware of the health benefits of boiling water for consumption, this is often time-consuming and puts pressure on fuel resources. Additionally, people express a preference for cool, river water over boiled water and water from wells. This highlights the importance of maintaining safe natural water supplies.

These participatory assessments revealed the livelihoods importance of the often *'invisible'* aquatic resources (Meusch *et al.* 2003). Most significantly, aquatic resources constitute the main source of protein in protein-poor diets. Harvesting aquatic resources is also the main coping strategy for periods of rice deficit. While rice deficits are common, with relatively few households meeting all rice needs for the year, there are no coping strategies for periods of aquatic resource deficit.

The most prominent wetland resources in local livelihoods are living aquatic resources (Meusch *et al.* 2003). People utilise a wide range of aquatic resources, identifying up to 100 species, partly influenced by seasonal availability, access and assets. For example, fishing activity is significantly influenced by

wealth and access to fishing gears - river fishing requires boats and specific gears, whereas harvesting aquatic animals from seasonal water bodies can be undertaken by poorer households, and often by women and children.

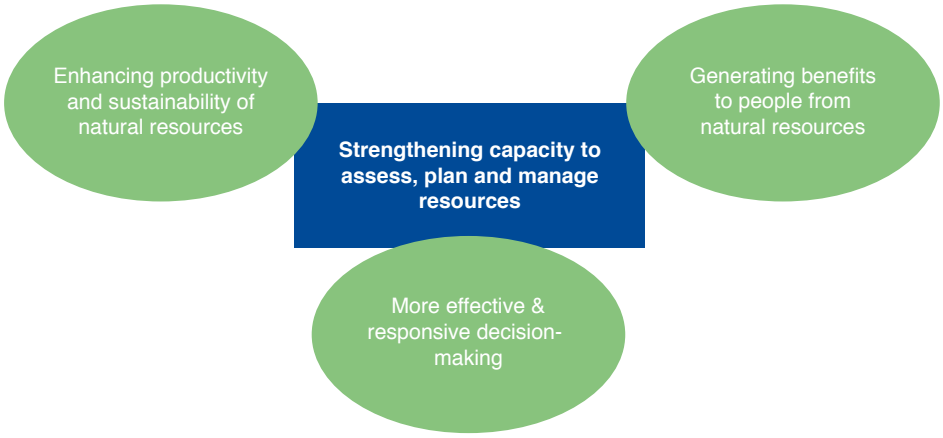
Much evidence suggests that poorer people tend to be more dependent on common property resources and on smaller aquatic resources (Meusch *et al.* 2003). However, this relative dependence of the poor might not be such a clear distinction. Evidence from other parts of Laos indicates that fishing remains important for wealthier households (Garaway 2005).

In the Mekong, aquatic resources remain reasonably abundant. However, malnutrition, particularly among children and pregnant women, remains common. Poor nutrition in childhood can have impacts throughout life since immunity to disease is likely to be permanently reduced. Several factors need to be considered. Nutritional status is not only influenced by quantity but also by the quality and diversity of food types in people's diets. Feeding practice is also influential. The tendency among people in Attapeu and elsewhere in the Mekong is to consume smaller fish within the household, and sell larger fish. Food is largely seen in terms of bulk, with an emphasis on volume (rice).

Even in villages and households from upper wealth categories, with access to productive natural resources, there can be high incidence of malnutrition among children (Friend 2007). Certain dietary practices and established beliefs may be contributory factors in the poor nutritional status of many local people (Meusch *et al.* 2003). For example, the widespread practice of not feeding colostrum to newborn babies, because it is believed not to be ripe, but feeding rice instead may result in nutritional and health impacts that can have lifelong implications.

There are important household and gender issues. Women's involvement in aquatic resource management is largely in terms of food rather than the management of the resources in the wild. Managing capture fisheries in rivers is men's business, but converting these resources into household food security and improved nutrition is largely the responsibility of women and girls.

Figure 14.1. Putting people first.



14.2.3. Identifying a strategic approach

Taking on board these kinds of insights into livelihoods and vulnerabilities, the challenge then comes in putting these lessons and perspectives into practice, taking people's livelihoods, their capabilities and knowledge as the starting point to develop a people-centred approach to wetland resource management.

