

Water Policy Entrepreneurs

A Research Companion to Water Transitions around the
Globe

Edited by

Dave Huitema

*Senior Researcher, Institute for Environmental Studies, Vrije Universiteit
Amsterdam, the Netherlands*

Sander Meijerink

*Assistant Professor, Institute for Management Research, Radboud
University Nijmegen, the Netherlands*

Edward Elgar

Cheltenham, UK • Northampton, MA, USA

© Dave Huitema and Sander Meijerink 2009

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical or photocopying, recording, or otherwise without the prior permission of the publisher.

Published by
Edward Elgar Publishing Limited
The Lypiatts
15 Lansdown Road
Cheltenham
Glos GL50 2JA
UK

Edward Elgar Publishing, Inc.
William Pratt House
9 Dewey Court
Northampton
Massachusetts 01060
USA

A catalogue record for this book
is available from the British Library

Library of Congress Control Number: 2009936762



ISBN 978 1 84844 331 0

Printed and bound in Great Britain by MPG Books Group, UK



Co-published by IWA Publishing, Alliance House, 12 Caxton Street, London SW1H 0QS, UK
Tel. +44 (0) 20 7654 5500, Fax +44 (0) 20 7654 5555
publications@iwap.co.uk
www.iwapublishing.com
ISBN 1843393158
ISBN13 9781843393153

6 Implementing integrated river basin management in China

*Dorri te Boekhorst, Toine Smits, Yu Xiubo, Li Lifeng,
Lei Gang and Zhang Chen*

6.1 Introduction

Water-related problems are one of the most pressing issues facing China. They are argued to have the potential ultimately to affect China's social, economic and political stability. In terms of the sustainable development of the country, they could be an important limiting factor (Kreimer and Munasinghe, 1991; World Bank, 1997; Flavin and Gardner, 2006; Turner and Otsuka, 2006). The main challenges concerning water are threefold: water scarcity, water pollution, and flood control (WWF, 2003; Chen, 2005; Lee, 2006; Yin et al., 2006). To meet these challenges, China's river ecosystems have to be properly protected. This will involve the development of an alternative approach to water management and major changes in different areas of society from land use and government to livelihoods.

The new approach to water management is envisioned in the strategy of integrated river basin management (IRBM), which was incorporated into China's 2002 Water Law. In 2004 a major joint report by the World Wide Fund for Nature (WWF) and a task force of the China Council for International Cooperation on Environment and Development (CCICED) stressed to the Chinese government the importance of IRBM (CCICED and WWF, 2004). As a non-governmental organization (NGO), WWF China used its national and international network to stimulate the acceptance and application of IRBM. In this chapter we focus on the role of WWF China as a policy entrepreneur.

First we present a general picture of the institutional set-up and legislation related to water management in China. We then illustrate the strategy and activities of WWF China with two cases: the Central Yangtze: Partnership for a Living River¹ and the WWF-HSBC Yangtze Programme. Finally, applying the concepts described in the first part of this book, we analyse the role of WWF China as a policy entrepreneur.

WWF has been active in China since 1978 and has been able to develop successfully in Chinese society. The cases we present here productively link small-scale bottom-up processes with national top-down measures. The role of the CCICED IRBM Task Force as a high-level governmental advisory body is in part described below using participatory observation by one of the Dutch authors of this chapter. All the Chinese authors are familiar with the cases presented here, either as former project leaders, or through advising on the process of integrating IRBM in China.

6.2 Institutional framework

The State Council of the People's Republic of China directs several ministries, agencies and commissions involved in water management (see also Figure 6.1). The Ministry of Water Resources (MWR) manages all administration concerning water quantity in



Notes:

Bold font indicates offices involved in water management. Other organizations, administrative offices and institutions under the State Council are not shown.

Top box: state administrative affairs departments; second box; macro control departments; third box: education, science and technology, culture, social security and resource administration departments; bottom box: specialized administration departments.

Box structure is based on the OECD report 'Environmental Performance China' (OECD, 2007).

* Former State Environmental Protection Agency (SEPA).

** Special organization under the State Council.

Figure 6.1 Simplified administrative structure relevant to Chinese water management

China. It is authorized by the Water Law to oversee China's 'water resource management'. Because water and flood control especially have been very important in Chinese history, the ministry is old and powerful. Its main responsibilities include surface and groundwater management, river basin management, flood control, and water and soil conservation. Mediation and arbitration of intersector or interprovince water disputes are also part of the MWR responsibilities. The ministry has water bureaus and departments at both the provincial and county levels (Turner and Otsuka, 2006; MWR official website).

The main laws and regulations providing the MWR mandate include the Water Law (1988, revised 2002), the key legal instrument containing general principles for the management of water resources in China (Chen, 2005; Lee, 2006; OECD, 2007). The Water

Law (revised 2002) reflects current thinking on integrated water resource and demand management. It enshrines the principles that everyone should have access to safe water and that water conservation and environmental protection are governmental priorities. The law focuses on four topics:

1. Water allocation, rights and permits.
2. River basin management.
3. Water use efficiency.
4. Conservation and environmental protection.

It defines river basin management institutions and functions. One of its core goals is to strengthen the administrative rights of river basin management organizations in order to improve the implementation of water conservation and management measures. Furthermore, the law requires the integration of water resource and economic development planning (Turner and Otsuka, 2006; OECD, 2007). In addition to the Water Law, the Law on Prevention and Control of Water Pollution (WPPC), the Water and Soil Conservation Law and other relevant laws and regulations, such as the 1997 Flood Control Law, all support China's institutional framework for water policy.

The MWR is responsible for several other institutes and commissions implementing regulations regarding water resources management, of which the seven River Basin Commissions (RBCs) are the most important (Lee, 2006; Yan et al., 2006; Ministry of Water Resources, MWR, official website). The RBCs were originally created in the 1950s to mitigate flood damage and exploit water resources, for instance to generate electricity and provide navigation facilities. From a historical point of view, the RBCs are extensions of the MWR and accustomed to taking a top-down, sectoral approach to river basin management (Turner and Otsuka, 2005, 2006). This is slowly changing and expected to change further while IRBM is being implemented in China.

In addition to the MWR, the Ministry of Environmental Protection (MEP)² is another important ministry involved in monitoring and improving water quality and ecological rehabilitation of the fluvial ecosystem.

6.3 Geohydrological data for the Yangtze River basin

Many river basins in China suffer from water shortage, flooding and pollution. The geohydrological background information given here is limited to the Yangtze River basin as the basin forms the target area for WWF activities.

The Yangtze (Changjiang) River, at 6300 km, is China's longest and the world's third-longest river. The snow-fed waterway starts in the Kunlun mountains of the Tibetan Plateau in Qinghai province, flows southeast and empties into the East Chinese Sea about 20 km north of Shanghai. It has about 700 tributaries and is the largest river system in China with a basin covering an area close to 19 per cent of China's total territory. It provides freshwater resources to around 400 million people (about a third of the Chinese population). The total water availability per year in the basin amounts to 996 billion m³ on a long-term mean basis, accounting for 36.5 per cent of China's total. Yangtze basin subcatchments larger than 1000 km² number 400, eight of these exceeding 80 000 km². The area covered by the basin is rich in lakes, totalling a lake area of more than 15 200 km², with most of the lakes situated in the middle and lower reaches. The



Map 6.1 China and the Yangtze River basin, including Poyang Lake and Dongting Lake

area includes the two largest freshwater lakes in China, Poyang Lake and Dongting Lake (Map 6.1) (Zhang et al., 1998; CCICED and WWF, 2004; Yang et al., 2007).

