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WETLANDS IN CHINA: FEATURE, VALUE AND PROTECTION

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ABSTRACT: The estimated total area of wetland in China is more than 25. 9 million hectares including about 11. 9 million hectares of marshes and bogs, 9. 1 million hectares of lake and about 2. 2 million hectares of coastal salt marshes and mudflats. The area of wetland is equivalent to 2. 7% of the land surface. China also has 2. 7 million hectares of shallow sea water (less 5m in depth at low tide). Marshes and bogs are equivalent 1. 3% of the land surface. Only three provinces(regions) — Qinghai, Xizang (Tibet)and Heilongjiang — have a larger total area of marsh and bog. According to the structure, type and development of wetland in different river basins, wetland can be classified nine main regions. The experiments indicate that the coefficient of the marsh to regulate flood is similar to that of lakes. Wetlands occupy 17. 8% of the Sanjiang Plain area, the annual carbon contribution is 0.78×10^4t. Carbon released from marsh soil return into atmosphere is 3.95×10^6t/a. At present there is a sharp contradiction between population growth and natural resources shortage, causing wetland to be exerted with huge pressures and serious threats.

KEY WORDS: wetland; wetland distribution; wetland protection; ecosystem service; China

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1 LOCATION AND AREA

The estimated total area of wetland in China is more than 25. 9 million hectares including about 11. 9 million hectares of marshes and bogs, 9. 1 million hectares of lake and about 2. 2 million hectares of coastal salt marshes and mudflats. China also has 2. 7 million hectares of shallow sea water (less 5m in depth at low tide). The area of wetland is equivalent to 2. 7% of the land surface. (State Forestry Administration *et al.*, 2000)

Marsh, swamp and bog are mainly distributed in the Sanjiang Plain, the Da and Xiao Hinggan Mountains in the northeast, the Zoigê Plateau and seashore, lakeshore, riverine zone. There are more woody marshes in mountainous areas while herb marshes in plains.

Coastal wetlands in China can been divided into two categories. One is inter-tidal marshes and mudflats along the northern coastal beach area, the other is mangrove swamps in the southern coastal beach area. Marshes and bogs are equivalent 1. 3% of the land surface. Only three provinces(regions) — Qinghai, Xizang and Heilongjiang — have a larger total area of marsh and bog(Table 1).

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Table 1 Percentage of province area covered by marsh and peat in rank order in China (This figure includes extensive marsh and bog that area is larger than 10km^2) (ZHAO *et al.*, 1999)

Rank order	Province (Region)	Wetland area	
		ha	%
1	Qinghai	2 554 400	3.55
2	Jilin	630 056	3.50
3	Heilongjiang	1 494 347	3.25
4	Jiangsu*	164 763	1.56
5	Xizang	1 866 235	1.56
6	Shandong	183 129	1.22
7	Fujian	122 268	1.01
8	Liaoning	109 345	0.73
9	Sichuan**	386 699	0.69
10	Hebei***	148 906	0.68
11	Inner Mongolia	612 334	0.56
12	Hunan	86 000	0.41
13	Jiangxi	61 000	0.38
14	Xinjiang	585 514	0.37
15	Guangdong	55841	0.31
16	Hong Kong	300	0.28
17	Taiwan	9 837	0.27
18	Guangxi	61 857	0.27
19	Hubei	48 000	0.27
20	Zhejiang	21 890	0.22
21	Gansu	84 849	0.22
22	Shaanxi	38 500	0.20
23	Hainan	6 253	0.18
24	Anhui	15 533	0.12
25	Henan	13 950	0.09
26	Yunnan	29 764	0.08
27	Guizhou	3 700	0.02
28	Ningxia	1 000	0.02
29	Shanxi	1 000	0.01
30	Macao	–	–

* Including Shanghai City; ** Including Chongqing City; *** Including Beijing and Tianjin cities.