There are four essential, over-lapping elements (see Figure 14.1). The starting point is to build on local people's knowledge, values and capabilities in order to strengthen their capacity to assess, plan and manage their resource base - whether the resources are fisheries, water, food or health resources. This marks a significant shift away from earlier conservation approaches that have often assumed ignorance rather than knowledge and capabilities. This new approach also takes on board lessons learned from experience in development and health that suggest that if people can take on these responsibilities actions are more likely to be locally relevant, applicable and sustainable.

Clearly, strengthened capacity is only meaningful if it can be put into action. There are three inter-dependent dimensions to this kind of action. In order for there to be both livelihood and conservation benefits it is essential that the resource base itself is both productive and sustainable. A range of activities have been implemented in this sphere - establishing community fishery management regimes, establishing fish sanctuaries, introducing rice-field fisheries, provision of drinking water supplies, provision of mosquito nets etc. Additionally, ensuring that the focus of assessment and management of resources extends to food resources within the household provides a mechanism for women and girls to be involved in management of household food security and nutrition.

However, the availability of these resources does not necessarily mean that they will be turned into livelihood benefits, and that these benefits will be distributed equitably. Specific measures need to be implemented to ensure that the resources deliver benefits. Such approaches might include addressing the use, preparation, processing and/or marketing of food resources, or the management of health and natural resources in such a way that those who need the resources have access to what they need through the establishment of fishery management committees and water and sanitation (WatSan) committees.

A key factor in people's vulnerability and poverty is that poor people tend to be excluded from decision-making processes, particularly those led by the state. When people are better able to represent their own interests and needs, and to do so in a convincing manner, they are more likely to exert some influence on the state and service providers to provide the services that are needed in a way that is needed. This is particularly important for wetland resources that still remain marginal to state development priorities. What is more, state development priorities that are defined in terms of the production of food, particularly rice, can have negative impacts on fishery resources and thereby risk exacerbating nutritional security.

Applying this kind of strategic approach in practice can have many manifestations. For example, a development programme in Cambodia has built on the experience of local people in Thailand who have undertaken their own research on fisheries, ecology and traditional livelihoods, originally as part of a civil society struggle against hydropower dam development (Srettachau and Deetes 2004). Later, similar research techniques were used to influence local institutions to be more responsive to local needs and environmental management. Women have played important roles in this

research process with a focus on the use of resources for food, health and nutrition.

This approach - known in Thailand as Tai Baan research and in Cambodia as Sala Phoum research, in which local people identify their research agenda as part of a broader local natural resource management agenda, and undertake field research themselves, presenting their findings and recommendations to local planning institutions - has proved influential in Stung Treng Province, Cambodia. The research has generated a wealth of information on such issues as fish species, migration and habitats, traditional medicinal plants and their uses, and changes to the natural environment. It has also proved to be an empowering process, particularly for marginalised communities and individuals who have had little formal education but have proved themselves to be knowledgeable, and who by going through an action-research process have learned more about their resource base and how it can be managed. Having conducted the research themselves they are better placed to identify management and development strategies to address a range of livelihood needs, including fisheries management, income generation, management of water resources for drinking and sanitation, and management of medicinal plants. But most significantly they are better placed to take a leading role in determining the direction of local development and influencing provincial and commune decision making, and steering outside interventions from development partners to better meet their needs.

14.3. Summary - Lessons Learned

When wetland conservation is viewed from people's own perspectives it becomes clear that there are well-established, traditional understandings of wetlands. However, these understandings are largely in terms of livelihood values, particularly food and medicinal resources, rather than conservation *per se*. While notions of sustainability and conservation are also evident, these must be approached through addressing more fundamental livelihood needs.

This requires a shift from assuming ignorance to building on existing knowledge. Where people can take a leading role in conducting their own assessment and planning of their resource base the wealth of local knowledge and practice can be strengthened in such a way that learning can be encouraged and that people can adapt to current circumstances and challenges. The traditional conservation focus on the management of resources is not enough. While it is possible to maintain a productive resource base that is well protected, this alone is no guarantee of generating tangible livelihood benefits.