Located in the centre of China, the Yangtze basin covers 19 provinces, autonomous regions and municipalities. With its many tributaries, the river functions as the most important transportation network through the heart of some of the most densely populated and economically important areas in China, known as the Yangtze River Economic Belt. The Yangtze is also the major inland waterway of navigation in China. Its navigation channel on both mainstream and tributaries adds up to 57 000 km, 52.5 per cent of the nation's total. The 2837 km mainstream navigation channel has a shipping capacity equivalent to four to six railways, each of this same length (Changjiang (Yangtze) River Water Resources Commission, CWRC official website). The Yangtze is a major resource for irrigation, agriculture and hydroelectric power (with a technically exploitable potential of 256 270 MW and an estimated annual power output of over 100 TWh, equivalent to 48 and 49 per cent respectively of the nation's totals). It currently holds 17 hydroelectric dams, including the well-known Three Gorges Dam. The Yangtze agricultural area delivers close to half the country's total crop harvest and contributes about a third of the national grain and gross domestic product (GDP) total. The river basin is recognized internationally as an important ecosystem rich in biodiversity (Yin et al., 2006). Currently six wetlands in the Yangtze River basin are listed as sites under the Ramsar Convention on the Wetlands of International Importance (Ramsar) (Cui and Wang, 2008). Two-thirds of China's plant species occur in the basin, and 370 fish species (several seriously threatened) and a diverse range of birds depend on the river basin system (Zhang et al., 1998; CWRC official website; WWF China official website; WWF International official website; Yangtze Forum official website).

The Yangtze River basin falls under the jurisdiction of the CWRC, one of the seven river basin commissions under the MWR. Together with the prefectural and local branches of the MEP, they are responsible for the water quality and quantity of the river basin. Other ministries under the State Council also have responsibilities related to management of the water system. Regional authorities (provinces, cities), public and private

organizations (for example conservation groups and construction firms) can be considered as 'stakeholders' of the river basin given their various claims on land and water use and their views on management.

6.4 Problem definition

Unconstrained deforestation activities in the upstream parts of the river basin (Nakamura, 2003) and gradual, but ongoing, land reclamation activities in mid- and downstream sections (Zhao et al., 2003; Yin et al., 2006) have undermined the hydrological and ecological resilience of the river basin. Originally Poyang Lake and Dongting Lake functioned as giant reservoirs that moderated extremes of high and low water discharges. However during the past decades, especially between the 1930s and 1978, many of the natural lakes and wetlands have disappeared due to land reclamation. Moreover hundreds of natural lakes, essential for spawning fish, feeding and natural retention have been disconnected from the Yangtze River for agricultural purposes and to protect farmers and fishermen against waterborne diseases such as snail disease (schistosomiasis) (Fischer and Heilig, 1997; Li et al., 2000; Utzinger et al., 2005). This has led to a dramatic decrease in lake size and flood retention areas (an estimated drop of 6000 km² in surface area of lakes ≥ 1 km² in Jiangnan Plain alone) (Yin and Li, 2001; Zhao and Fang, 2004; Yin et al., 2006).

The relative abundance of water in the Yangtze River basin and the structural water scarcity problems in the Yellow River basin were the basis for the current South-to-North Water Transfer Project, a far-reaching and enormous engineering project to divert water to the north through three planned routes, east, middle and west (Varis and Vakkilainen, 2001; Turner and Otsuka, 2005).

Apart from water quantity-related developments, heavy pollution of the river system from industrial waste and mainly agricultural non-point sources provides the second serious threat to the river basin system (Wang et al., 2006). In general, water quality in China has deteriorated tremendously, reducing the access of about a third of the Chinese population to safe and clean drinking water and negatively affecting the natural habitat of many species (Varis and Vakkilainen, 2001; Fang et al., 2006).

6.5 The shift to integrated river basin management

It can be argued that many of the water problems in China result from a structural denial of the importance of a healthy ecosystem for a sustainable economy and from a sectoral approach to river basin management. Basically the Five Year Plans (FYPs) were focused on the economic development of the country. With the start of the first one in 1953, economic growth was a top priority and until the sixth FYP there was little attention in these plans to environmental values. In addition, coordination was poor or non-existent among local and regional authorities within the river basin. Most administrators and politicians, and most of the general public, considered the exploitation of the river and its catchment area as an undisputable right. Overarching problems were addressed by the MWR, but mainly from an engineering point of view. The emphasis on engineering solutions, with a 'primary focus on supply-side options that can provide water with a high assurance of supply' (Turton et al., 2007) and with little respect for environmental consequences, is generally referred to as the 'hydraulic mission' (Waterbury, 1979; Turton et al., 2007; 2004; see also Gupta, Chapter 3 in this volume) of a society. This has formed the dominant paradigm in Chinese water management as illustrated by the many

vast hydro-engineering projects, including the present South-to-North Water Transfer Project.

However, recent years have seen an increased incidence of floods (major floods occurring every one and a half years between 1988 and 1998, compared to an interval of four to five years between 1852 and 1980), topped by the flood of 1998, and alarming environmental degradation entailing the loss of biodiversity and extinction of some endemic species (CCICED and WWF, 2004; Zhao et al., 2005). These events, on top of existing problems, formed the motivation for the central government to change the situation (Zhao et al., 2006). The launching of the US\$1.2 billion '32-character' policy in 1998 to be implemented by local government in the Yangtze River Basin could be interpreted as a first step towards IRBM. The '32-character' policy was launched by the central government after the flood events of 1998 with the aim of stopping further deterioration of the hydrological resilience of the Chinese river basins. The name refers to the number of Chinese characters needed to formulate the various policy measures:

1. Stop logging and promote forestation (the National Logging Ban).
2. Return reclaimed land to the river (make room for the river).
3. Convert cultivated land to wetland and lakes (wetland restoration).
4. Resettle people who live in flood-prone areas.
5. Reinforce the primary flood defence structures.
6. Dredge river sections that have silted up.
7. Give people work instead of relief subsidies for agricultural use of mountain slopes and reintroduce forest and grass (grain for green).

Although the 32-character guiding policy was an important step in recognizing the key functions of nature in the sustainable use of a river basin, implementation has not been easy. Soon after the proclamation of the policy, its shortcomings became clear: it does not properly address sustainable alternatives to 'wrong land use within the river basin' (for example land reclamation for growing rice, extensive logging); and the many complex institutional arrangements between water resource management and land use plans have proved a real hindrance (Wang et al., 2007). Moreover there was little or no awareness among the wider public of how a river (ecosystem) functions and of the urgent need for coordination of up- and downstream land use. The popularity of the concept of IRBM at different policy levels has increased as public and administrative understanding of the problems in China has increased (personal communications – WWF China; GWP China official website).

6.6 WWF China as a policy entrepreneur for integrated river basin management

6.6.1 Introduction

Why is WWF so concerned with the fate of rivers? River basins are the way nature gathers and delivers water. They constitute ecosystems that provide services to humans in the form of hydropower, transport, recreation and tourism, as well as flood and drought regulation, sediment and nutrient retention, and habitat for diverse fauna and flora. Freshwater biodiversity is an important source of food, income and livelihood, particularly for rural communities in developing countries. Studies have estimated the

economic value of ‘healthy’ river basins in the billions of dollars (Schuyt and Brander, 2004; Schuyt, 2005). Therefore one of the primary goals of WWF is to develop strategies to manage the use of rivers and their wetlands without reducing biodiversity and ecological functioning (WWF, 2003).

