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RESEARCH ARTICLE

Developing phase of China's system of nature reserves in perspective

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Abstract Up until 2009, 2541 nature reserves had been established in China. However, the process of developing this system of nature reserves was not quite smooth. Various kinds of information related to nature reserves, such as annual growth, the type of nature reserves established, motives behind building a nature reserve, legal instructions and the constitution of government sectors, were collected and analyzed in order to highlight the characteristics of the development of our nature reserve system. As a result, we identify three phases and their characteristics, i.e., the initial phase from 1956 to 1978**,** the establishment phase from 1979 to 1996 and the management standardization phase from 1997 to 2009, could be clearly identified. It is suggested that since the establishment of this comprehensive structural framework in China, the system should be entering a new developing phase. We recommend that more attentions should be paid on how to guarantee effective management and how nature reserves are able to maintain their value and fulfill their objectives in the future.

Keywords system of nature reserves, China, developing phase, nature conservation jurisprudence, types of nature reserve

Introduction

The origin of nature reserves in China started in 1956, 84 years after the first modern protected area, Yellowstone National Park in the USA, was established. It took more than fifty years to build China's system of nature reserves, guided by the basic tenets of "earlier division and thereafter construction, emergency rescue and gradual improvement to the establishment of nature reserves". It was a milestone for China since the establishment of its first nature reserve in 1956 (Fig. 1**)**. By 2009, 2541 nature reserves had been established in China (DNEC, 2010). The total area of nature reserves has grown to 147.75 million ha (DNEC, 2010), or 15.3% of China's sovereign territory, which is well over the mean of the 236 nations assessed in 2007 (i.e., 12.2%) (UNEP-WCMC, 2008). With the expansion of this system, 90% of China's terrestrial ecosystem types, 85% of its animal species, more than 300 endangered animal species, 65% of its vegetation communities and major distribution regions for more than 130 valuable tree species are conserved in the system of nature reserves (Ouyang et al., 2002; Zhang, 2010). Nature reserves have become the cornerstone of China's national strategy to conserve biodiversity and maintain ecosystem resilience.

However, the development process of this

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system was not quite smooth sailing. In order to understand its fluctuations, the course of establishing the reserves can be divided into an initiation stage (1956–1965), a stagnation and devastation stage (1966–1974), a restoration stage (1975–1979) and a rapid growth stage (1980–now) (http://www.nre.com.cn/01/08.htm from Lv et al., 2003a; Tian and Zou, 2006). Zhou (2003) divided the development of nature reserves in China into an original stage (1956–1965), a stagnation and slow growth stage (1966–1978) and a rapid growth stage (1979–2003). Cui (2004) thought that the development of nature reserves in China had experienced five stages: an original stage (1956–1965), a stagnation and devastation stage (1966–1974), a restoration stage (1975–1979), a rounded planning and rapid growth stage (1980–2000), as well as a scientific layout, establishment and intensive management stage (2001–now). We think that these divisions, largely based on the development of society, do not really highlight the characteristics of the different stages of nature reserve development.

In this study, various types of information, related to nature reserves, such as their annual growth, the kinds of nature reserve, motives of establishing a nature reserve, legal instructions relating to nature reserves and the constitution of the government sectors in charge of nature reserves, were collected. This information on the characteristics of different periods was teased out and then three phases in the development of China's system of nature reserves were newly assessed according to the results. The objectives of this work was to enhance the understanding of the developing history of China's nature reserves and to identify in which phase we currently find ourselves; as well, we provide suggestions of