2 DISTRIBUTION IN CATCHMENTS

There are 50 000 rivers (each catchment area over 10 000 hectares) in China (Hydrology Bureau of Water Resource Ministry, 1997), which usually originate from mountainous areas, dominantly run from east to west. Most of them are external rivers and some of them are internal rivers. These rivers create large areas of wetlands. Many internal rivers finally flow into marshes. According to the structure, type and development of wetland in different river basins, wetland can be classified nine main regions (Fig. 1).

Qinghai-Xizang (Tibet) catchment is the largest wetland area region. Innumerable lakes, ponds and bogs dotted this region. Its total area is about 7 million hectares, including about 4.4 million hectares of salt lakes and 2.7 million hectares of herb bogs.

Xinjiang catchment is the largest saline lake region. To the north, the great inland drainage systems of the Xinjiang deserts include several large saline lakes, such as those of the Tarim Basin, Turpan Depression and Junggar Basin. Qinghai Lake (434 000 hectares) is the largest saline lake in China. Most of the lakes of Xinjiang catchment are shrinking in size, and the largest lake in Xinjiang, Lop Lake, has dried out completely in recent years.

Heilongjiang catchment is the largest marsh area region. There are over 1.58 million hectares of marshes in the Sangjiang (Three Rivers) Plain alone. This catchment, consists of a vast complex of shallow freshwater lakes, reed beds and peat bogs near the confluence of the Heilong (Amur), Songhua and Wusuli (Ussuri) Rivers. They are of great significance as breeding and staging areas for huge numbers of waterbirds, including four endangered species of cranes.

The Changjiang (Yangtze) River catchment is the largest concentration region of freshwater lakes. The alluvial plains of the Changjiang River in eastern China contain over 1.6 million hectares of lakes. Some of them are famous such as the Dongting Lake, the Poyang Lake and Shengjin Lake. All are freshwater and many are fringed with extensive reed beds.

The Huanghe (Yellow), Huaihe and Liaohe rivers catchment is the largest coastal and mudflat region. Most of China's 0.4 million hectares of coastal marshes and mudflats occur in the Huanghe River Delta and Liaohe River Delta. Most of the rivers flowing into the Yellow Sea carry large amounts of sediment, resulting in rapid build-up of deltas and continuous creation of new wetlands. For example, the Huanghe River Delta in 1974 – 1984, created 6068 hectares of mudflat each year in 1855 – 1984, the total creating area is about 25 million hectares.

The Gansu and Inner Mongolia internal river catchment is located in arid region, including 0.25 million hectares of marshes and 0.06 million hectares of lake.

The southeastern China, the southern China and the southwestern China are the major mangrove distribution

