

Chapter 2

Wetland Utilization and Protection in China

Q.G. Zhao and J. Song

Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, People's Republic of China

Abstract. Wetland is an important component of the global ecosystem and plays a key role in water conservation, environmental clean-up and biodiversity conservation. China possesses approximately 10% of the world's total wetlands. However, with increasing population and economic growth, wetlands have been over-exploited, which resulted in a sharp decrease in quantity, quality deterioration and degradation of ecological functions. In this chapter, concrete measures for protection of wetland resources are proposed. Utilization of coastal wetland in Jiangsu province exemplified the prospects of wetland utilization and protection, and may serve as an example for wetland utilization and protection in other parts of China.

2.1. Brief Introduction to Wetland Resources in China

As an indispensable component of the global ecosystem, wetlands are among the most important natural habitats that support biodiversity and provide subsistence for humans. Although wetlands occupy only 6% of the earth's surface, they support roughly 20% of all living organisms on this planet.

China has 65.94×10^6 ha of wetlands (excluding rivers and ponds), accounting for about 10% of the world's total. In terms of wetland area, China ranks the first in Asia and the fourth in the world. According to a survey, China's natural wetlands amount to 25.94×10^6 ha including 11.97×10^6 ha marshes, 9.10×10^6 ha natural lakes, 2.17×10^6 ha inter-tidal flats and 2.70×10^6 ha shallow seas (less than 5 m deep at low tide) (State Forestry Administration, 2000). By 2001, China had 21 wetlands of international importance (Fig. 1).

Wetlands are widely distributed, unique ecosystems of various types and with complex structures. Their ecological functions include water conservation, environmental clean-up, biodiversity conservation and biomass production, etc.

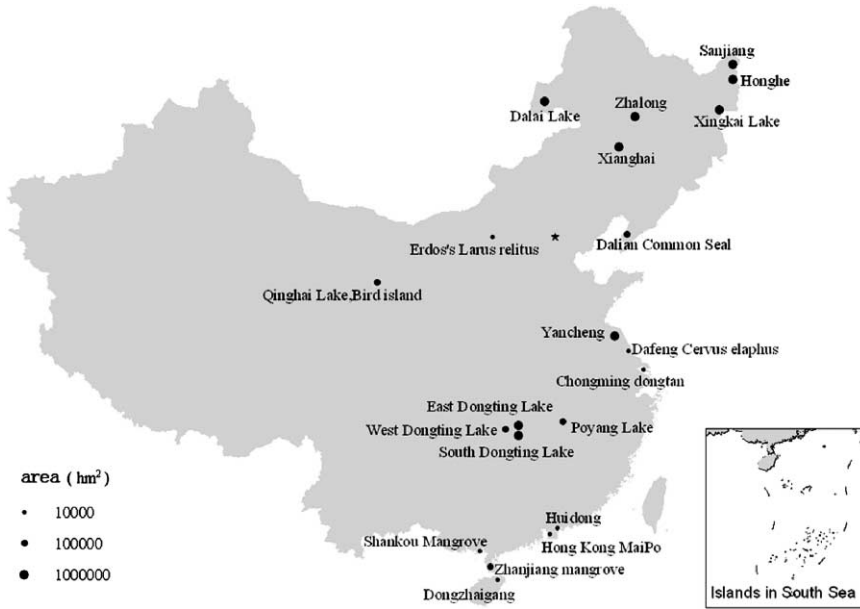


Figure 1: Chinese wetlands of international importance.

With increasing demand for material and expansion of territories, human intervention and utilization of wetlands also intensified. Therefore, wise utilization and protection of China's wetland resources is of great significance for the ecological balance of China's natural resources, environmental protection and sustainable development of the national economy.

2.2. Problems Arising from Wetland Exploitation and Utilization

Over-exploitation of wetlands and inappropriate farming practices have caused a series of problems such as reduction in the quantity of wetlands, quality deterioration and degradation of their ecological functions and reduced biodiversity, etc.

