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Nature reserve construction and its contribution to the biodiversity conservation in China mainland

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Abstract—By the end of 1993, 763 nature reserves were established in China with a total area of 66184.1 kha, occupied proximally 6.84% of the whole country's land area. The reserves concerning biodiversity conservation include ecosystem categories of forest, grassland, desert, terrestrial wetland and waters, ocean and coast and categories of wild animal and wild plant. Based on the construction of the reserves, the contributions of the reserves of various categories to the biodiversity conservation and the existed shortages for the reserve construction in China were analyzed thoroughly in this paper.

Keywords: nature reserve; protected area; reserve construction; biodiversity; conservation.

1 Introduction

Nature reserve construction is one of the important approaches for biodiversity conservation, especially it is more outstanding for *in situ* conservation of natural ecosystems and wild life species. In 1956 the first nature reserve——Dinghushan Nature Reserve in Guangdong Province was established. And after 37 year's efforts the 763 reserves belonging to 3 categories including 9 types (Xue, 1994) were established by the end of 1993 with a whole area of 66184.1 kha, occupied about 6.84% of the whole country's land (Jiang, 1993; Xue, 1993).

2 The contribution of reserve construction to the natural ecosystem conservation in China

2.1 The conservation for the forest ecosystems

Forest is the most complicated and important ecosystem in land area and it possesses the richest biodiversity. The forests in China distribute widely and they have various ecosystems with 16 categories including 185 types, whereas there are just 27 categories including 460 types for all the land ecosystems including forest in China. Therefore, the reserve construction for the category of forest ecosystem is of very significance for the biodiversity conservation.

By the end of 1993, 371 reserves of forest ecosystem category were established with an

area of 14290.5 kha, and it reached to 17668.4 kha after adding the area of 3377.9 kha from the other reserves which main conserving targets are the wild animals and plants based on the forest habitats, totally occupied 7.1% of the whole forest land in China (250000 kha). For example, some more typical and important reserve sites of this category are as follows:

Huzhong Reserve in Heilongjiang Province, which main conserving target is conifer forests of the cold-temperate zone;

Fenglin and Liangshui Reserves in Heilongjiang Province, which main conserving target is the mixed conifer and deciduous broadleaf forests of the temperate zone;

Baishilazi Reserve in Liaoning Province and Wulinshan Reserve in Hebei Province, which main conserving target is the deciduous broadleaf forests of the warm-temperate zone;

Jigongshan Reserve in Henan Province and Mazongling Reserve in Anhui Province, which main conserving target is the mixed deciduous and evergreen broadleaf forests of the sub-tropics zone;

Guniujiang Reserve in Anhui Province, Shenglongjia Reserve in Hubei Province and Wanmulin Reserve in Fujian Province, which main conserving target is the evergreen broadleaf forests of the sub- tropics zone; and

Jianfengling Reserve in Hainan Province and Xishuangbanna Reserve in Yunnan Province, which main conserving targets are the rain forests and the seasonal rain forests of the tropics zone.

Besides, some reserve which main conserving target is the vertical forest spectrum in mountain areas were established also, such as Changbaishan Reserve of the temperate zone, Taibaishan Reserve of the Warm-temperate zone, Fanjingshan Reserve, Guoligongshan Reserve and Motuo Reserve of the sub-tropics zone, and so on.

2.2 The conservation for the grassland ecosystems

China possesses rich grass resources with the grassland area of some 173000 kha, occupied 18% of the whole country's land. The grasslands mainly distribute in the west area of the Northeast, Inner-Mongolia, the north area of the Loess Plateau, the Northwest and Qinghai-Tibet Plateau. The types of the grasslands are typical grassland, meadow, desert and high-cold mountain grassland.

The construction of the grassland ecosystem reserves began late and developed slowly. By the end of 1993, 13 reserves of grassland ecosystems were established with an area of 1298.4 kha, and it reached to 1342.7 kha after adding the other reserves which main conserving target was the wild animals and plants based on the grassland habitats, totally occupied 0.8% of the whole grassland area in China. There are some representative grassland ecosystem reserves established, such as Xilanguole Reserve in Inner-Mongolia Autonomous Region, Yaojingzi Reserve in Jilin Province, Yanwushan Reserve in Ninxia Autonomous Region, Gongnaisi Reserve in the middle area of Tianshan Mountain in Xinjiang Autonomous Region, and so on.

Besides, some other mountainous reserves have also conserved the some fragments of grassland, such as high-mountain meadows, highland grasslands and shrub-grasslands.

Moreover some wetland reserves also conserve the large area of grassy marshes.

The grasslands in China have complicated natural landscapes and possess rich biodiversity due to the influences of the varied topographies and climates. But the number of the grassland reserves established is still not enough to meet the conservation requirement for the diverse grassland ecosystems and rich grassland species in China.