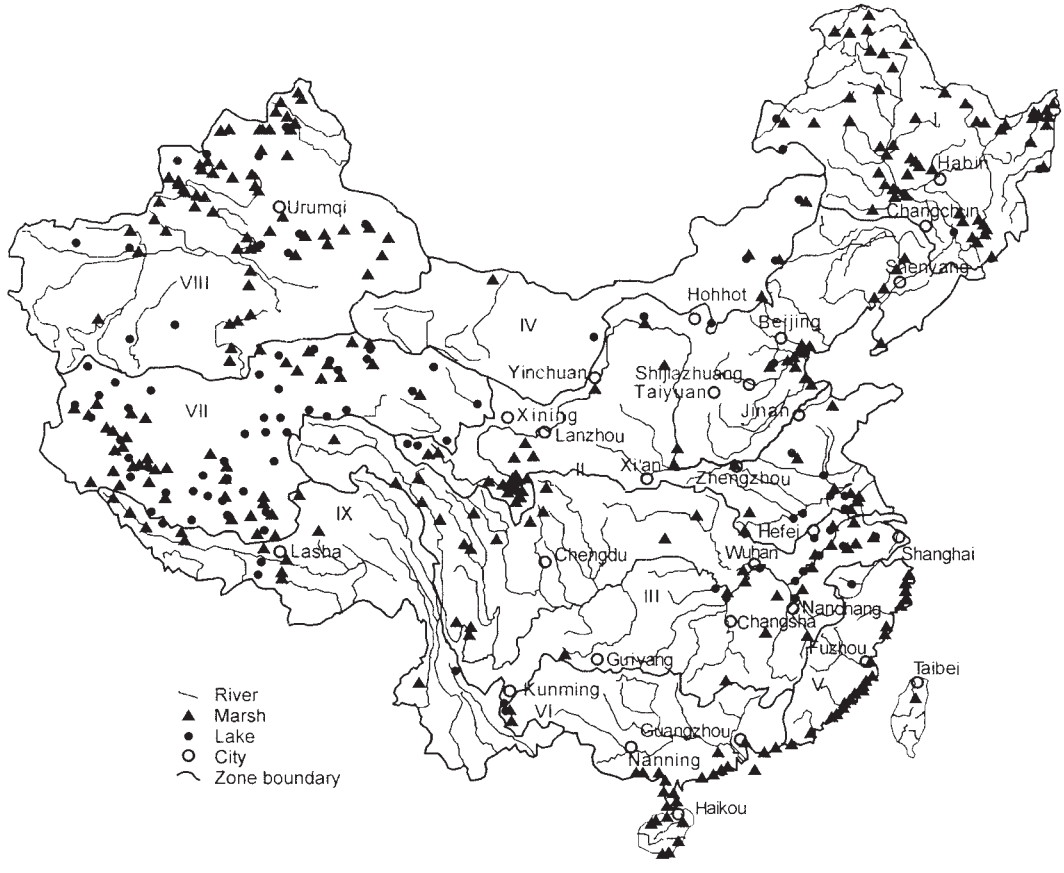

Fig. 1 Wetland main regions in China according catchment

Ⅰ. Heilong River catchment; Ⅱ. Huanghe (Yellow) River, Huaihe River and Haihe River catchment; Ⅲ. Changjiang(Yangtze) River catchment; Ⅳ. Gansu and Inner Mongolia internal river catchment; Ⅴ. Southeastern rivers catchment; Ⅵ. Southern rivers chtchment; Ⅶ. Qinghai and Xizang internal river catchment; Ⅷ. Xinjiang internal river catchment; Ⅸ. Southwestern rivers catchment

region. Much of China's south coast is rocky, with extensive wetland occurring only at the mouths of the larger rivers. It is the major mangroves distributing area, with the total area of 0.4 million hectares of mangrove marshes.

3 WETLAND VALUE AND SERVICES

3.1 Flood Control

Wetlands play an important role in regulating the stream runoff and can reduce flood peaks. We measured runoff of marsh and farmland in these sites. The experiments indicate that the coefficient of the marsh to regulate flood is similar to that of the lakes (CHEN *et al.*, 1982). The marsh soils have tremendous capacity of holding water, so, it is called "the biological reservoirs". On the ground of the experiments in the Sanjiang Plain, the saturation moisture capacity of the peat horizon is 500% – 800%, even up to 900% and that of the grass root layer is 300% – 800%. The runoff modulus and the runoff yield of precipitation of the marsh is less than that of the farmlands (CHEN, 1988). The annual dropping rates of the meadow marsh soil (0 – 16cm in depth) and the putty marsh soil (0 – 10cm in depth) are 7.36% and 6.22%, respectively (MA, 1996). Marsh has more water content than farmland. Among many vital functions of wetlands, flood control is one of the most important. Wetlands act like sponges, storing and slowly releasing rainfall and run-off thus reducing flood peaks. This can reduce the need for expensive dams and other engineering struc-

tures.

3.2 Wetland Biodiversity

Wide range of wetland habitats of various types supports rich biological species. China has not only large number of species, but also many rare, endangered or endemic species, which have important scientific and economic values. According to preliminary statistics, there are 1548 species of higher plants, 1500 species of higher animals in wetlands of China. Thirty-one species of the 57 endangered waterfowl species for Asia are found in China, making up 54%. Among the total 166 Anatidae species in the world, 50 species are supported by wetlands in China, making up 30%. Eight species of the total 15 crane species in the world have been recorded in China. China's wetland vegetation is composed of 101 families including 94 families of vascular plant (LU *et al.*, 1996). At least 100 species of higher plants in wetlands are rare and endangered. There are more than 770 subspecies of freshwater fish, which include many migratory fish. They spawn and breed in the special environment of wetland systems. There are 8200 species in China's coastal wetlands, including 5000 species of plants, 3200 species of animals. Many of them are endemic species to China.