To use and manage river basins in a sustainable way is complex, but in the experience of the WWF (and others), no strategy will be effective unless it is implemented through cooperation across social, economic and political boundaries (Muldavin, 2000; WWF, 2003; Nakamura, 2006). In this context IRBM can be seen as a tool for communities to balance development and conservation needs. Hence the WWF’s actions to support development and implementation of IRBM in China form part of such cooperation.

Against this background WWF China launched two major programmes: The Central Yangtze: Partnership for a Living River, 1998–2008³ and the WWF–HSBC Yangtze Programme in 2002. Both programmes supported the goal to: ‘restore the Yangtze as a living river by securing effective management of a significant area of wetlands in the central Yangtze basin over a period of 25 years’ (WWF, 2003). Realization of this goal requires cross-sectoral cooperation throughout the river basin, public awareness and participation. IRBM was seen as an important tool in meeting this need and achieving the programme aims (CCICED and WWF, 2004). Here we describe two cases that illustrate the introduction of IRBM in China.

6.6.2 The Central Yangtze: partnership for a living river

This WWF programme, completed in 2008, had the following objectives:

1. To restore Dongting Lake wetlands and to enhance the management of the Yangtze as a ‘living river’ through partnership with all stakeholders.
2. To restore biodiversity in the Central and Lower Yangtze River and develop new land use and flood plain management approaches with authorities and other organizations.

In order to realize these goals, pilot sites were selected to demonstrate that working through a bottom-up, co-production model, economic, ecological and safety interests can be brought into harmony. Also, actions were taken to promote IRBM at the highest political level in order to facilitate the creation of a legal framework for the organization of round-table events for the stakeholders in the Central and Lower Yangtze regions (Hunan province official website; personal communications – WWF). Both subprojects and the actions of the CCICED are discussed below.

Pilot sites: Dongting Lake Dongting Lake, China’s second-largest freshwater lake, is located in the southern part of the Central Yangtze River basin, in Hunan province. The lake area totals 15 465 km² and spans 13 counties. The lake is one of the two remaining retention lakes naturally connected to the Yangtze River (Poyang Lake is the second). It has an important function as a natural reservoir, storing freshwater and reducing the extent and impact of flooding in areas occupied by people. Rich in biodiversity, including important fish and water bird populations and many threatened species (Fang et al., 2006), the lake is of great socio-economic and cultural importance. The Yangtze River

and the lakes of its basin, including Poyang Lake and Dongting Lake, are listed by WWF as one of the 200 global conservation priority regions (Olson and Dinerstein, 1998).

Due to land reclamation, the size of the lake has been drastically reduced over the last few decades (Map 6.2). The maximal lake area is set at the 1825 figure of 6270 km². By the 1950s, this area had fallen to 4350 km², while the following 50 years saw yet another 1650 km² reclaimed, shrinking the lake by an additional 40 per cent. Besides reduction, the lake also faces fragmentation. The number of patches of reclaimed land, known as polders, increased by 25 per cent between the 1930s and 1998 (Zhao et al., 2005). To create and sustain the resulting 'polder society' requires technical engineering in the form of dams, dykes, canals, and sluices. Such development weakens the lake's ability to store and safely release floodwaters. The natural siltation of the area adds to this problem, but is likely to reduce, since the Three Gorges Dam will trap a large portion of the sediment (CCICED and WWF, 2004; Schuyt, 2005; Zhao et al., 2005).

Dongting Lake is divided into three sections: east (Dong), west (Xi) and south (Nan). East Dongting was one of the first seven sites to be designated in 1992 as the most important international wetland conservation areas in China under Ramsar (Ramsar Convention on Wetlands (Secretariat) official website). In 2002, as a result of the WWF project, the State Forest Administration (SFA) added south Dongting Wetland and Waterfowl Reserve and West Dongting Lake to the Ramsar list. The WWF project was embarked on its specific aim to restore Lake Dongting and its wetlands to their 1950s maximal extent (4350 km²) in ten years; this in order to reverse a massive loss of biodiversity and to improve ecological conditions and security for the conservation of the natural heritage, ecosystem and species of the Yangtze. (This proved to be too ambitious and was adjusted in 1992 to the more general goal of 'restoring Dongting Lake wetlands'.) This goal was combined with the aim of identifying alternative livelihoods for the local people that achieve a better balance with the natural environment (for example ecotourism). Improved security was the subject of the second specific objective for the lake, setting out wetland restoration as a means to mitigate catastrophic peak floods that destroy economic, agricultural and infrastructure assets.

WWF China selected the recently reclaimed polder Xipanshanzhou, a village in Yuanjiang County, Hunan province, in the Dongting Lake area, to start realizing the above goals. After the 1998 flood the national government decided to give up the Xipanshanzhou polder, which opened the way for WWF China to start a joint transition process with the local people to alternative land use.

Starting in 1999, 147 households were selected to participate in the project. First, WWF China organized meetings for the local people, explaining how the natural lake systems function and how human intervention during the previous decades had led to the deterioration of the ecological functioning and increased flood risks. After these 'awareness sessions', WWF led a joint exploration of alternative livelihoods more in alignment with the natural dynamics of such a huge lake as Dongting.

Eventually a series of workshops produced the main outcome of support by the WWF project for several alternative income-generating activities, including animal husbandry (pig, duck, cow, hen and goat), fish cage farming and organic horticulture (but moving away from rice growing). Biogas as an alternative source of energy was also introduced, and a number of households living in the polder were resettled to higher ground.

The approach created public support for the new way of life, but one result that partic-

ularly boosted motivation was an increase of more than 100 per cent of the participants' annual income. In 2000 income attributable to the project was 1465 RMB/household; in 2003, it had reached 2881 RMB/household and in 2004, the figure was 3196 RMB/household. A WWF survey (Schuyt, 2005) demonstrated that households participating in the project had a higher income level than non-participants. The average household income of polder residents totalled 9360 RMB/household in 2003 (up from 2000 RMB/household in 1999). In addition to a rise in income, the project also generated important living standard improvements.

