

# **BIODIVERSITY IN CHINA - STATUS, THREATS AND RECOMMENDATIONS**

**L. Z. Chen**

*Institute of Botany, Chinese Academy of Sciences, Beijing, P. R. China*

**S. Wang**

*Institute of Zoology, Chinese Academy of Sciences, Beijing, P. R. China*

**S. D. Zhao**

*Institute of Geographic Science and Natural Resource Research, Chinese Academy of Sciences, Beijing, P. R. China*

**Keywords:** China, biodiversity, conservation, plant, animal, micro-organism, gene, species, ecosystem, habitat.

## **Contents**

### 1. Introduction

#### 1.1. Physical and socio-economic conditions

### 2. Ecosystem Diversity

#### 2.1 Forest

#### 2.2 Meadow

#### 2.3 Steppe

#### 2.4 Savanna

#### 2.5 Desert

#### 2.6 Marsh

#### 2.7 Freshwater and Marine Ecosystems

### 3. Species Diversity

#### 3.1 Megadiversity

#### 3.2 Endemism

#### 3.3 Status

#### 3.4 Threats

##### 3.4.1 Habitat Destruction

##### 3.4.2 Over-exploitation

##### 3.4.3 Pollution

### 4. Genetic Diversity

### 5. Recent Progress

#### 5.1 Survey and Bioinventory

#### 5.2 Species Conservation

#### 5.3 In Situ Conservation: Nature Reserves

#### 5.4 Ex Situ Conservation

##### 5.4.1 Botanical Gardens and Arboreta

##### 5.4.2 Zoos and Other Breeding Centers

##### 5.4.3 Germplasm and Gene Banks

### 6. Recommendations

#### 6.1 General Recommendations for Strategy and Actions

#### 6.2 Scientific Research

Glossary

Bibliography

Biographical Sketches

## Summary

Because of its unique physical conditions, China is one of the countries with the richest biodiversity in the world. But because of the very high pressures of population growth, rapid economic development and inappropriate management of ecosystems, the current status of biodiversity conservation in China is very serious. The Chinese government has paid much attention to biodiversity conservation since the 1950s. Many laws and regulations on conservation have been established in recent decades, great achievements have been made, and facilities for nature conservation have been greatly improved. Although there are still many difficulties, it is obvious that the situation regarding biodiversity in China will be improved in the near future.

## 1. Introduction

### 1.1. Physical and socio-economic conditions

China is situated in the east of Eurasia, on the edge of the Pacific Ocean, and not far from the Indian Ocean. It lies between 3° 51' to 53° 34' and 73° 40' to 135° 05'. The total area of its territory occupies about 9.6 million km<sup>2</sup>, together with a sea area of 4.73 million km<sup>2</sup>.

Most of China's vast area is located in mid latitudes. The great variety of its geographical and physical conditions create a very wide range of habitats favoring survival and multiplication of countless species, i.e. the distinct relief with many large mountain ranges and plateaus, the strong monsoonal influence on climate, the large number of rivers and lakes, the diversity of vegetation and soil types, and the wide continental shelf with scattered islands. In addition, natural processes over geological time have created many refuges for relic taxa and places of origin and radiation of new ones. All of these factors provide extremely favorable natural conditions not only for survival and development of biodiversity, but also for its protection and sustainable utilization.

Currently, the population in China is close to 1.3 billion, comprising about one fifth of the total world population. The annual increase in population is still about 15 million at present, but this is expected to drop off because the very successful family planning program which has been implemented in recent decades. The large total population and rapid increase has put tremendous pressure on biodiversity.

China is in an era of rapid industrial development, and has been maintaining a high economic growth rate recently. The average growth rate of GNP has been over 9.0% since the early 1980s. One of the consequences of the economic development has been rapid land use change, and this has added to the pressures facing biodiversity conservation.

Realizing the significance of biodiversity, the Chinese government has paid much

attention to issues of nature conservation, and has made great achievements, especially in the last two decades. These include stronger legislation, regulations and policies, training human resources, developing inventories, research and public awareness programs, and increasing the number of reserves, botanical gardens, zoos and other facilities for both *in situ* and *ex situ* conservation needs.