2.2.1. Over-Exploitation and Shrinking Wetlands

Wetland shrinkage in China can be mainly ascribed to wetland reclamation and urbanization. This is especially true in the densely populated coastal areas and

Table 1: Temporal changes (in km²) of lakes in the middle stream of Yangtze River.

Period	Dongting Lake	Jinghan Lakes	Four Lakes region
The 1920s–1930s	4,206	8,330	
The 1950s	4,009	5,960	2,030
The 1970s	2,507.87	2,373	
The 1980s	2,146.9	2,983	844
The 1990s	1,502.7	2,608	707.34

Source: Yu (1999).

lakesides. Wetlands have been disappearing at a rate of 20,000 ha per year as a consequence of conversion of lakeshore to farmland. On Sanjiang (the Three Rivers) Plain, where wetlands are widely distributed, farmland increased by 4.6 times from 786,000 ha in 1949 to 3.668×10^6 ha in 1995 (Zhang et al., 2001). The number of lakes (larger than 0.5 km²) in the middle and lower streams of the Yangtze River was reduced by 43.5% over 30 years from 1950s to 1980s (Table 1).

Mudflat was reclaimed and thus shrank more than any other wetlands. Between the 1950s and the 1980s, 2×10^6 ha of mudflat had been reclaimed, accounting for 50% of the total in China. As a consequence of aquaculture and tideland reclamation, the mangrove area in the whole country was reduced by 50% from 40,000 ha in 1957 to 18,000 ha in 1986.

2.2.2. Wetlands' Quality Deterioration

Based on past experience and current status of wetland degradation in key regions and in the whole country, the main influencing factors of wetland degradation can be categorized as follows: wetland reclamation and exploitation, improper use of biological resources, wetland pollution, utilization of wetland water resources and water engineering projects, sedimentation, coastal erosion as well as urbanization and tourism. Different influencing factors pertained in different regions and had different consequences and trends (see Table 2).

Wetland reclamation is now strictly prohibited. However, other factors are still exerting their effects on wetland degradation. Therefore, the trend of wetland degradation is unlikely to be altered in the near future.

Table 2: Influencing factors of wetland degradation and their trends.

Influencing factors	Affected regions	Consequences	Trends
Reclamation and over-exploitation of wetland resources	Densely populated coastal area and lakeshore	Wetland shrinkage and degradation of ecological functions	Reclamation for farming before the 1980s and for aquaculture between the 1980s and the 1990s, the impact will be reduced in the future
Improper use of wetland biological resources	Excessive fishing in lakes, reservoirs and coastal area, mangrove shrinkage in the coastal area	Reduced biodiversity, degradation of ecological functions and habitats destroyed	Productivity reduced significantly, but huge demand still remains
Wetland pollution	Nearly all wetlands are affected by anthropogenic activities, especially in developed areas	Deteriorating water quality, increasing pollutants' concentration, loss of water decontamination function, reduced biodiversity	Serious situation at present, and impact will be intensified
Improper use of wetland water resources and water engineering projects	Northwestern and Northern China, hydro-engineering projects on big rivers	Water sources shrank or dried-up, habitats destroyed, degradation of ecological functions	Impact will last for a long period, deteriorating in Northwestern and Northern China

Sedimentation	Nationwide, especially in Central and Eastern China	Wetland shrinkage, loss of water conservation function Mudflat shrinkage	Deteriorating
Coastal erosion	Coastal area, especially Southeastern China		Impact still remains
Urbanization and tourism	Southeastern coastal area including Yangtze and Pearl River Deltas	Wetlands demolished or isolated, habitats of water birds changed	More impact by urbanization and increasing impact by tourism

Source: Zhang et al. (2001).

2.2.3. Ecological Degradation and Reduced Biodiversity

According to statistics, higher plants of 172 families, 495 genera and 1,642 species (including varieties) can be found in China's wetlands. They account for 48.7, 15.5 and 5.5 of the total higher plant families, genera and species in China, respectively. Microbial biomass in marshes can be as high as 7.26×10^7 cfu/g DW, of which bacteria, actinomycosis and fungi constitute 99.62, 0.032 and 0.34%, respectively. About 68 soil animals from 5 kingdoms, 10 classes, 2 orders and 37 families can be found in swamps (Tian et al., 2002). Due to human intervention, natural habitats of some wetland flora or fauna were destroyed. As a consequence, composition, structure and quantity of wetland biological communities were changed. In worse scenarios, the number of certain wetland species will decrease sharply or even die out. Simplification and reorganization of the wetland biological community, changes in dominant species or even converse evolution may take place, which eventually leads to reduced or even loss of biodiversity.