Wetlands are still poorly understood in national and provincial policy and practice in Laos, but where they do appear they do so in the context of conservation rather than development, therefore fall largely under the jurisdiction of the Ministries of Environment and Agriculture. However, placing wetlands in the context of food security and nutrition also faces institutional challenges. There is an institutional distinction between food security and nutrition, with the former being housed in the Ministry of Agriculture and the latter in the Ministry of Public Health. Food security is framed in terms of rice production, and nutrition as a health issue, but, significantly for both, wetlands and aquatic resources remain largely ignored in policy. The emphasis on increasing rice production addresses an important dimension of vulnerability in a country with widespread rice production deficits. There are, however, also risks in Laos that intensified production of rice and refashioning floodplains might undermine aquatic resource production, thus creating a nutritional and health problem.

The experience of working together at field level can contribute to a greater appreciation of linkages at policy-level and give some sense of future direction for addressing these issues, as can integrated approaches to assessment and planning, in which local people and government representatives from health, agriculture, fisheries and conservation sectors work as a joint team to identify issues and potential responses. This helps move wetlands away from the domain of natural resources, production and conservation by providing a perspective from the health sector. While it is argued that wetland resources are undervalued, health is one of the most important values that tends to be ignored. Addressing health and food security can deliver tangible impacts relatively soon, and these can be the most effective ways of reaching poorer people and having long-lasting impacts.

But this approach presents challenges, particularly for the conservation and health sectors. For example, conservation organisations and projects can feel uncomfortable funding the provision of wells and distribution of mosquito nets, and may find it difficult to justify to their own organisations the use of conservation funds for such purposes. Equally, health concerns may go beyond obvious natural resources linkages, for example, in such issues as pre-natal and post-natal care, and prevention of HIV/AIDS. The challenge really comes down to the extent to which putting people first moves from rhetoric to action, and the extent to which partnerships and integrated approaches can be applied.

Even though there are short-term benefits to be achieved, these are long-term approaches, and it remains a challenge for project-based organisations to make the financial and time commitments to see the process through to a time when the efforts can stand on their own. Ultimately, taking long-term approaches is a moral imperative as much as a practical consideration.

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15. How EcoSan Works in China

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Abstract

The paper describes the development and spread of ecological sanitation and EcoSan toilet systems in China. These systems are now in operation in over 20 provinces and will be extended in rural areas so that ecological sanitation becomes a national practice and contributes to achieving the Millennium Development Goals. It is hoped that the government's 10-year campaign 'to build a new socialist countryside' *will also provide a great opportunity to promote ecological sanitation.*

Key Words: EcoSan, sewage, dry toilet, China

15.1. Introduction

The movement of huge numbers of people from rural areas to cities and other urban areas has been one of the primary social and economic characteristics of China in the past 25 years. One of the most challenging consequences of this has been the need to address the corresponding increase in urban water consumption and to deal with the disposal of domestic sewage. Planners rarely make the connection between these issues and wetlands. Yet human excrement, for example, is discharged mostly into water (wetlands) rather than being recycled onto the land. This increases water eutrophication and there are corresponding hazards and risks to human health. The *'EcoSan'* organisation has devised an ecological toilet system that reduces water pollution, improves water quality and reduces water usage, thus providing combined benefits for both wetlands and health.

15.2. The Development of Ecological Sanitation in China

Ecological sanitation (EcoSan) has been practised in China for about eight years and is now in its third stage of development. The first stage involved learning about the practice and history of EcoSan. A pilot project was successfully set up and EcoSan technology was implemented at the local level with local resources. In the second stage, EcoSan and biogas, improving the physical environment and agriculture were combined, and EcoSan became a recognised system. In this way, EcoSan was promoted village by village, and to date there are nearly 10,000 villages using EcoSan in Guangxi Province alone. There are now some 130,000 EcoSan dry toilets in operation in Guangxi and about 700,000 more in over 20 other provinces. Work has now begun on the third stage, in which efforts will be made to promote EcoSan in different ways:

- The EcoSan system will be extended in rural areas, so that it becomes a national policy and contributes to achieving the Millennium Development Goals (MDGs). At present only about 30% of rural China has sanitation.
- Using EcoSan to control water pollution. A large EcoSan project was begun in the Dianchi Lake area, which is located in Kunming in Yunnan Province. The lake has an area of 500 km^2 (in the past the lake measured 800 km^2) but is seriously polluted. The government has spent more than RMB 10 billion on improving the lake but nothing has happened; the pollution has actually become much worse. In 2005 the EcoSan system was introduced in order to solve the problem. The Kunming government took the decision to develop 100,000 EcoSan toilets and use EcoSan throughout the Dianchi area within three years, starting with the rural area. Some 40,000 EcoSan toilets have been built to date.
- Introducing the EcoSan system to urban areas. This is the main goal and the greatest challenge of the third stage. A great deal of preparation has been made for this step, and although the author is sure that a successful model could be set up within three years the funding is lacking. External support is required to get the project off the ground, and the opportunity is still awaited.

15.3. Promoting EcoSan in Different Situations

Promoting EcoSan is just like selling any other product so it is very important to make a strong selling point. In some areas, epidemic disease control may be a serious issue, in some areas water shortage may be the main selling point, and in other water-rich areas pollution control may be the issue.

15.3.1. Water-poor areas

Since the EcoSan toilet is dry and needs only a little water to flush urine (about 1 l per flush) it can be promoted in areas where there is a water shortage or where there is no running water.

15.3.2. Areas prone to faeces-transmitted diseases

The EcoSan toilet destroys faecal pathogens on site by dehydration, thereby reducing the incidence of faeces-transmitted diseases.

15.3.3. Polluted areas

The standard water-flush sanitation system consumes a large volume of clean water and is also a major contributor to water pollution; EcoSan achieves zero discharge of blackwater and returns nutrients rather than water to the soil.

15.3.4. Different climates

EcoSan has been promoted from the north to the south of China and more than 1.7 million EcoSan toilets have been installed in over 20 provinces, which clearly shows that the system can respond to wide variations in climate.

15.3.5. Tourism areas

Good sanitation is an important aspect of tourism. In Guilin, Guangxi Province, the local government sees the toilets as one of the prerequisites for tourism and local farmers can earn money by providing EcoSan toilets - more than they earn from agriculture.

15.4. Summary

Since the EcoSan organisation arrived in China more than 130,000 eco-dry toilets have been installed in Guangxi Province alone, and the concept has also been promoted in more than 20 other provinces. Generally speaking, however, this is relatively few compared with the huge potential demand for EcoSan.

Since 2006 China has begun to implement its Eleventh Five-Year Plan for National Economic and Social Development, and central government will pay more attention to and invest more money in rural development in order to try to reduce the huge gap between urban and rural areas.

The most important action in this respect is that the Communist Party Central Committee and the central government will start a campaign to build a new socialist countryside. This campaign will last more than 10 years and will cover a population of nearly 1 billion; it will provide a great opportunity to promote EcoSan.

16. Shaoxing Symposium - Discussion on the Presentations

Chair: **Mike Ounsted**

Panel members: **Ton Meijers, Max Finlayson, Lin Jiang, Ma Guangren, Wang Hao, Abdoulaye Berthe, Richard Friend**

The presentations at the Shaoxing symposium were followed by a lively plenary discussion in which questions were put to the panel of presenters. A summary of the discussion is given below.

16.1. Ecological Sanitation Technologies

Questions were asked about the extent to which wetland biodiversity was increased through the adoption of the technologies described by Lin Jiang in his paper 'How EcoSan works in China'.

Lin Jiang responded by stating that in China 60% of household water is used for flushing toilets. By using the *'joint toilet system'* that he had described, water savings can be as much as 30%. Water security is increased and, at the same time, a reduction in the amount of raw sewage distributed on the land helps to prevent the transmission of disease.

Lin Jiang said that an integrated approach to the management of sanitation is essential; the mere transfer of sewage to the land, as is commonly practised, increases the chances of groundwater contamination. The new toilet technology has to be combined with wetland conservation techniques. This is creating a great deal of interest in China, and after one of Ecosan's pilot projects was set up at Cho Huai, which is a reserve for cranes, the concept of ecological sanitation gained much media attention.

Lin Jiang also drew attention to the importance, in terms of poverty reduction, of by-products from sewage treatment such as biogas.