Biodiversity (or biological diversity) is the total sum of life's variety in a region or the world. It deals with three levels: species diversity, genetic diversity and ecosystem diversity. Species diversity is the variety and abundance of all living organisms existing on earth. The total number of species has been estimated to range from 30 to 50 million. Genetic diversity relates to the sum total of genetic information contained in genes of individual organisms inhabiting the earth. Ecosystem diversity refers to the variety and abundance of different ecosystems, including the variety of habitats, biotic communities and ecological processes in the biosphere.

The plan of the Chinese government sets a target of establishing a total of 1200 natural reserves by the year 2010, with a total acreage of 10% of the state's territory, and a state-wide biodiversity monitoring network is to be established. It is very clear that biodiversity will be well protected in the near future, although we are still facing many problems on conservation.

## 2. Ecosystem Diversity

### 2.1 Forest

The forested area of China is small with an unbalanced distribution and variety of types. The forest coverage is about 14%.

Forest has 212 main formations indicated by dominant species, co-dominant species or characteristic species in tree layers. In addition, the bamboo forests of China are very rich, with 36 formations, most of them are planted. Shrub-lands are fairly complex, with 113 formations. (Table 1)

Ecosystem Type	Main Formation
Forest	212
Bamboo forest	36
Shrubland	113
Meadow	77
Steppe	45
Desert	52
Savanna	2

Table 1. Terrestrial Ecosystem Diversity in China

The forest of China can be broadly classified into coniferous forest, broad-leaved

deciduous forest, evergreen broad-leaved forest and coniferous and deciduous mixed forest, etc.

The coniferous forest in China consists of taiga (44 types), warm temperate coniferous forest (5 types) and subtropical and tropical coniferous forest (27 types).

The temperate coniferous and deciduous broad-leaved mixed forest is mainly distributed in Northeast China.

There are 42 main types of broad-leaved deciduous forest. They are widely distributed over hilly areas and mid or lower mountainous areas in the temperate zone, the warm temperate zone and the subtropical zone of China. Broad-leaved deciduous forest is the zonal vegetation of the warm temperate zone.

The broad-leaved evergreen forest contains a very wide range of broad-leaved evergreen tree species in the subtropical zone. Some of the animals inhabiting this forest are in imminent danger of extinction due to habitat destruction.

Tropical seasonal rain forest and tropical rain forest covers a small area of Southern China. The 24 main types are dominated by more than one characteristic species. Tropical forests have been seriously destroyed, especially on Hainan Island. Protection of the remaining tropical forest is therefore a priority for biodiversity conservation in China.

## **2.2 Meadow**

The meadows are those communities which developed under appropriate moisture conditions. The dominant species are mesophytes and perennial plants. They can be divided into several types: typical meadows (27 formations), saline meadows (20 formations), marsh meadows (9 formations) and high cold meadows (21 formations). In total, there are 77 meadow formations.

## **2.3 Steppe**

Steppe consists of perennial xeric herbs, occurring from the temperate to tropical zone. It is an ecosystem developed under certain hydrothermal conditions of semi-humid and semi-arid regions. There are 45 formations of steppe, broadly classified as meadow steppe, typical steppe, desert steppe and high cold steppe. The steppe can be found in temperate semi-arid zones, such as the Qinghai-Xizang (Tibet) Plateau and the mountainous areas of arid regions where the typical dominants are species of *Stipa*, *Festuca*, *Aneurolepidium*, *Cleistogenes* and *Artemisia*. The total area of temperate steppe in China is 315 million ha. Due to over exploitation and over-grazing, the steppes have deteriorated and the degenerative area has been estimated at 30% of the total.

## **2.4 Savanna**

Influenced by the warm air mass from the South China Sea and Indian Ocean, the tropical regions are covered with tropical forests, while the arid savanna can only be

found in the xerothermic valley in southern Yunnan and some parts of Hainan Island. In addition, some tropical forests which have been repeatedly felled have become secondary savanna.

## 2.5 Desert

Desert covers a total of 20% of the land area and is mainly found in northwestern region of the country. There are 52 formations of desert, divided into small wood desert, shrub desert, dwarf shrub desert, and cushion-like dwarf shrub desert.