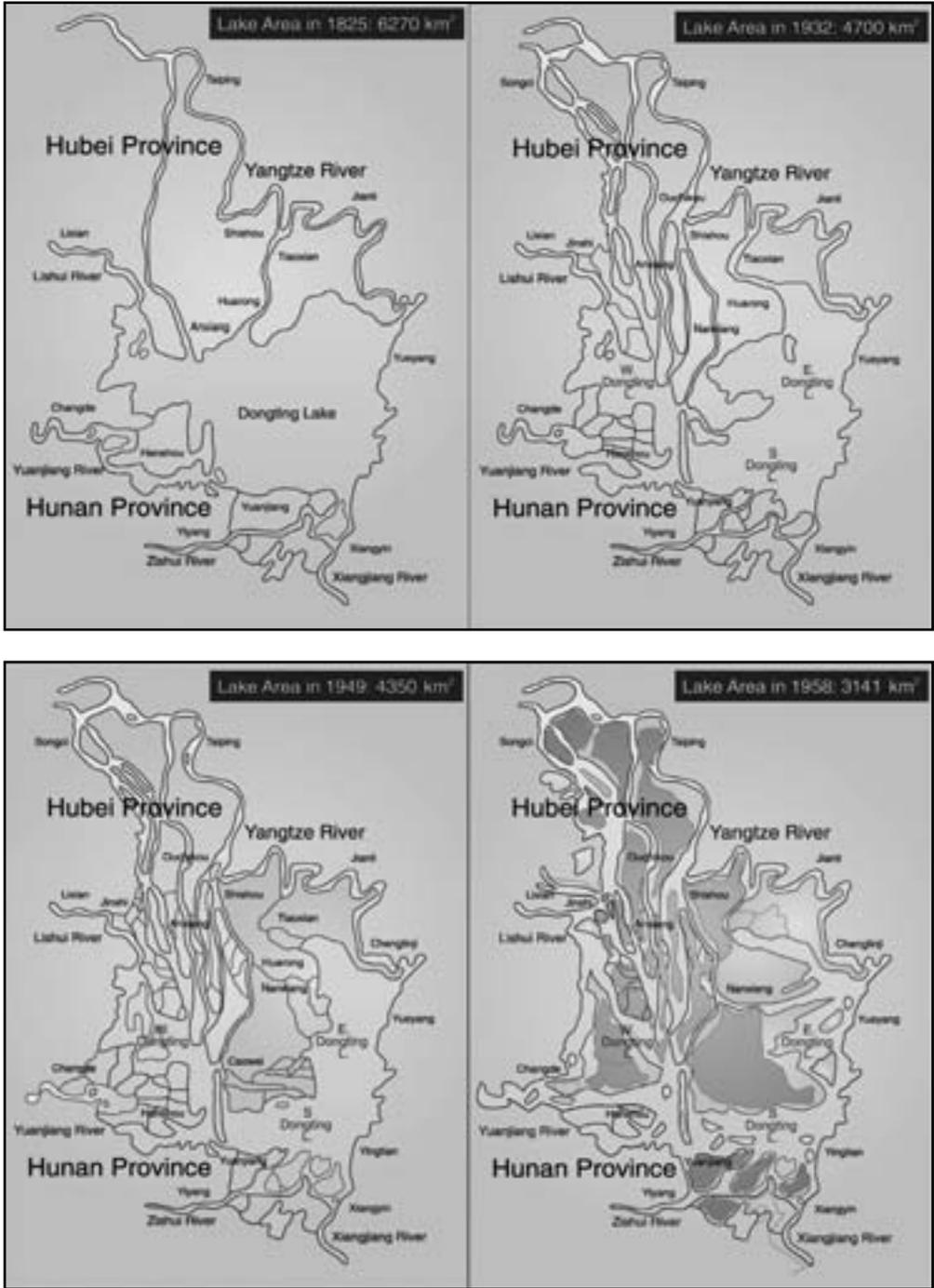
Improved living standards produced a ripple effect: without any intervention by the Dongting Lake project, neighbouring families replicated activities like cooking on biogas stoves and pig farming. The project demonstrated active participation by and benefits for women and the elderly. Another major outcome came in the form of raised awareness of the local community (Schuyt, 2005). Overall the livelihoods approach used by the WWF project at Dongting Lake produced lasting improvements seen beyond the end of funding in 2001.

Various partnerships were built during the project for livelihood development. At the local level, WWF China supported the creation of a community-based organization, in which 110 families participated, and an Organic Farming Association (OFA) managed by farmers themselves. Organic agriculture companies (amongst others, the Hunan Sun and Soil Organic Agriculture Company and the Naniwan Agriculture Company) also became involved during the exploration and building of a solid market for the products of organic farming and horticulture. This public-private cooperation provided support and marketing advice to farmers and the OFA. The MEP's Organic Development Center certified some of the organic products, thereby giving them official endorsement.

Apart from joint efforts with WWF China in the Dongting Lake project to search for and develop alternative livelihoods, actions were also carried out to restore the ecological value of the Xipanshanzhou polder. Success in identifying sufficient alternative livelihoods led to relocation of the residents of the polder and wetland restoration of its entire acreage, a total embanked area of 110 hectares. At present the former polder serves also as a flood retention area during high peak flows on the Yangtze when it can be inundated to reduce the floodwater level (WWF China official website). Preliminary biodiversity monitoring reports from WWF China showed that vegetation species diversity and quantity both increased, bringing an increase also in amphibian, fish and bird species (WWF China official website). As a result of the wetland restoration, major environmental and heavy metal indices for water (including dissolved oxygen, nitric salt, ammonia-salt, coliform, microbe population and fluorine) show lower levels than those set in health standards for water used to irrigate food crops (Schuyt, 2005).

In summary the WWF Dongting Lake project demonstrates that a bottom-up approach that uses the expertise of local farmers makes it possible to identify and adopt alternative livelihoods better suited to the natural environment and conducive to its restoration. Both results derive from important aspects of IRBM.

The role of the IRBM task force of the China Council for International Cooperation on Environment and Development Active involvement of the other major water resource management institutions became more pressing during the Dongting demonstration project. Possibly one of the most difficult and important steps was to bring the CWRC



Map 6.2 *Shrinkage of the Dongting Lake area due to land reclamation projects*

and the MWR into the process. A perfect opportunity occurred with the decision by the CCICED to devote a special task force to IRBM implementation in China. The Chinese government had established the CCICED in 1992 as a high-level non-governmental advisory organization with the aim 'to further strengthen cooperation and exchange between China and the international community in the field of environment and development' (CCICED official website).

For the past several years, the CCICED has been successful in articulating high-level advice and assisting Chinese decision-makers to increase their understanding of the relation between environmental protection and economic development in the river basin context.

The CCICED launched the IRBM Task Force in 2002 to advise and inform the national government on implementation of IRBM in China. At that time the CCICED's WWF representative had succeeded in gaining a chair position. This made it possible to promote two candidates who had a clear view of IRBM and the importance of a healthy river ecosystem to co-chair the IRBM Task Force. The viewpoints of the co-chairs are important because they set the agenda for the task force and thus pave the way for recommendations to the Chinese government. WWF China was also pleased to co-host the task force secretariat as a way to further ground its position.

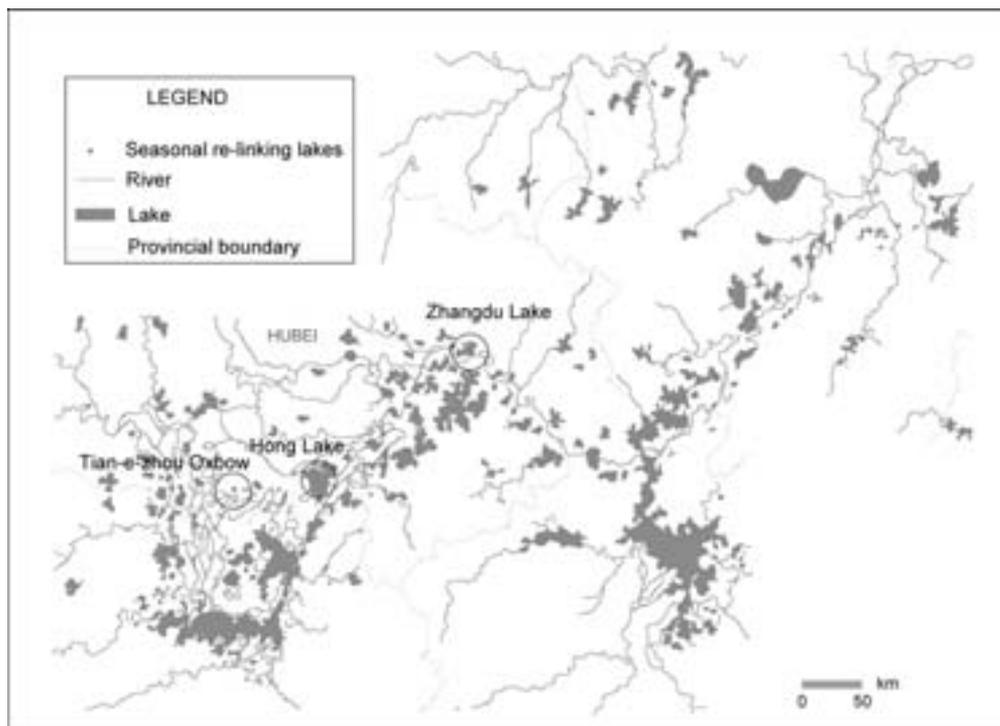
The co-chairs of the IRBM Task Force delivered their recommendations to the CCICED Annual General Meeting in November 2004. The recommendations went on to the relevant ministries (in particular the MWR) for implementation. In 2006 the CWRC began revisions (expected to take three years) to the Yangtze Basin Comprehensive Utilization and Development Plan to make it more sustainable and integrated. Although this was not a direct result of CCICED recommendations, it shows how a new way of thinking has taken hold to some degree in the Chinese government. Even more important was acceptance of the recommendation to establish a special Yangtze Forum, which would gather all key stakeholders of the river basin (Yangtze Forum official website).

