

STUDY ON WETLAND BIODIVERSITY IN CHINA

Lu Xianguo(吕宪国) Wang Rongfen(王荣芬)

*Changchun Institute of Geography, the Chinese Academy of Sciences,
Changchun 130021, PRC*

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ABSTRACT: Wetland biodiversity means mainly the types of wetland ecosystem and biological species diversity. Biodiversity includes all species of plants, animals and microbes, all gene possessed by them and all ecosystems consisting of them and environment. According to the origin and genesis, China's wetlands can be divided into natural wetland ecosystems including mires, lakeshores, bottomland, seashore, wet meadow, etc., and artificial wetland ecosystem including paddy field. Then based on geomorphological type, these ecosystems can be divided into 15 subsystems, then based on soil substrata and ecological niche conditions, they can be subdivided into 15 classes, finally according to construction species of plants, several types can be divided into. They are not only the expression of ecosystem diversity, but also the base for biological communities subsistence. This peculiar ecological niche provides a complex and perfect special habitat for various animal and plant communities. In this special habitat, there exist various biological types from monomolecular microbes to higher plants and animals, especially some endangered and rare plants and animals. According to the statistics, there are more than 300 species of birds in China's wetlands, making up one-third of the total number of China's birds. Wetlands not only the good place for waterbirds living, but also the important environment on which wild animals and plant rely for existence. There are 65 species of mammals, 50 species of reptiles, 45 species of amphibious animals, 1040 species of fish, 825 species of higher plants, 639 species of angiosperm, 10 species of gymnosperm, 12 species of pteridophyte and 164 species of bryophyte investigated in China's wetlands.

KEY WORDS: wetland biodiversity, biodiversity protection, wetland conservation, wetland classification, China's wetland, wetland development

I. INTRODUCTION

Wetland is a unique ecosystem abundant in biodiversity in the world. It is not only rich in wetland resources, but also has huge functions to regulate and control environment, for example, retarding flood, conserving water, preventing soil erosion, regulating climate and purifying environment, which can improve human living environment, so that it is called as "kidney" of the world by scientists. Especially wetland can protect many rare and endangered plant and animal species on the globe, so it is a natural species gene pool. Besides, the high biological productivity and harmonious environment provided by wetland can also create a good condition for human sustainable development, and recreation and tourism.

China is one of the countries with large area and wide distribution of wetland, as well as varied types, such as mires, peatlands, fresh water lakes, floodland, coastal tideland, salt marsh, etc. In addition, there is a special wetland in the Qinghai-Xizang Plateau of China. In China from frigid zone to tropical zone, from coast to inland, from steppe to plateaus and mountains, there are wetlands distributions. The man-made wetland mainly includes paddy field and ponds. In recent years, wetland protection is facing the serious threat caused by population growth, reclamation, pollution, introducing species and over-hunting, etc. The wetland area is gradually reduced, wetland environment is suffering from interference and destruction.

The Chinese Government has been paying great attention to the study on wetland and its biodiversity. In 1992, China joined "The Convention on Wetlands of International Importance Especially as Waterfowl Habitat" (that is Ramsar Convention). After the Conference on World Environment and Development, the Chinese Government formulated "the 21 Century Agenda of China", and listed the wetland protection and rational utilization at the priority items of the agenda^[1]. For many years, under the emphasis and support by all-level governments, the forestry system made great effort to protect wetlands, and did many effective works. Now more than 700 natural reserves of varied types have been established in China. Among them, over 130 reserves belong to wetland natural reserves, of which 6 wetland reserves such as Xianghai in Jilin Province, Zhalong in Heilongjiang Province, Boyang Lake in Jiangxi Province, East Dongting Lake in Hunan Province, Bird island in Qinghai Province, Dongzhaigang in Hainan Province famous in China have been listed at International Important Waterbird Wetland List of "Ramsar Convention"^[1].

China's wetland area and biological resources hold an important place in the world. The wetland area ranks the third place in the world, only next to Canada and Russia. There are 192 wetlands which have been listed at Asian Wetland List. Wetland is a transitional zone between hydrosphere and pedosphere, a semi-land and semi-water ecosystem. Its unique habitat determines its characteristics of rich biodiversity.

II. WETLAND BIODIVERSITY IN CHINA

Ecological Society of U. S. A. points out, in Ecological Research Program, that biodiversity on the globe mostly exist in semi-natural forests, grazing land, rivers and mires. Mire is the important component of wetland. Wetland is one of the richest regions of biodiversity in the world. Wetland biodiversity includes all species of plants, animals and microbes, all gene possessed by them, and the ecosystems consisting of them and environment.