3.3 Waste Treatment

The Wetland acts as a filter for certain kinds of waste and soluble contaminants. Biological, chemical and physical processes of wetlands are often able to immobilize and transform a wide range of environmental contaminants and nutrients, which, in excess would cause severe eutrophication and pollution. Heavy metals, pesticides and industrial wastes can be bound to soil and sediment particles, and there be rendered more or less inert.

3.4 Carbon Pool

In the Sanjiang Plain, the wetland distribution in geographical space depends mainly on hydrological regime. Different hydrological regime leads to a unique vegetation community but can limit primary production and rate of organic accumulation or decomposition. The annual primary production of above-ground is estimated at about 471.85×10^4t and the annual carbon contribution is 188.74t. The annual primary production of below-ground is estimated at about 638.07×10^4t and the annual carbon contribution is 0.78×10^4t. Carbon released from marsh soil return into atmosphere is 3.95 million t/a. (LU *et al.*, 1995). Peatlands occupy just 3 per cent of the world's land area, yet they store almost 20 per cent of the globe's soil carbon pool. The storage of organic matter in wetlands represents a carbon resource without which there could be dramatically higher levels of atmospheric carbon dioxide.

4 HUMAN ACTIVITIES AND WETLAND CHANGES

China is a developing country with huge population and eco-environment has been destroyed seriously for a long time. At present there is a sharp contradiction between population growth and natural resources shortage, causing wetland to be exerted with huge pressures and serious threats.

4.1 Threats, Human Activities and Wetland Changes

In China, about 95 percent of the massive population is concentrated in the eastern half of the country, principally at the vast alluvial plains of the major rivers. Now with the development and rapid increase of population, almost everywhere, wetlands have come under extreme pressure from human activities. Vast areas have been drained for agriculture and urban development, or converted into rice paddies, aquaculture ponds, water-storage reservoirs or salt pans. Rivers have been dammed and diverted, mangrove and swamp forests have been clear-felled for their timber, and wetlands of all types have been polluted with domestic sewage, herbicides, pesticides, fertilizers, industrial effluents and other waste products. Rivers and lakes are silting up, and the entire hydrology of river basins is being altered.

The situation is particularly serious in the eastern

China, where most natural wetland ecosystems are now under threat.

4. 1. 1 Reclamation

The most serious threat has been drainage or reclamation for agriculture, aquaculture, industry and urban development. Since much of China' human population is concentrated in the coastal lowlands, alluvial plains, coastal wetlands and alluvial plains in particular have come under pressure from drainage.

In much of eastern China, reclamation of wetlands for agriculture land has greatly reduced the area of lakes and marshes. It has been estimated that in the 30 years from the 1950s to the 1980s, the number of lakes in China decreased from 2800 to 2350, and the total area of lakes shrank by 11 percent. According to the statistics, China has lost 1. 19 million ha and 1 million ha of intertidal flat area due to reclamation and urban and industrial encroachment respectively in the past 40 years. The total loss is over 2 million ha, accounting for 50% of the whole coastal wetland area of China.

In inland lake areas, area shrinkage and number decrease of lakes are more serious. The lake area has reduced from original 833 000ha to 236 000ha in Hubei Province which was called as "Thousand Lake Province" in the past. Reclamation has reduced 12 million ha lake in the middle and lower reaches of the Changjiang River with a loss rate of 34%.

4. 1. 2 Accretion

Accretion is a serious problem in many parts of China, where deforestation, overgrazing and potentially wasteful agricultural practices have led to severe soil choked with silt, a notable example being the Huanghe River in China, probably now the world' s greatest earth-mover. With the bed of the river currently rising at the rate of 75 – 150mm per year, the chance of disastrous flooding is constantly increasing. Sand amount carried by the Huanghe River reaches 1. 5 billion tons each year. The Haihe River is also a river with much sand and its average annual sediment discharge is 160 million tons.