## 2.6 Marsh

This is a kind of wetland dominated by emergent plants, and typically supporting high diversity of birds and fishes. There are approximately 19 marsh formations which can be recognized as follows: herbaceous marsh (14), woody marsh (4) and peatbog (1). Chinese mangrove (a tropical marsh forest), has 18 formations.

The total area of marsh is about 11.5 million ha. It occurs in the mountainous area of the North-east, Sanjiang Plain and Qinghai-Xizang (Tibet) Plateau. The largest marsh was the Sanjiang Plain, Heilongjiang Province, which has now been mostly reclaimed and turned into farmland. The remaining 2.27 million ha are protected to some extent through establishment of nature reserves.

In addition, there are 17 formations of tundra, alpine cushion-like and alpine mobile sand vegetation, each occupying relatively small areas.

## 2.7 Freshwater and Marine Ecosystems

Freshwater and marine ecosystem are home to a tremendous diversity of fishes, amphibians, invertebrates, aquatic plants and microorganisms. The richness of biological diversity in coral reefs is sometimes compared to that of tropical rainforest.

Marine ecosystems are far more diverse than terrestrial ones at higher taxonomic levels e.g. phyla, and marine organisms are also highly diverse at the genetic level. Freshwater habitats are relatively discrete units causing hydro-biodiversity to be highly localized.

Accordingly, freshwater ecosystems support a very high degree of endemism. Biodiversity is known to be very high in both freshwater and marine ecosystems, but scientists believe that the deep sea floor may contain as many as a million undescribed species.

Among the many rivers, streams and lakes in China, there are 22 rivers longer than 1000 km and 2848 lakes larger than 1 km<sup>2</sup>. Seven hundred and seventy two species of fish are distributed in freshwater ecosystem. China is one of the largest producers of freshwater fish in the world. The silver carp (*Hypophthalmichthys molitrix*), bighead (*Aristichthys nobilis*) and grass carp (*Ctenopharyngodon idellus*) are very well-known in aquaculture.

China is also very rich in marine fishes, with 1694 species recorded from China's seas. These comprise 175 chondrichthyes and 1519 teleosts. From the total of 2804 fish

species recorded, 440 are considered to be endemic.

-  
-  
-

TO ACCESS ALL THE 17 PAGES OF THIS CHAPTER,  
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

### Bibliography

Biodiversity Committee of the Chinese Academy of Sciences (1992). *Biodiversity in China—Status and Conservation Needs*. Science Press, Beijing and New York. [A booklet prepared for the Rio World Summit held in 1992. Although short, it is the earliest publication on the biodiversity of China, playing a very important role for briefly introducing the definitions of biodiversity, describing the status and recommendations for better conservation]

Chen Lingzhi et al (1993). *China's Biodiversity—Current Status and Conservation strategy*. Science Press, Beijing [The earliest comprehensive publication on China's biodiversity, describing the status and the strategies for improving conservation]

Compilation Group of China's Biodiversity: A Country Study (1998). *China's Biodiversity: A Country Study*. China Environmental Science Press, Beijing. [A most comprehensive publication on biodiversity in China, prepared for implementation of the International Convention of Biodiversity. It covers various aspects of biodiversity of China, from baseline, status and measures for improving conservation]

### Biographical Sketches

**Chen Lingzhi**, a Professor of Plant Ecology in the Center of Plant Ecology and Biodiversity Conservation, Institute of Botany, Chinese Academy of Sciences. She graduated from Department of Biology, Fudan University in 1954. As a visiting scholar, she worked at Merlewood Research Station, Institute of Terrestrial Ecology, U.K. from 1979-1981. She has been working in the following fields: mountain vegetation types and their distribution in Chinese temperate regions; planning the development of agriculture, forestry, animal husbandry sideline production; research on biomass, energy flow, water and nutrient cycling and litter decomposition of forests, and conservation of biodiversity; studies on the effect of contaminated material on plant and soil and protection of the natural environment in mountainous regions of temperate zone China. Several monographs have been published, such as *The Ecology of Beijing Tainjin Region* (1990); *Biodiversity in China* (1993); *Study on Regressive Ecosystem in China* (1995); *Nutrient Cycling of Forest Ecosystem in China* (1997); *Forest Diversity and Its Geographical Distribution in China* (1997); *Studies on Structure and Function of Forest Ecosystems in Warm-temperate Zone* (1997); *The Effect of Human Activity on Ecosystem Diversity* (1999); *Biodiversity Science—Principle and Practice* (2001). More than 100 papers have been published as well, such as "Studies on Chinese Arborvitae (*Platycladus orientalis*), Forest and Its Biomass in Beijing" (1986); "The Chemical Element of Planted Forest of *Pinus tabulaeformis*" (1987); "The Ordination, Quantitative Classification of Mountain Coniferous Forest in Warm-temperate Regions" (1992) and "Frontiers in Biodiversity Science" (1997).