The Yangtze Forum has been established as a precursor to an Integrated Yangtze River Basin Commission and is responsible for developing a vision for the river's management and for coordination of the activities of national and provincial government. Its membership established a multidisciplinary team including representatives from all the major water management institutions, NGOs and scientists.

It is important to note that the work of the IRBM Task Force of the CCICED directly facilitated the local interactions between CWRC and WWF China in the Dongting Lake case. In this way WWF China was able to demonstrate that there are good alternatives to the mainstream water management approaches used previously. It also increased the credibility and trustworthiness of WWF China as a partner. The success of the Dongting Lake Project has received a lot of public attention, involving all kinds of media, site visits, an international conference, publications and so on, creating visibility and impact. Its positive results and reception opened the door for other projects.

6.6.3 The WWF-HSBC Yangtze programme: 'restoring the web of life'

The WWF-HSBC Yangtze Programme is a major freshwater initiative to restore the 'web of life' along the Yangtze River by reconnecting lakes to the river's main flow. The reconnection programme, part of the five-year eco partnership between the WWF and



Map 6.3 Yangtze River and Zhangdu Lake, Hong Lake and Tian-e-Zhou Oxbow

HSBC (initials of the Hongkong Shanghai Banking Corporation, one of the original banks merged and rebranded), started in 2002. The goal was set to rehabilitate the food chain and ecological networks in the Central Yangtze River basin through policy work and demonstration projects that undertake reconnection, support local economic development, and create a network of wetland reserves. The Zhangdu Lake, Hong Lake, and the Tian-e-Zhou Oxbow in Hubei were selected as demonstration sites (Map 6.3).

More than 100 lakes once dotted the Yangtze River basin with natural channels linking the river's main tributaries. Even at its present-day reduced level, this network of interwoven streams and lakes creates a unique and complex ecosystem rich in biodiversity, but middle and lower reaches of rivers are often the sites of heavy rainfall and extensive flooding. Farmers who work the rice paddies are at risk of snail fever (schistosomiasis), an infection that leads to gradual, serious damage to the internal organs. Snail fever is caused by a blood fluke (a trematode), which grows in lakes and rivers and swims into the paddies (Wu et al., 2008). To prevent flooding and stop blood flukes from reaching rice paddies, dams and thousands of kilometres of dykes were built in the basin beginning in the 1950s (Utzinger et al., 2005). The dams and dykes often cut off water flow between rivers and lakes. Now only Poyang Lake and Dongting Lake still have naturally occurring links with the Yangtze River.

In recent years environmentalists have begun to study the effect of damming on local biodiversity. They conclude that the Yangtze and its lakes once formed a complex

wetland network providing just the right conditions for fish to spawn and feed, but disconnection obstructed the natural flow of migratory fish, dramatically decreasing biodiversity across the whole basin (Fu et al., 2003; Park et al., 2003; Wu et al., 2004; Lopez-Pujol et al., 2006; Yang et al., 2007). Sluice gates were constructed in the embankments, but were used only for irrigation. Few considered the impact on water quality, fish migration routes, flora and fauna. As a consequence, inbreeding among the fish led to inferior-quality specimens of much smaller size. In addition, the number of fish species decreased, dropping, for example, in Zhangdu Lake from more than 90 to 40.

Within a few years, the locals' lucrative fishing business seemed on its last legs. Still, though, resource destruction continued as intensive land reclamation followed the construction of the dykes, with both agricultural and urban settlements springing up on the former flood plains and around the lakes. In the 1990s Zhangdu Lake dwindled to one-quarter of its original 1930s size. Lakes also began to suffer from the inflow of farm run-off and domestic and industrial sewage. Deteriorating water quality affected local ecology and wildlife. Natural fisheries output in the two lake regions declined sharply. Without the natural water exchange with the river, the lakes started to clog quickly with silt. For example, the annual deposit of silt in Zhangdu Lake increased from an average depth of just 1 cm to 1 metre after its disconnection from the Yangtze in the 1950s. All these effects continue today, the worse for their continuation over time.

Within the framework of the WWF–HSBC project, environmental experts propose seasonal opening of the dykes, outside the flood season, to help restore the lakes' natural links to the Yangtze. The seasonal opening coincides with the fish-breeding season to enable the migratory flow, allowing fish to breed upstream in the Yangtze and fish fry to return to the lake where they mature. This measure will also ensure a natural hydrological fluctuation in the lakes, where wetland areas will receive fresh water from the Yangtze, helping to ensure a healthy wetland ecosystem. To prevent the re-entry of blood flukes during the linking period, the local governments now provide funds to build concrete snail retention ponds between the first and second sluice gates linking river and lake.

The programme staff have also been promoting the concept of environment-friendly farms and fisheries in the reconnection scheme, hoping to restore wetland habitats for displaced migratory and endemic birds, as well as reduce water pollution. Local fish farmers have been using fertilizer for a few years to promote the growth of algae, which serves as food for fish, but with the accumulation of poisonous substances in the fertilizer that sinks into the silt, epidemics among fish have become increasingly frequent. Local fishermen were invited to join an eco-fishery programme advocated by the local government and WWF China. Farming began of a more environment-friendly type that demands clean aquatic conditions and uses a special fish species that feed on artificial fish pellets. Fish farmers who have put the eco-fishery programme into practice are currently earning more than two to three times the sums typical of traditional farming practices (WWF China official website; personal communications – WWF China).

The Yangtze programme has so far resulted in the seasonal relinkage of 11 lakes to the Yangtze River. The wetlands covering 450 000 hectares are effectively protected. Water quality has improved, and 34 varieties of birds and 14 species of fish now travel freely back to the river. In all, 15 million bamboo poles and fishing nets have been removed, and the 'falling and rising tide of the Hong Lake' has returned. In addition, members of

296 families have been taught sustainable fishing solutions, which has helped to increase their incomes by more than 20 per cent.

6.7 Analysis

It can be argued that Pierre and Peters's 'strong state', mentioned in Chapter 1 of this book, in many ways still applies to the Chinese political situation. Obviously government takes the leading role, especially in water management. This in itself, and in relation to the institutionalization of water resource management, might not actually be much different than in other, more democratically governed countries. However it can be argued that in Western (democratic) culture a case must become a social movement or at least a social issue before it can become part of a political agenda. There is a vast body of knowledge on the extent of these movements, the capacity to actually change policy and the different ways in which agenda-setting and policy influence can occur (see the theoretical introduction by Meijerink and Huitema, Chapter 2 in this volume). In China, agenda-setting is mainly limited to the central government as the country's leader of innovation. This means that policy-making in China is much less of a 'multilevel game' than in Western nations. However much this may still hold true, clearly Chinese society and the way it is governed are changing, opening avenues for third parties to enter the game, albeit with caution and care. The projects examined show WWF China successfully following new political paths in China in just such a way.