1. Ecosystem Diversity

China has a vast area and complex natural conditions, which causes the varieties of ecosystem. According to the origin and genesis, wetlands can be divided into natural wetland ecosystem such as mires, lakeshore, floodland, seashore, and man-made ecosystem of paddy field. Based on geomorphological types, they can be divided into 15 subsystems, then based on the soil substrata and ecological niche conditions, they are divided into 15 classes (Fig. 1). And based on the construction species of plants, some basic types can be divided into further.

2. Species Diversity

Biodiversity is often presented by species number. The known species of wetland plants and animals estimated according to the preliminary statistics of data available are listed in Table 1^[2]. Wetland higher animals mean the animals which live in shallow water (water depth <2m) or wetland environment all the year round or seasonally. Wetland higher plants mean hydrophyte, hygrophyte and helophyte. Table 1 does not list insects, invertebrates, fungi and microbes. Wetland organisms include endangered species, populations with great scientific values and important economic values.

Endangered species: Mammal such as *Castor fiber* is an amphibious animal, which originated in streams in Xinjiang and the northern part of northeast

Table 1 Known species of plants and animals in China

Population	Known China's wetland species	Known Chinese species	Percentage
Mammal	65	499	13
Bird	300	1186	26.1
Reptile	50	376	13
Amphibian	45	275	16.4
Fish	1040	2804	37.1
Higher plant	1020	3000	3.4
Angiosperm	834	25000	3.3
Gymnosperm	10	200	5.0
Pteridophyte	12	2600	0.5
Bryophyte	164	2200	7.5

China, now it is seldom found. *Lutra lutra* grows in Xingkai Lake area, at present wild species are little. Birds such as *Ciconia nigra*, *Gurus japonensis*, *Gurus antigone*, *G. nigricollis*; reptile *Alligator sinensis*; fish such as *Anabajilius alburops*, *Cyprinus pellegrini*, etc. all belong to rare and endangered species.

There are not complete statistics for the endangered species of wetland higher plants. If it is estimated based on 10% of the mean value of varied populations, there are about 80 species of endangered wetland higher plants. The typical species is *Glyptostrobus pensilis*. It is a high tree growing in the floodplain inundated by river water in subtropical zone. In the tertiary, it was distributed in north hemisphere, now it is only sparsely scattered in Guangdong, Guangxi and Fujian provinces^[1]. Mangrove forest is a special swamp forest growing on seabeach of tropical zone. The mangrove forest area is reduced gradually. Now there are 20,000 ha of mangrove forest. Because mangrove forest disappeared, many organisms lost their habitats, causing many organisms loss. *Bruguiera gymnorrhiza*, *Humnitzera littorea*, *Nypa fruticans* are endangered species. *Leersia oryzoides* growing in wetlands of South China, *Carex doniana* in wetland of the Qinghai-Xizang Plateau, *Primula tibetica* in Xizang, *Pedicularis longiflora* var. *tubiformis*, *Spiranthes amoena* and *Pedicularis grandiflora* in wetlands of the Sanjiang Plain, are all endangered and rare plants^[2].