2.3. Measures for Protection of China's Wetlands

The Chinese government has attached great importance to the eco-environment development. A wetland recovery plan has been implemented in the middle and lower streams of the Yangtze River. The trend of human-induced wetland shrinkage is contained. However, mudflat exploitation has not been brought under control. With establishment of more wetland nature reserves and strengthening of wetland management, wetland protection will be reinforced. But, as a whole, the trend of wetland degradation is unlikely to be reversed in the near future.

The following measures can be taken to reinforce management and protection of wetland resources.

1. Attention should be given to both protection and utilization. The protection and utilization of wetland resources should be considered from the viewpoint of sustainable development. Economic, social and ecological benefits should all be taken into consideration. Based on a better understanding of natural conditions, ecological functions of the wetland and demands from society, the best utilization pattern (farming, forestry, animal husbandry or fishery, etc.) can then be decided. In the meantime, principals of landscape ecology and agro-ecology should be applied to establish integrated wetland utilization patterns that are based on modern, highly efficient, agro-ecological methods.
2. Wetland protection lawmaking and implementation should be reinforced.
3. Further studies on wetland resources are greatly needed, which include wetland structure and functions, wise utilization and protection of wetland resources,

restoration of degraded wetland ecosystems, wetland ecosystem indicator systems, wetland ecology and health diagnoses, and wetland contribution to globe warming, etc.

2.4. Utilization and Protection of Coastal Wetland in Jiangsu Province

The coastline of Jiangsu province is 1,000 km long. There are 650,000 ha of coastal wetland (mainly mudflat) in Jiangsu province, which accounts for one-quarter of the total mudflat in China. Mudflat is increasing at a rate of about 1,300 ha each year (Yang et al., 1997). The potential use of the mudflat can be summarized as follows:

- (1) Cultivation and amelioration of enclosed mudflat. Yields of cereal crops and cotton can reach at least 9 and 0.75 t per ha each year.
- (2) Amelioration of cultivated mudflat with medium and low productivity. By means of increasing input, change of product composition and scientific management, yields of cereal crops and cotton can increase by 2.25 and 0.75 t per ha. Yields of aquatic products are expected to be doubled.
- (3) Enclosing tideland for cultivation, as well as for integrated exploitation and utilization of mudflat. About 33,300 ha of mudflat in Jiangsu province can be enclosed in the near future.
- (4) Intensified processing of cereal, cotton, forest, fruit, grass, livestock and aquatic products also has considerable potential.

2.4.1. Problems Associated with Utilization of Mudflat

Problems associated with utilization of mudflat can be summarized as follows:

- (a) irrigation and water conservancy facilities need to be improved;
- (b) where there is freshwater shortage, groundwater should be exploited wisely;
- (c) low and unbalanced nutrients in the soil;
- (d) the scale and efficiency of farming, animal husbandry and aquaculture need to be improved; and
- (e) more financial support and R&D (research and development) are needed for mudflat exploitation.

To deal with the above-mentioned issues, monetary as well as scientific and technological investments are needed in mudflat exploitation and protection. Integrated exploitation of mudflat should be extended fully. Mudflat exploitation can be intensified in four aspects: (1) improving productivity and benefits of land

with mediocre and low yields; (2) cultivation of enclosed mudflat; (3) integrated utilization of tideland; and (4) enclosing more tideland for cultivation. By doing so, the regional agricultural potential of mudflat in Jiangsu province can be fully exploited. This will help upgrade natural resources' utilization and increase benefits, thus facilitating regional economic development. In the meantime, this will provide an example for exploitation and utilization of mudflat resources in other parts of China.

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