WWF China plays the role of main policy entrepreneur in our case studies. Since the start of China's Open and Reform Policy in 1978, the WWF has been active in the country (launching a panda protection project in 1980). An international NGO, WWF currently has a subdivision in China, but still no status as a Chinese NGO. A lot of time has been needed for it to be able to address environmental issues in China and cooperate successfully with governmental bodies in finding a better balance between nature and the economy. One of the major characteristics of policy entrepreneurship in China seems to be perseverance. Over the years, the WWF has slowly built a coalition with the Chinese Academy of Sciences and the State Forestry Administration. Resulting cooperation led to nature reserve staff training in the 1980s and, as above, to some Ramsar site listings as early as 1992, but it was not until the 1998 flood and the proclamation of the 32-character policy that a problem window was created that gave WWF China the opportunity to bring a new perspective on sustainable river basin management to the table. In this context WWF China was able to launch its Living River programme and organize joint planning events with local farmers, regional authorities and water management experts to identify alternative livelihoods (case one, Dongting Lake), restore wetlands, and implement sustainable fishing programmes (case two, Hong Lake).

The introduction and implementation of new ideas generates a broad spectrum of technical and non-technical questions and often requires seed money to trigger transition processes. In water management and land use, therefore, the need to make optimal use of the available knowledge, experience and finances makes it essential to build coalitions with public, private and governmental stakeholders in the river basin. This is true at both the national and the international level. The successful creation of coalitions led to the discovery of the experts and funding necessary to launch the Living River programme and its demonstration projects.

However, in any society, working from the bottom up to generate policy change is not sufficient. Particularly in a country like China, where agenda-setting for innovation is usually centralized, it is very important to invest time and attention in enlisting administration officials, lawmakers, policy research specialists and journalists. For this reason WWF China worked with the CCICED once it became clear that this organization would formulate recommendations to implement IRBM in China. This 'investment' proved highly profitable. By providing the secretariat of the IRBM task force and lobbying for suitable co-chairs, WWF provided a firm basis for incorporating the approach into the final CCICED recommendations with an effective plan for implementation including, for example, establishment of the Yangtze Forum. WWF China's strategic cooperation also helped to expedite the administrative process, resulting, for instance, in the recommendations being delivered directly to the premier of the State Council without passing through the ministerial levels.

Parallel to this activity, intensive contact with the academic field (for example the Chinese Academy of Sciences) opened the way to media coverage in the form of a special issue in *Chinese National Geography*, articles in the *China Daily* and newsletters for experts dealing with IRBM. This had a huge impact on awareness in- and outside China. Now, following the demonstration projects, the transition to IRBM seems to be gaining momentum and meeting little coordinated effort to block forward movement.

That said, the context for the transition process needs to be considered. The introduction and implementation of IRBM as a new paradigm can be regarded as the emergence of resistance to the Chinese hydrological mission and its unintended consequences. However the ongoing execution of large hydro-engineering projects indicates a competition between two paradigms and an outcome that has still to be determined (Boxer, 2001; McCormack, 2001). As seen, too, in other countries, the difference between policy transition and policy implementation will also be telling.

The adoption of IRBM in China necessarily involves the Chinese political system and consequently its governance system. In this respect we refer to the trialogue model currently refined by Turton et al. (2007), in which governance and especially good governance (as a product) depends on a dynamic interplay between the domains of government, society and science. This model underlines the importance of stakeholder participation, accountability and ultimately democracy in order to achieve good governance. The concept of IRBM (and the related concept of integrated water resources management) is based on the same principles regarding the 'human system' as formulated by the Global Water Partnership (Global Water Partnership, GWP, 2000; Jonch-Clausen and Fugl, 2001; Falkenmark et al., 2004). It requires a major participatory role for all stakeholders involved and appears to root firmly in a democratic policy system. As such, IRBM as developed elsewhere might not be fully applicable in the Chinese situation.

As shown, however, the Chinese government has allowed room for a new paradigm to enter. The rules of stakeholder participation may differ but, as cautiously undertaken in the cases presented above, efforts are being made to involve stakeholders in parts of the policy cycle (Wang et al., 2003; Zhong and Mol, 2007). How the government will attempt to direct the transition to IRBM and the results, both in water management and in governance, will be of great interest for future study.

6.8 Strategies of transition management

In order to characterize the strategies used by WWF China acting as a policy entrepreneur, we use the terminology and categorization presented in Chapter 2.

6.8.1 Development of new ideas

WWF China introduced ideas new to Chinese decision-makers. The importance of wetlands, and the possibility of using them as flood retention areas while simultaneously restoring valuable ecosystems, was a novelty previously only discussed in academic settings in China. The concept of IRBM as an approach where the environment, safety and economic matters can go hand in hand (case one, Living River programme) was likely the most influential ‘new’ idea. The IRBM conceptual framework provided a basis for rethinking all kinds of engineering solutions and methods that exploit freshwater resources and cause detrimental effects to ecosystem functions.

6.8.2 Build coalitions and sell ideas

Coalition-building is a very important part of WWF strategy and thus also of WWF China. It is a core WWF belief that: ‘no solution will be effective in any river basin unless it is implemented through cooperation across social, economic, and political boundaries’ (WWF, 2003). All stakeholders in a river basin need to come together around the table, establish respect for each other, number the needed experts among themselves, and bring the financing necessary to identify solutions in which the environmental, safety and economic goals are well balanced. Generally this method of working prevents unfair distribution of effort and costs where only one or two groups of stakeholders would have to ‘bear the pain’.

Involvement of the wider public in the transition process takes the formulation of clear messages in plain language and illustrated with practical examples of where the ‘new’ ideas have proven to be feasible, easily adopted and scaled up by other stakeholders. These messages need to be made available prior to or during public events designed to draw media attention. WWF China accomplished all these steps very effectively in both the Yangtze River basin cases studied.

6.8.3 Recognize and exploit windows of opportunity

That WWF China acted during the right window of opportunity is clear. It did so by first presenting plans already formulated for the Yangtze River basin and Dongting Lake in concordance with and building upon the national 32-character policy. Next, to ensure top-level influence, it capitalized on WWF representation on the CCICED and support for IRBM by other members in order to steer the related task force and hence to influence national policy-makers.

Only once part of the senior hierarchy of the CCICED could the WWF create a ‘shadow network’, a circle outside direct governmental influence, where there is more room for debate. This network has proven to be very influential in the introduction of IRBM and in bypassing less enthusiastic organizations and players.

6.8.4 Recognize, exploit, create and/or manipulate the multiple venues in modern societies

Many venues exist for policy issue debate. These include, for example, various government processes, from planning to legislative and science fora. As Richardson (2000)

argues, these venues are an interest group resource: that is, they can be exploited by policy entrepreneurs.

In the context of introducing IRBM to China, WWF China has also demonstrated a capacity to recognize and make efficient use of international and national venues that are known and visible in society. One of the most important parts of the WWF strategy is its constant advocacy of its ideas, successes, approaches and visions for the future. Clearly use of both international and national media is very important, but informing politicians at all levels of government through field visits, conferences, lectures and so on, might be just as important. The success of the IRBM task force and the amount of positive media coverage of its demonstration projects show that WWF China can be considered a very effective 'venue shopper' (Richardson, 2000).