16.2. Ecosystem Restoration and Vulnerability

Participants inquired about evidence which showed that restored wetlands, especially coastal wetlands, reduced the vulnerability of coastal dwellers.

Ton Meijers responded that there was gradual acceptance of these linkages within the development and aid sectors, but that there was a real need to look for new partnerships.

Jane Madgwick welcomed the fact that ecosystem restoration was one of the three strategies in the Oxfam Novib presentation concerning vulnerable people on vulnerable coastlines in Southeast Asia and asked to what extent this was the case throughout the Oxfam family.

Ton Meijers replied that the concept of wetland restoration was not very widespread in the Oxfams as a whole, although it was specifically on the agenda of Oxfam Novib's programme in East and Southeast Asia. Ton Meijers said that livelihoods in general are on the Oxfam agenda and that six years ago the combined Southeast Asia desk of Oxfam International decided to make fisheries a priority. There were plenty of opportunities to further explore collaboration and partnering; a start should be made whenever an opportunity arose.

Gerard van Dijk asked what treatment was necessary before sewage water/organic human waste could be used in horticulture and whether any specific treatment was recommended? Was there a health risk using human waste on vegetable crops?

The question was not answered directly but Lin Jiang added that there were many different methods of sanitation, as his presentation had demonstrated, and diversification was also key to sustainability. Other options for food security need to be

examined, and as urban areas become more populated gardens are even being constructed on the tops of buildings. Ecosan is currently developing more soil-less plant technologies and mixing new technologies. There were options to consider the conversion of degraded forests and riverine areas for productive organic agriculture harnessing natural systems. In China food consumption and production are major issues. As the population of urban areas increases, more food needs to be grown there so as to reduce environmentally unfriendly transportation costs.

Max Finlayson referred to peri-urban agriculture in Africa where waste water was being used in urban centres. This water is being used because the imperative is to produce food at low costs. In the west waste water is not used to grow crops, but in some parts of the world people cannot afford to not use it.

Nyoman Suryadiputra from Indonesia commented that dry toilets and the separation of solids and liquid wastes were good for wetlands. In Indonesia, biogas for domestic use is made from human excreta; if this was not done, there would be is a risk of groundwater contamination. The production of biogas is one way to mitigate climate change. However, in many parts of Indonesia and the rest of the world the use of human excreta in this way is culturally unacceptable.

Bakary Kone from Mali commented that if human waste is used to grow vegetables, typhoid may result, and he asked if there were any tests to check the quality of the waste water. The panel were unable to answer this question.

16.3. Themes for World Wetlands Day in the Context of Wetlands and Human Health

Members of the panel were asked to choose an appropriate theme for the next World Wetlands Day. The participants generally agreed that there was a need for 'wetland people' *to focus more on health than on their immediate interests of wetland biodiversity.*

Ton Meijers suggested that human health was a good entry point to encourage a wider interest in wetlands, which were generally seen as the preserve of biologists and water engineers.

Lin Jiang commented that about half the Chinese population has no proper sanitation facilities. Excrement has a high organic content and is rich in proteins and other elements. In large cities nitrogen from toilet water should be returned to the soil as a natural fertiliser. Unfortunately, however, it is usually released into watercourses.

Sanitation practices play a significant role in water pollution. World Wetlands Day should highlight this issue to governments, and the public should more clearly understand that their daily practices impact the environment, which in turn affects their daily life.

Johan Mooij added to the discussion by stating that the situation in Beijing is not unique. In Europe all sewage was discharged into watercourses until the 1950s-60s. In Germany there are Ramsar sites that are former sewage plants. Now there is a new problem in Europe in that people are consuming so many pills that groundwater is suffering toxic pollution.

Max Finlayson expressed concern that Ramsar's World Wetlands Day theme for 2007 had been *'fish and food'* but had not been sufficiently taken up. New themes were emerging all the time - the role of

wetlands for agriculture and the effect of agriculture on wetlands came from the Millennium Ecosystem Assessment, 2005. The UN World Water Development Report, released two weeks earlier, and the United Nations Development Programme's Global Environment Outlook provide further information. So much information is now being made available. Ramsar and others need to take more time to study these documents.

Richard Friend suggested that World Wetlands Day should be used to point out how wetland management could specifically contribute to the Millennium Development Goals (MDGs), and it was further pointed out that nearly all the MDGs are relevant to wetlands.