2.3 The conservation for the desert ecosystems

There is 192000 kha desert area in China, occupied 20% of the whole country's land (Cheng, 1987). It mainly distributes in the Northwest and Qinghai-Tibet Plateau. In addition, the desert can be divided into many types, for example, there are large areas of arid deserts including Gobi, clay desert, salinized desert and sandy desert, whereas there locates a worldwide unique high-cold desert in the west and north of the Qinghai-Tibet Plateau.

Though the construction of desert ecosystem reserves began late, it developed very fast. Since 1980s, 8 reserves of A'erjinshan Reserve in Xinjiang, Anxi Reserve in Gangsu, Qiantang Reserve in Tibet, and so on, were established. In spite of the few number of the reserves, they have a large area of 30147 kha, after adding the other 6 reserves of wildlife category based on the desert habitats, the total area reaches to 35748.8 kha, occupied 18.6% of the whole desert area in China, higher than the other ecosystem categories.

Desert ecosystem has a characteristic of vulnerability and it is very difficult for its restoration or unrestorable at all if the ecosystem is destroyed. So it is very significant for conserving the desert vegetation and maintaining the stability of the ecosystem to improve the whole natural environment of the Northwest in China.

2.4 The conservation for the ecosystems of terrestrial wetlands and waters

The terrestrial wetlands and waters distribute widely in the whole country, especially rich in the plains of the middle and lower reaches of the Yantze River and in the northeast region of China. The total area is about 38000 kha, occupied 4.0% of the whole country's land.

The construction of the reserves for the terrestrial wetland and waters ecosystems began at the late of 1970s and as far 16 reserves have been established with an area of 915.5 kha. Mainly, they are Honghu Reserve in Heilongjiang Province, Yueyahu Reserve in Jilin Province, Dalaihu Reserve in Inner-Mongolia Autonomous Region, Jiulongkou Reserve in Jiangsu Province, and so on. In addition, the other 64 reserves that mainly conserve the wild animals and plants based on the habitats of terrestrial wetlands and waters were also established with 6753.7 kha. The total area reaches to 7669.3 kha, occupied 20.2% of the whole area of terrestrial wetlands and waters in China.

Wetland ecosystem also has a characteristic of vulnerability. It is easy to be impacted by human activities and changes of natural conditions. Therefore the construction of wetland reserves is of great importance and emergency. In the established reserves of wetland ecosystems there is a relative high proportion for the reserves of wildlife conservation, with 80.0% in number and 88.3% in area of the whole wetland reserves. So it is emphasized that the main conserving targets should be expanded from species to whole wetland systems.

2.5 The conservation for the ocean and coast ecosystems

China has a vast sea area and crosses the warm-temperate, sub- tropics and tropics zones from north to south, covering 44 degrees north latitude. The sea area amounts to 470000 kha and coastline reaches to over 18000 km long. There are over 5100 islands located in the coastal waters and the island coastlines are up to more than 14000 km. So it exists diverse ecosystems of coasts, islands, continental shelfs and coastal waters.

The construction of reserves for ocean and coast ecosystems began in 1970s, mainly concentrated on coastal mangrove forests, such mangrove reserves as Dongzaigang and Qinlangang Reserves in Hainan Province, Bailunhekou and Shankou Reserves in Guangxi Autonomous Region and Zhanjiang Reserve in Guangdong Province. Since 1980s the reserve construction has been extended from the coasts to the islands and coastal waters, gradually established Sanya and Lingaojiao Reserves in Hainan Province for conserving coral reefs and Nanjiliedao Reserve in Zhejiang Province for conserving island ecosystems. All together, 25 reserves for conservation of ocean and coast ecosystems were set up with an area of 378.4 kha by the end of 1993. In addition, the other 31 reserves were established with 3363.4 kha, which main conserving targets are rare marine animals and valuable marine products. The total area amounts to 3741.8 kha, very less amount relative to China's vast territorial sea waters. Moreover the existed reserves for ocean and coast ecosystem conservation mainly focus on the coasts, coastal continent shelves and islands, and it should be extended to beaches, estuaries and shallow sea ecosystems.

3 The conservation for wild species resources

China is one of the richest species resource countries in the world, occupying some 10% of the global flora and fauna. Due to China's special geographical environment and climate conditions, especially not being impacted by glacier since the late of the Tertiary Period, the flora and fauna contain many relic species that extincted in other places of the Northern Hemisphere long before and possess some primeval and isolated species groups in their origination, so the endemic genera and species are very rich.

The construction of the reserves for wild animal conservation began in 1970s and since 1980 the reserves for wild plant conservation have also been gradually established. By the end of 1993, there were 284 reserves established for wildlife conservation and the total area is 19040.9 kha. Having been considered the roles of the other reserves of the ecosystem categories in conserving wildlife, the majority of 257 animal species and species groups issued in "The Wild Animal List for National Priority Protection" by the State Council and the majority of 354 plant species issued in "The Wild Plant List for National Priority Protection" by the Environmental Protection Committee under the State Council have been under the effective *in situ* conservation.