6.8.5 Orchestrate and manage networks

Upscaling ideas and implementing new policies entails expanding and managing networks at all levels in society. Mustering sufficient public support and the necessary 'entrepreneurship' to envision, draft and implement new policies and/or concepts demands more than one social actor. The WWF sets out, therefore, to finance demonstration projects, but is keen to return ownership to the appropriate level of governance or society, including financial ownership for scaling up the demonstration projects and converting innovation to common practice. This explains why, apart from realizing demonstration projects, the WWF's core business is the orchestration and management of networks worldwide. These networks are managed by individuals highly skilled at addressing stakeholders of all kinds with respect and at communicating solution-oriented strategies.

6.9 Lessons learned and conclusions

In this chapter we have elaborated the role of WWF China as a change agent for the transition process to IRBM in China. We have demonstrated that WWF uses various strategies of different types to support this transition process. Successful deployment of these strategies for change in environmental policy requires special skills, actions and attitudes on the part of the policy entrepreneur (the role taken by WWF China in the cases presented above), including:

1. Broad focus: efforts are needed to understand the interests of partner stakeholders. For WWF China this means a focus not only on biodiversity, but also on the importance of a healthy ecosystem in balance with sustainable livelihoods and economies.
2. Pursuit of win-win situations that respect the interests of all stakeholders: what do they seek to gain or lose from the ultimate goal, and where do they stand regarding the balance of economy, safety and ecology?
3. Focus on the realization of demonstration projects: one successful demonstration project proved more convincing than any number of reports and academic studies.
4. Support for and action on a transition process by players at all societal levels: this requires investment by a change agent in a joint planning process run from the bottom up and from the top down.
5. Use of media as powerful tools for dissemination: messages need to be linked to news events.

6. Attention to the continuation of demonstration projects: help-desks and/or other forms of support need to be organized to assist stakeholders as they take over the lead in the transition process.
7. Frequent, continuous and meaningful communication: reiteration of long-term goals and presentation and analysis of short-term successes proved helpful in the work of WWF China.

The WWF as an IRBM policy entrepreneur contributed considerably to China's current stance on river basin management to the point where hardly any official now defends the traditional development model of high levels of growth and high pollution. According to the newspaper *China Daily*, officials of Shanxi, Henan and some other resource-rich provinces planned to close down local small coal mines and chemical plants managed on nineteenth-century concepts, even though these were erected only a decade ago or so earlier (You, 2007). Specifically in regard to the water sector, *China Daily* mentions that Hunan province recently closed down 230 paper-producing plants, producing an improvement of the water quality from level V to level III (near drinking water standard) within two months (Xu, 2007). Although the newspaper is a state medium and as such gives voice to the official view, nevertheless these kinds of reports are a sign that those who govern China recognize the growing importance of environmental issues. This represents a continuing opportunity for skilled, strategic action by policy entrepreneurs seeking transitions in China to ecologically and economically sustainable policies.

The 17th Communist Party of China (CPC) Congress in October 2007 settled China's political strategy for the next five years and officially confirmed a promising political future for the first time in modern history for sustainable development. As stated by President Hu Jiantao, the CPC aims to:

[I]mprove energy, resources, ecological, and environmental conservation and enhance China's capacity for sustainable development. Adhering to the basic state policy of conserving resources and the environment is vital to the immediate interests of the people and the survival and development of the Chinese nation. We must give prominence to building a resource-conserving, environment-friendly society in our strategy for industrialization and modernization and get every organization and family to act accordingly. (Hu, 2007)

Such a statement is welcome. However experiences in many countries have taught that the transition towards an environment-friendly society is a complex and difficult process, one that involves an indispensable role for sophisticated policy entrepreneurs like WWF China.

Notes

1. The Central Yangtze: Partnership for a Living River programme was begun by WWF China in 1998. The initiative for this project came from WWF China, and the first financial donations to pay for related activities were generated by WWF Netherlands.
2. As of March 2008 the State Environmental Protection Agency (SEPA) was upgraded to the Ministry of Environmental Protection (MEP).
3. The Yangtze Focal Project builds upon the Central Yangtze: Partnership for a Living River programme.

References

- Boxer, B. (2001), 'Contradictions and challenges in China's water policy development', *Water International*, **26** (3), 335–41.
- CCICED, official website www.cciced.org/node_7040746.htm, accessed 19 September 2008.
- CCICED and WWF (2004), *Promoting Integrated River Basin Management and Restoring China's Living Rivers*, Beijing: CCICED.
- Chen, Z. (2005), 'Tackling China's water pollution problem: a legal and institutional perspective from Taihu Lake water pollution control', *Temple Journal of Science, Technology and Environmental Law*, **24**, 325–50.
- Cui, L.J. and Y.F. Wang (2008), *Wetlands of International Importance in China*, Beijing: China Forestry Press (in Chinese).
- CWRC, official website, www.cjh.com.cn/eng/index.html, accessed 19 September 2008.
- Falkenmark, M., L. Gottschalk, J. Lundqvist and P. Wouters (2004), 'Towards integrated catchment management: increasing the dialogue between scientists, policy-makers and stakeholders', *International Journal of Water Resources Development*, **20** (3), 297–309.
- Fang, J., Z.H. Wang, S. Zhao, Y. Li, Z. Tang, D. Yu and L. Ni (2006), 'Biodiversity changes in the lakes of the Central Yangtze', *Frontiers in Ecology and the Environment*, **4** (7), 369–77.
- Fischer, G. and G.K. Heilig (1997), 'Population momentum and the demand on land and water resources', *Philosophical Transactions of the Royal Society of London Series B – Biological Sciences*, **352** (1356), 869–88.
- Flavin, C. and G. Gardner (2006), 'China, India, and the new world order', in L. Starke (eds), *State of the World 2006*, Washington, DC: Worldwatch Institute, pp. 3–23.
- Fu, C.Z., J.H. Wu, J.K. Chen, Q.H. Qu and G.C. Lei (2003), 'Freshwater fish biodiversity in the Yangtze River basin of China: patterns, threats and conservation', *Biodiversity and Conservation*, **12** (8), 1649–85.
- Global Water Partnership (GWP) (2000), 'Integrated water resources management', TAC Background Papers, Global Water Partnership, Stockholm.
- Global Water Partnership China (GWP China) official website, www.gwpcchina.org/echinagwp/Publish/News.aspx?NewsID=2bcf1615-f6b9-4525-8d6f-33508483e7dd&DisplayOrder=05, accessed 8 October 2008.
- Hu, J. (2007), 'Speech: report to the 17th National Congress of the Communist Party of China (CPC)', Beijing, 15 October.
- Hunan province, official website, www.hbj.hunan.gov.cn/dongT1/wzDisplay.aspx?id=130, accessed 8 October 2008.
- Jonch-Clausen, T. and J. Fugl (2001), 'Firming up the conceptual basis of integrated water resources management', *International Journal of Water Resources Development*, **17** (4), 501–10.
- Kreimer, A. and M. Munasinghe (1991), 'Managing environmental degradation and natural disasters: an overview', in A. Kreimer and M. Munasinghe (eds), *Managing Natural Disasters and the Environment*, Washington, DC: World Bank, pp. 3–6.
- Lee, S. (2006), 'China's water policy challenges', China Policy Institute Discussion Paper, Nottingham: China Policy Institute of the University of Nottingham.
- Li, Y.S., A.C. Sleight, A.G.P. Ross, G.M. Williams and M. Tanner (2000), 'Epidemiology of *Schistosoma japonicum* in China: morbidity and strategies for control in the Dongting Lake region', *International Journal for Parasitology*, **30** (3), 273–81.
- Lopez-Pujol, J., F.M. Zhang and S. Ge (2006), 'Plant biodiversity in China: richly varied, endangered, and in need of conservation', *Biodiversity and Conservation*, **15** (12), 3983–4026.
- McCormack, G. (2001), 'Water margins: competing paradigms in China', *Critical Asian Studies*, **33** (1), 5–30.
- Ministry of Water Resources (MWR), official website, www.mwr.gov.cn/english1/, accessed 19 September 2008.
- Muldavin, J. (2000), 'The paradoxes of environmental policy and resource management in reform-era China', *Economic Geography*, **76** (3), 244–71.
- Nakamura, T. (2003), 'Ecosystem-based river basin management: its approach and policy-level application', *Hydrological Processes* **17**, 2711–25.
- Nakamura, T. (2006), 'Development of decision making indicators for ecosystem-based river management', *Hydrological Processes*, **20**, 1293–1308.
- OECD (2007), *China, Environmental Performance Reviews*, No. 5, Paris: OECD Publishing.
- Olson, D.M. and E. Dinerstein (1998), 'The Global 200: a representation approach to conserving the earth's most biologically valuable ecoregions', *Conservation Biology*, **12** (3), 502–15.
- Park, Y.S., J.B. Chang, S. Lek, W. Cao and S. Brosse (2003), 'Conservation strategies for endemic fish species threatened by the Three Gorges Dam', *Conservation Biology*, **17** (6), 1748–58.
- Ramsar Convention on Wetlands (Secretariat), official website, www.ramsar.org, accessed 19 September 2008.