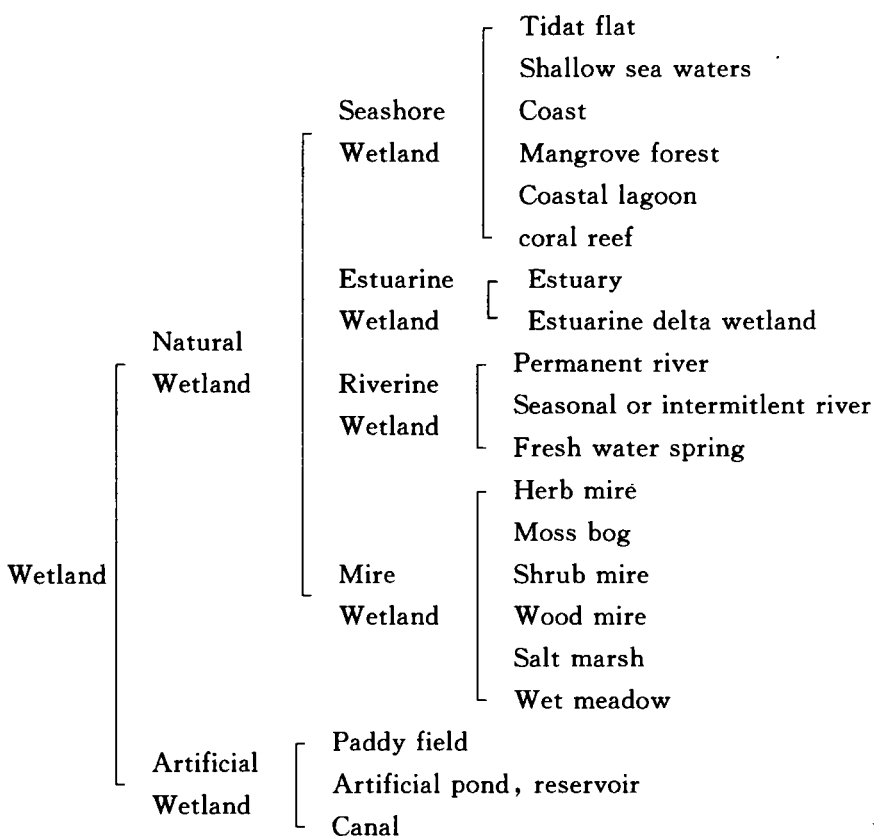


Fig. 1 Classification of wetlands in China

Populations with great scientific values: Among mammals, birds, reptiles and fish living and dwelling in wetland, there are some species with important scientific values, for example, *Lipotes vexillifer*, *Psephurus gladius*, *Myxocyprinus sinensis* are special species of the Changjiang River basin. Among higher plants, besides *Glyptostrobilus pensilis*; *Butomus umbellatus*, *Hippuris vulgaris*, *Drosera rotundifolia*, *Euryale ferox*, *Vallisneria spiralis*, *Nepenthes mirabilis*, etc. are all species with great scientific values^[2].

Populations with important economic values: Many wetland animals belong to this population, for example, famous *Chelonia mydas* grows in the coast of South China. *Andrias davidianus* is the largest one of the existing amphibian with a tail grows in rivers of mountainous areas of South China. Fish mostly has a certain economic value. Wetland is rich in plants with important economic values. Wetland fibre plants are distributed widely, with a great quantity. Only in the Sanjiang Plain, fibre plants of *Phragmites australis*, *Carex lasiocarpa*, *Carex meyeriana* and *Deyeuxia angustifolia*, etc., have an

annual yield of over 8,800,000 tons. In the North China Plain, the lake area of the lower and middle reaches of the Changjiang River, Bosten Lake in Xinjiang and the coasts are teem with reed. The reed field in Liaodong Bay is the second largest reed field in the world. Reed is the important paper-making materials. In China the annual reed yield is about 1,500,000 tons. Wetland is also abundant in forage plants. It is estimated that the annual yield of forage grass in the Sanjiang Plain is about 3,200,000 tons. There are many edible plants, for example, *Vaccinium uliginosum*, *Lonicera caaurulea*, *Rubus chamaemorus* are small shrubs of mountains, their fruits with good taste are good wine-making materials. Among wetland plants there are also more than 200 species of medicinal plants^[2].

III. THE IMPACT OF HUMAN ACTIVITIES ON WETLAND BIODIVERSITY

For a long time, since the contradiction between population and resources, energy, grain is getting more and more obvious, China's wetlands were reclaimed on a large scale, polluted by industrial waste water and introducing species, the wetland resources were over exploited, which not only result in the environmental deterioration of local places and biodiversity loss, but also seriously restrain the wetland resources potential and environmental functions to bring into play. Owing to lack of scientific planning the coastal belt development caused the contradiction among reclamation and aquatic products and natural conservation, valuable mangrove forests and tourist spots were destroyed and some species were lost. Due to the influence of human activities, there is a tendency of wetland ecoenvironment deterioration. The destruction of some places is near to or exceeds the threshold of the system, leading to the system disintegration. These problems may be shown as follows:

1) The reclamation of lake wetland leads to loss of fresh water resources and biodiversity destruction. Owing to reclamation, lake number and area decreased. From 1950 to 1980, China's natural lakes decreased from 2,800 to 2,500, the total lake area reduced by 11.5%. Dongting Lake area has decreased from 4,350 km² in 1949 to about 2,000 km² at present. The lower and middle reaches area of the Changjiang River lost lake area of 12,000 km², the loss rate is 34.16%. Such a large area loss inevitably result in the decline of biological species and population resources. For example Honghu Lake, from the 1950s to the 1980s, lost 45.6% of lakeshore land owing to reclamation, causing the continuous decrease of overwintering waterbird number, the dominant species of the community *Fulica atra* was replaced by large geese and ducks, aquatic

plants decreased from 92 species in the 1950s to 68 species, fish decreased from 90 species in the 1950s to 31 species. In the Dongting Lake, due to reclamation of lakeshore, fish breeding field and bait field were shrunk artificially, leading to fish yield drop continuously, the annual average fishing capacity per ship dropped by 37.9% compared with the 1950s. Due to reclamation, storage capacity of over $325 \times 10^8 \text{ m}^3$ was lost, and fresh water reserve of 35 billion m^3 was lost too in China.

2) The irrational reclamation of mire wetland leads to resource decline and environment deterioration. For example, in the Sanjiang Plain, a large area of mires was reclaimed into dry farmland, the original island-shaped forests were cut down, mire vegetation was destroyed, resulting in the intensification of water erosion and wind erosion, local sandification, the decrease of rare plant and animal resources. In the Zoige Plateau of west Sichuan Province, the underground level of mire grassland drop, rat disaster is severe, sand dunes and salinization began to appear. The reed field area of the country has reduced from more than 10 million ha in the early period of the liberation to 5.05 million ha nowadays.

3) The discharge of industrial waste water and sewage make water quality pollution of river wetlands and lake wetlands, and coastal waters, intensify the eutrophication of water body and wetlands, and prevalence of parasitic disease. At present the polluted and eutrophic lakes make up 70%—75% of the lake number.

IV. SUGGESTIONS ON PROTECTING WETLAND BIODIVERSITY

1. Supplementary Investigation of Wetland Resources Dynamic Change and Biodiversity

Influenced by human activities and climatic change, the situation of wetland resources and their exploitation and utilization change greatly, one must firstly systematically sort out survey data available, take it as the basis, combine remote sensing image interpretation with supplementary on-site survey, further investigate the type, distribution, area, present exploitation and utilization and protection of China's wetlands, water resources and their dynamic change of China's wetlands, biological resources of China's wetlands, especially the distribution, habitat, population amount of rare and endangered plants and animals, as well as endangered reasons and tendency, compile reports and maps concerned^[3].

2. Study on the Environmental Function of Wetland and the Influence of Human Activities on Wetland Resources and Environment

Through the fixed study of wetland ecological station and the typical analysis of selected important wetlands, to study the effects of main types of wetlands in aspects of regulating climate, conserving water resources, even flooding process, accelerating silting to make land, purifying environment, protecting biodiversity; the influence of greenhouse gas emission from wetland ecosystem on global change; the factors and sources of threatening, destroying and polluting wetlands; the impact of reclamation, large water conservancy projects on wetland resources and environment^[3].

3. Study on the Evaluation of Important Wetland Ecosystem with Representativeness and Uniqueness and the Policies of Species Protection

Six wetlands of China have been listed at International Important Wetland List. In order to effectively protect much more important wetlands, it is necessary to evaluate important wetland ecosystem and species resources (especially rare and endangered waterbirds) according to the standard of Ramsar Convention, study the characteristics of wetland plant and animal communities, the composition structure and function of main wetland animal species, the biology, ecology and habitat features of threatened and endangered species, the minimum population amount and the need of minimum habitat of population self-steadiness, the policies on ensuring sustainable development of wetland biodiversity, provide scientific bases for selecting natural wetland conservation list, working out wetland conservation planning and action plan.

4. Study on Wetland Classification System, Succession Law and System Productivity

On the basis of systematic investigation and typical analysis of wetland, one should study and establish comprehensive wetland classification system of China, research the laws of wetland vegetation succession, nutrient circulation and soil environment change, lake paludification, meadow paludification and forest paludification and their reversing conditions, carry out the evaluation of ecological steadiness, and the research on system productivity of major wetland types.

5. Test Demonstration of Optimum Models for Wetland Conservation and Sustainable Utilization

To select representative wetlands to set up demonstration area, to carry out the test demonstration of optimum models for wetland conservation and sustainable utilization, develop the techniques of on-site protection, other place protection and restoration of degraded ecosystem, provide the effective ways for sustainable utilization. To spread optimum models, applied techniques and management techniques to make different types of wetland ecosystem to develop in the direction of a good circulation.

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