Among the 284 reserves for conserving wild species, there are 214 sites for wild animals with 18001.3 kha and 70 sites for wild plants with 1039.6 kha, of which:

There are some reserves that take the terrestrial mammals as their main conserving target, for example, 14 reserves for giant panda of Wuolong and Tangjiahe Reserves in Sichuan Province, Baishuijiang Reserve in Gansu Province, Foping Reserve in Shaanxi Province, and so on; Zhouzhi Reserve in Shaanxi Province for taking Bawangling Reserve in Hainan Province for gibbon; and so on.

There are some reserves that take rare birds and migratory birds as their main conserving target, i. g. Zhalong Reserve in Heilongjiang Province and Yancheng Reserve in Jiangsu Province for cranes; Poyanghu Reserve in Jiangxi Province and Niaodao Reserve in Qinghai Province for migratory birds; Yangxian Reserve in Shaanxi Province for Nipponia nippon; and so on.

There some reserves that take reptile and amphibian as their main conserving targets, i. g. Xuancheng Reserve in Anhui Province and Yinjiabian Reserve in Zhejiang Province for Chinese alligator; Huidong Reserve in Guangdong Province for green turtle; Liaophe Reserve in Jiangxi Province for Chinese giant salamander and so on.

There are some reserves that take aquatic mammals as their main conserving targets, i. g. Xinluaojiangduan Reserve of Yangtze River in Hubei Province for Chinese river dolphin; Humahe and Xunbielahe Reserves in Heilongjiang Province for taimen, huso sturgeon and dog salmon; Hepu Reserve in Guangxi Autonomous Region for dugong and so on.

There are some reserves that take rare and endangered plant species as their main conserving targets, i. g. Lichuanxiaohe Reserve in Hubei Province for primeval matasequoia population; Enshi Xingdoushan Reserve in Hubei for dove trees and metasequoia; Huaping Reserve in Guangxi for *Cathaya argyrophylla*; Leigongshan Reserve in Guizhou Province for *Taiwania flousiana*; Chishui Reserve in Guizhou Province and Jinhua Reserve in Sichuan Province for *Alsophila spinulosa*; Shangyue Reserve in Guangxi Region for Camellia chrysantha; Qingyuan Baishanzu Reserve in Zhejiang Province for *Abies beshanzuensis*, and so on.

There are some reserves that take wild relatives of crops as their main conserving targets, i. g. Gongliu Reserve in Xinjiang Autonomous Region for wild walnut trees; Jiaowutuohai Reserve also in Xinjiang for wild apple trees; Bawangling Reserve in Hainan Province for wild litchi trees, and so on.

In short, a great achievement has been obtained in the construction of wildlife reserves. It has greatly relieved many rare species from the threatened situations and even the populations of some rare species have restored and expanded. However the whole situation for wildlife conservation is still serious.

As to the wild animal conservation, there are many animal species still under the risk of extinction. In the other hand, a more attention has been paid to the vertebrate conservation now, especially to the large mammals, ignored the invertebrate animals such as insects, shellfish, microbe, as well as the aquatic vertebrate animals.

As to the wild plant conservation, some plant species are, as far, still out of effective conservation though most of the national protected plant species have, more or less, existed in the reserves. For some plants, the parts of their populations exist in the reserves, but

their numbers are often not enough for a viable population size, as a result of less security for their survivals. Besides, the present conservation measures are concentrated on the large woody plants. But the herbs and shrubs have been ignored, they, therefore, are sensitive to human activities and easy to be extinct because of their weak viabilities.

Furthermore, the conservation of the wild relative of crops has not obtained a sufficient conservation, for instance, the wild rice can play a significant role in the improvement of rice varieties, but there is no reserve established for the wild rice habitats. As the expansion of human's activities, the habitats of wild rice will reduce gradually, resulting in a more endangered state. Actually, the populations of some rare economical and medicinal wild plants are decreasing day by day due to the over-harvests. The problems in question should be paid more attention in the State Plan for Reserve Construction in the future.

4 Conclusion

China is a large country with rich biodiversity. To enhance the construction of reserves is necessary, not only to meet the domestic requirements of biodiversity conservation, but also to implement the international obligations that China undertakes. The reserve construction will be still a heavy task for a long time in future. So government at various levels and sectors concerned should stress furtherly the leadership for reserve management and incorporate the construction and management of reserve into the National Plan of Economical and Social Development and into the Government's Objective Responsibility System for Environmental Protection. Meanwhile, all active actions from the whole society should be involved in the reserve construction and management, in order to create a new aspect for China's reserve cause.

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