- Richardson, J. (2000), 'Government, interest groups and policy change', *Political Studies*, **48** (5), 1006–25.
- Schuyt, K. (2005), *Freshwater and Poverty Reduction: Serving People, Saving Nature*, Zeist, The Netherlands: WWF International.
- Schuyt, K. and L. Brander (2004), *The Economic Values of the World's Wetlands, Living Waters*, Gland, Switzerland and Amsterdam: WWF International and Institute for Environmental Studies, Vrije Universiteit Amsterdam.
- Turner, J.L. and K. Otsuka (eds) (2005), *Promoting Sustainable River Basin Governance: Crafting Japan–US Water Partnerships in China*, IDE JETRO Spot Survey Report No. 28, Chiba: Institute of Developing Economies.
- Turner, J.L. and K. Otsuka (2006), *Reaching Across the Water*, Washington, DC: Woodrow Wilson International Center for Scholars.
- Turton, A.R., H.J. Hattingh, G.A. Maree, M. Claassen, P.J. Roux and W.F. Strijdom (2007), *Governance as a Dialogue: Government–Society–Science in Transition*, Berlin and Heidelberg: Springer-Verlag.
- Turton, A.R., R. Meissner, P.M. Mampame and O. Seremo (2004), *A Hydropolitical History of South Africa's International River Basins*, Pretoria: Water Research Commission.
- Utzinger, J., X.N. Zhou, M.G. Chen and R. Bergquist (2005), 'Conquering schistosomiasis in China: the long march', *Acta Tropica*, **96** (2–3), 69–96.
- Varis, O. and P. Vakkilainen (2001), 'China's 8 challenges to water resources management in the first quarter of the 21st century', *Geomorphology*, **41**, 93–104.
- Wang, Q.G., G. Gu and Y. Higan (2006), 'Toward integrated environmental management for challenges in water environmental protection of Lake Taihu basin in China', *Environmental Management*, **37** (5), 579–88.
- Wang, Y., L.F. Li, X.J. Wang, X.B. Yu and Y.H. Wang (2007), *Taking Stock of Integrated River Basin Management in China*, Beijing: WWF China.
- Wang, Y., R.K. Morgan and M. Cashmore (2003), 'Environmental impact assessment of projects in the People's Republic of China: new law, old problems', *Environmental Impact Assessment Review*, **23**, 543–79.
- Waterbury, J. (1979), *Hydropolitics of the Nile Valley*, New York: Syracuse University Press.
- World Bank (1997), *Clear Water and Blue Skies: China's Environment in the New Century*, Washington, DC: World Bank.
- Wu, J.G., J.H. Huang, X.G. Han, Z.Q. Xie and X.M. Gao (2004), 'The Three Gorges Dam: an ecological perspective', *Frontiers in Ecology and the Environment*, **2** (5), 241–8.
- Wu, X.H., S.Q. Zhang, X.J. Xu, Y.X. Huang, P. Steinmann, J. Utzinger, T.P. Wang, J. Xu, J. Zhang and X.N. Zhou (2008), 'Effect of floods on the transmission of schistosomiasis in the Yangtze River valley, People's Republic of China', *Parasitology International*, **57** (3), 271–6.
- WWF (2003), *Managing Rivers Wisely: Lessons from WWF Work for Integrated River Basin Management*, T. Jones, B. Phillips, C. Williams and J. Pittock (eds), Gland, Switzerland: WWF International.
- WWF China, official website, www.wwfchina.org, accessed, 19 September 2008.
- WWF International, official website, www.panda.org, accessed 19 September 2008.
- Xu, X. (2007), 'Hunan Province cleans up its act', *China Daily*, 17 October, p. 24, available at: http://www.chinadaily.com.cn/cndy/2007-10/17/content_6181797.htm, accessed 20 June 2009.
- Yan, F., D. He and B. Kinne (2006), 'Water resources administration institution in China', *Water Policy*, **8**, 291–301.
- Yang, G.S., L.D. Weng and L.F. Li (2007), *Yangtze Conservation and Development Report*, Wuhan.
- Yangtze Forum, official website, www.yangtzeforum.org, accessed 19 September 2008.
- Yin, H. and C. Li (2001), 'Human impact on floods and flood disasters on the Yangtze River', *Geomorphology*, **41** (2–3), 105–9.
- Yin, H., G. Liu, J. Pi, G. Chen and C. Li (2006), 'On the river–lake relationship of the middle Yangtze reaches', *Geomorphology*, **85**, 197–207.
- You, J.M. (2007), 'Transforming the model', *China Daily*, 15 October, p. 5, available at: http://www.china-daily.com.cn/bw/2007-10/15/content_6173701.htm, accessed 20 June 2009.
- Zhang, M., G. Yang, H. Zhang and CWRC (1998), 'Water resource development and utilization in the Yangtze Valley', Los Alamos National Lab, unpublished work.
- Zhao, S. and J. Fang (2004), 'Impact of impoldering and lake restoration on land-cover changes in Dongting Lake area, Central Yangtze', *Ambio*, **33** (6), 311–15.
- Zhao, S., J. Fang, W. Ji and Z. Tang (2003), 'Lake restoration from impoldering: impact of land conversion on riparian landscape in Honghu Lake area, Central Yangtze', *Agriculture, Ecosystems and Environment*, **95** (1), 111–18.
- Zhao, S.Q., J.Y. Fang, S.L. Miao, B. Gu, G. Tao, C.H. Peng and Z.Y. Tang (2005), 'The 7-decade degradation of a large freshwater lake in central Yangtze river, China', *Environmental Science and Technology*, **39** (2), 431–6.

- Zhao, S., C. Peng, H. Jiang, D. Tian, X. Lei and X. Zhou (2006), 'Land use change in Asia and the ecological consequences', *Ecological Research*, **21** (6), 890–96.
- Zhong, L.-J. and A.P.J. Mol (2007), 'Participatory environmental governance in China: public hearings on urban water tariff setting', *Journal of Environmental Management*, **88** (4), 899–913.