16.4. Multiple Indicators of Wetland Ecosystem Health

Participants asked about the difficulty of defining indicators that accurately measured improvements in human health in relation to wetland health.

Ma Guangren agreed that this was an important issue but that as far as he knew no such indicators existed and needed to be developed.

Referring to the keynote presentation from Max Finlayson, Christine Prietto asked when a wetland could be described as healthy. Was a wetland's health measured by its value to humans? The presentation had suggested that wetlands could be healthy in many ways.

Max Finlayson responded by saying that in many parts of the world people are not restoring wetlands but just using natural wetlands. The Ramsar parties had accepted a change of definition of the wise use of wetlands to include ecosystem services, and the Millennium Ecosystem Assessment also included this in its definition. This suggests that wetland ecology is increasingly being assessed in terms of the value to users. We usually refer to ecological conservation in which all ecosystem services are dependent on biodiversity. It is human interventions that change wetlands, and this brings to the debate the issue of *'trade offs'* and how trade offs are used.

16.5. Wetlands International's Initiatives on Wetlands and Human Health

In view of the fact that the symposium had been called by Wetlands International (WI) participants were interested to learn of future WI initiatives related to the health sectors.

Chris Baker informed the symposium that WI had liaised with the *'WatSan'* community during Stockholm Water Week to identify a niche for a programme on water and sanitation and wetlands health. This symposium had been a great opportunity to discuss and explore these issues further. WI has now started to develop partnerships and projects on the ground to explore this area of work. WI has recently signed a partnership agreement with WASTE, and will engage in one of their projects in Benin. WI has also just begun two small grant projects, one in Uganda in partnership with the Ugandan government and the Dutch organization International Water and Sanitation Centre (IRC) and the other in India with WaterAid. Furthermore WI had just secured a European Union (EU) research project as part of a wider EU Framework research programme in Mali, inner Niger Delta, where issues related to wetland health and waterborne disease will be considered. WI's long-term goal is to influence donors and policy makers to integrate these issues in their activities.

Marcel Silvius said that two years ago WI started thinking about this subject and had developed a 2-year project which had been approved by the Dutch government

for funding; this project will start in 2009. WI had needed first to implement and learn from its current Wetlands and Poverty Reduction Programme before attacking the bigger health issue. There was a need to establish a strong integrated knowledge base through working in partnership with the development and health sectors. The new project will provide the opportunity to develop demonstration projects and to identify innovative ways to address wetlands and health issues.

The knowledge gained will be used by WI's African Training Board to develop capacity development materials to be distributed to educate and train various stakeholders. WI might work at the policy/legislation level, but would prefer to act as a catalyst and promote others to do this since WI is quite a small organisation.

Bakary Kone informed the participants that WI in Mali had a project in the Inner Niger Delta funded by the EU. Part of the area is irrigated and here many diseases are rife, but downstream, where the water is less polluted, there is less disease. Working jointly with the National Laboratory of Water Quality (funded by the Dutch Embassy) and the University of Mali, the project will investigate ways to purify the water.

16.6. Changing Attitudes

The panel was asked to elaborate on how public perceptions of the link between well managed wetlands and good health could be improved.

Marcel Silvius commented that it is people who degrade wetlands, and degraded wetlands increase disease risks. However, there are also many naturally occurring diseases in wetlands, and even when wetlands are managed wisely some diseases will still be found. The wetlands community will have a great problem in communicating this to the general public. Many of these natural diseases will increase when wetlands further degrade. Some diseases are not wetland related, but affect local people's ability to cope. For example, HIV affects large communities in Africa and Asia; if community-based approaches are to be taken in poverty-stricken and HIV-stricken areas, this needs to be taken into account.

Bakary Kone observed that WI is sometimes asked why wells are being dug within the framework of the Wetlands and Poverty Reduction Programme. He would explain that wells were dug because people defecate in rivers and they then use the river water for everything; WI's main priority is to dig wells in order to have clean drinking water and grow vegetables, which has a beneficial impact on health. There are many entry points for those concerned with wetland management.