4. 1. 3 Shrinkage of lakes

The simultaneous shrinkage of floodplain lakes due to accretion and reclamation has lowered their capacity to store floodwaters, further increasing the likelihood of flooding downstream. Such problems are particularly serious along the lower reaches of the Changjiang River in China, where flash-flooding is becoming a common phenomenon.

4. 1. 4 Construction of dams

Most major rivers have been dammed for irrigation, the generation of electricity and flood control. Many of dams and barrages have had serious downstream effects, floodplains, essential for the reproduction of many riverine fishes, have been destroyed, and the seasonal migrations of fish have been disrupted. As a result, there have been major declines in many riverine fisheries.

4. 1. 5 Construction of reservoirs

In some regions, many wetlands have disappeared through the construction of large water-storage reservoirs on the major rivers and diversion of water supplies for irrigation. A reduction in the flow of fresh water at river mouths during the dry season has resulted in greater saltwater incursion into delta areas with consequent loss in agriculture potential and damage to mangroves. Since 1949, China has built 84 thousand large, medium and small reservoirs and the storage capacity is more than 460 billion m^3. However, over 100 billion m^3 storage has been silted causing direct economic loss of 20 – 30 billion yuan (RMB).

4. 1. 6 Pollution

Pollution from domestic sewage, industrial waste and agriculture chemicals is a serious problem in many parts of China. Many coastal wetlands and inshore waters are now heavilly polluted with sewage, heavy metals, pesticides and other contamination, and with increasing industrialization taking place, the situation is likely to deteriorate still further. Water pollution of China' s rivers is featured by organic pollution. According to environmental monitoring data for 7 large river systems, the pollution of the Huaihe River valley, the Songhua River valley, the Liaohe River valley and the Haihe River valley is the most serious. It is estimated that more than 12 billion tons of industrial and domestic sewage are discharged into rivers and lakes in the Changjiang River valley.

4. 1. 7 Overexploitation of forest wetlands

Forested wetlands have suffered widely from over-

exploitation. In the more densely populated rural areas, local demand for timber, fuel and fodder has degradation of the forest ecosystems.

4.2 Management and Conservation

The economic development depends to a large extent upon the sustainable utilization of wetlands, indeed, large sectors of the human population depend on wetlands for their everyday survival. In China the importance of wetland conservation is becoming apparent. The need to protect watersheds to prevent soil erosion and flash-flooding, the vital role of many floodplain wetlands in water storage and flood control, and the value of mangrove swamps in fisheries production and coastal protection are now becoming widely recognized. Major steps are being taken to protect and restore watersheds, to reduce accretion and pollution, and to conserve fisheries. Mangroves are being replanted, wetlands are being restored.

4.2.1 Biodiversity conservation

We should pay great attention to wetland biodiversity conservation and need to do a lot of work in protecting endangered wetland wild animals and plants. Especially to conserve rare and endangered waterfowls, as well as the national grade A protected animal and grade B protected animals.

4.2.2 Nature reserves construction

To establish different types of wetland nature reserve is one of the effective measures to protect wetland ecosystems and biodirversity.

4.2.3 Water resources conservation

Water is a key component of wetlands. In recent years, water resource shortage has become a worldwide crisis and exerted influences on the economic and social development of many countries. China is seriously short of freshwater resources and the freshwater amount per capita ranks No. 109 in the world. We should attach importance to the utilization and protection of water resources and actively taken measures to solve the problems of water shortage and pollution.

4.2.4 Pollution control

In order to control and prevent marine and inland water pollution, we should pursue various management systems and measures with the level of environmental pollution control.

4.2.5 Wetland survey and scientific research

We should carry out wetland inventory by researching wetland resource systematically. At present, this survey is still on going at the extent of the whole country. Now we begin to carry out the project "process of interaction between water and land in wetland as well as its effect on the resources and environment" supported by CAS. We hope to co-operate with associated scientists of other countries in the future.

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