**Wang Sung**, Fudan University. Research Professor of Institute of Zoology of Chinese Academy of Sciences (CAS), member of China Council for International Cooperation on Environment and Development (CCICED) and Co-Chair of Biodiversity Working Group/CCICED. Other honors include Vice President of China Zoo Association, Member and Vice Chair of China National Committee for IUBS, Vice President of China Foundation for Protection of Wild Animals and Plants. Song Qingling Foundation, member and advisor of CAS Biodiversity Committee, etc. Previous honors include Executive Vice Chairman and Advisor of Endangered Species Scientific Commission of P.R.C. (1983-2000),

Scientific Advisor of China's State Council Environmental Protection Committee (1991-1997), head of Working Group on Biodiversity Conservation/Chinese Academy of Sciences (1990-1992), member of CITES Animals Committee & Nomenclature Committee (1989-1994), IUCN Councilor and Member of Species Survival Commission and World Commission of Protected Areas (1990s), etc. He edited *China Red Data Book for Endangered Animals* and was Chief Compiler for a volume of *Mammalia*. He is also Chief of Editorial Board of *Acta Zoologica Sinica*, member and Deputy Chief Editor of *Acta Zootaxonomica Sinica*, Deputy Chief Editor, of *Chinese Biodiversity*, member of CITES/C&M International Magazine Scientific Committee, 1994-6, member of *Environmental Awareness of International Society of Naturalists*, Member, Advisory Board, *International Environmental Agreements: Politics, Law and Economics*, 2001. Notable awards achieved are Scientific Award for *FAUNA SINICA: MAMMALIA, CARNIVORA*, CAS (1994); IUCN Certificate for Dedicated Service to Conservation of Nature and Natural Resources as IUCN Regional Councilor at World Conservation Congress I (1996 & 2000); IUCN; Environmental Award by China Council for International Cooperation on Environment and Development for his outstanding contributions to the lofty cause of environment and development in China and for his accomplishments in the field of international cooperation (1996 & 2001), Honorable Member of American Society of Mammalogists, New York Zoological Society, etc.

**Zhao Shidong**, a Research Professor of Forest Ecology in the Institute of Geographic Science and Natural Resource Research (IGSNRR), Chinese Academy of Sciences (CAS) and Vice-Chair of Scientific Committee of Chinese Ecosystem Research Network (CERN), member of the Standing Committee of Chinese Association of Ecology, and member of the Standing Committee of Chinese Association of Natural Resources. He graduated from the Department of Forestry of N.W. Agricultural University in 1963 and finished the graduated study in the Institute of Applied Ecology of CAS in 1967. Since then, he has been doing research on plant taxonomy and distribution, forest ecology, impacts of human activities on ecosystem biodiversity, impacts of climate change on ecosystems and land use and land cover change. So far, about 100 papers and 16 books in these fields have been published. He was the Deputy Director of the Institute of Applied Ecology of CAS from 1987-1991, and the Director of the Commission on Integrated Survey of Natural Resources of CAS from 1994-1998. As a Visiting Scientist, he did research in the School of Natural Resources, University of Michigan in USA from 1983 to 1985. As a member of the Steering Committees of Global Observation System (GTOS), International Long-Term Ecological Research (ILTER) and Global System for Analysis, Research and Training (START) and Assessment Panel of the Millennium Ecosystem Assessment (MA), and the Regional Vice-Chair of Commission on Ecosystem Management of IUCN, he has been working with several international programs.