From the floor, Gordon Reid commented on conservation psychology and, specifically referring to the presentation by Richard Friend, asked how people's attitudes could be moderated. How could women who are cooking food be persuaded to change their ways in order to create more nutritional benefits?

Richard Friend explained that there were aspects of traditional food behaviour that are difficult to change. There was a tendency in some villages to subsist on rice and to be *'filled up'*; people were unaware of the importance of variety in diets. The process adopted in the project that he had described was to identify which resources were available and then suggest a cooking method, for both vegetables and other foods. The changes had come about in a very short time with a significant, positive impact on child nutrition.

Max Finlayson added that his experience in Africa had been that displaced people and people who have moved into new and less habitable lands do not know how to manage

food production and cooking, and need to be taught. This provided a good opportunity to teach best practice.

16.7. Shaoxing Communiqué

As a statement of the day's events, the participants then debated and approved the Shaoxing Communiqué.

16.8. Conclusion

On behalf of Wetlands International **Jane Madgwick** summarised the discussion and day's events:

The symposium had helped to emphasise the complex relation between wetlands and human health. The issue should not be oversimplified.

For WI's future work, the conclusions of the symposium give confirmation of the relevance of its future programmes on wetlands, livelihoods and health, especially for its work in Africa and Asia. Conservation is not the starting point for WI's work on these continents.

WI is intending to increase its work on wetlands, human health and agriculture. The symposium will give WI legitimacy for its future emphasis on wetlands, pollution and human health. In this respect, the new partnership with the WatSan sector and the partnership with WASTE provide many opportunities.

WI's Green Coast project in Asia makes the links between livelihoods and poverty, which are interrelated with human health; in fact, half of WI's work is on the coast. However, as was highlighted during the symposium, WI must also face the issue of prevalent existing diseases such as malaria and find ways by which good wetland management can reduce disease risks.

In this respect, WI needs to extend its networks of scientific experts. WI has a major role to play in terms of linking good practice with good policy, and there are many examples of good practice. WI should take some responsibility for identifying some good examples and bringing these to the attention of policy and decision makers.

WI is a small organisation, and it cannot tackle all the issues of wetlands and human health. What it can do is to demonstrate integrated solutions: the work on avian influenza is a good example of sound research and issues addressed practically on the ground. WI can work in particular places where it has a history and has partnerships in place, such as the Inner Niger Delta. It can focus on a few key issues and a few key basins to make some important points and adapt and extend its capacity-building programme, for example through the Africa Training Board. And there is an ongoing need to use WI's expertise to influence the different conventions.

To achieve all this, WI needs good ambassadors who can cross this line between environment and development. WI would like to ask those present to act as ambassadors and connect with the development and health sectors.

16.9. Closing

In his concluding words from the Chair, **Mike Ounsted** complemented **Jane Madgwick**'s remarks by observing that none of the speakers of the symposium had met each other before the event. Bringing together practitioners with this diverse range of expertise was an achievement to be emulated and a demonstration of partnerships for the future.

Mike Ounsted thanked Shaoxing City for generously hosting the symposium, Wetlands International for its initiative in setting up and organising the day's events, and the speakers and all participants for their thoughtful contributions.

Mission:

To sustain and restore wetlands, their resources and biodiversity for future generations.

On 8 November 2007 the People's Government of Shaoxing City and Wetlands International hosted a symposium entitled *'Healthy Wetlands, Healthy People'*. The opening sessions were chaired by Chen Kelin, Director of Wetlands International - China, and the technical sessions and discussion by Mike Ounsted, Chair of the Wetlands and Livelihoods Working Group of Wetlands International. The symposium was attended by 80 development and conservation actors from both governmental and non-governmental sectors in all continents.

The symposium was structured in five sessions. The opening and welcome sessions, with messages from the national government, Shaoxing City and Wetlands International, were followed by two keynote speeches, one giving a global overview and the other a perspective on wetlands and health as seen from Africa. The seven technical papers provided broad perspectives and focused on specific issues related to wetlands and human health.

The technical presentations were followed by panel and plenary discussions after which a joint statement, the Shaoxing Communiqué, which consolidated the symposium's major conclusions and areas of action, was agreed. The outcomes of the symposium formed the basis for the development of a Resolution on Wetlands and Health by the Ramsar Convention on Wetlands.

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