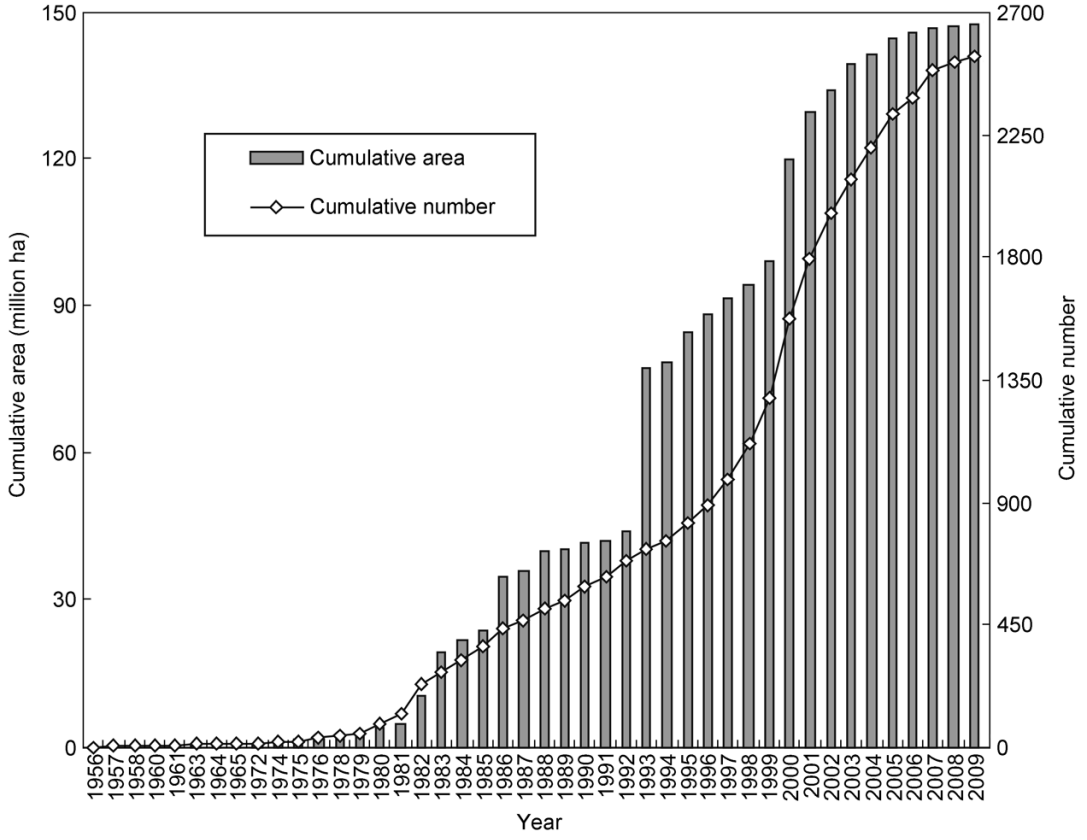

Fig. 1 Growth in the total number and area of nature reserves in China from 1956 to 2009. The Tibet Qiangtang Nature Reserve with an area of 29.80 million ha was established in 1992 and the Qinghai Sanjiangyuan Nature Reserve, with an area of 15.23 million ha in 2000, which led to the sharp increase in area.

improving the management practice of the system of nature reserves in China.

Characteristics of different phases

The three phases we identified are defined as the initial phase (from 1956 to 1978), the establishment phase (from 1979 to 1996) and, for the moment, the management standardization phase (from 1997 to 2009). The characteristics of the different phases of nature reserve development are listed in Table 1.

Initial phase (1956–1978)

China's first nature reserve was created in 1956 and by 1978 only 41 nature reserves had been established. During this period, the average

Table 1 Characteristics of different stages of nature reserve development in China

Item	Initial phase (1956–1978)	Establishment phase (1979–1996)	Management standardization phase (1997–2009)
Average annual growth	1.78 (0–8)	47.28 (10–105)	126.77 (21–290)
Cumulative area (ha)	1,933,616	86,515,616	59,297,227
Percentage of total nature reserve area	1.31%	58.56%	40.13%
Type of nature reserve	Nature reserves mainly fell under wildlife species and forest ecosystems.	Various categories of nature reserve were ratified. Over 75% of the total number of national-rank nature reserve was established.	Most of the new nature reserves fell under low-rank, small-area (≤ 5,000 ha) and forest categories.
Motive to build a nature reserve	Nature reserves were established either for protecting special wildlife species or for unique forest vegetation.	The central government wanted to alleviate the growing pressure for enhanced nature conservation. Local government perceived a nature reserve both as a symbol of administrative achievement and as a potential source of tourism income.	The central government aimed at guaranteeing the national eco-safety. Local government can obtain political and financial incentives through establishing a nature reserve.
Main force to boost nature reserve construction	Scientists	Governments	Governments
Nature conservation jurisprudence	Only several legal documents were issued. Most of those prescripts were not largely brought into effect.	The earliest law relating to nature reserve was decreed. The principal and rounded legal system came into being. Several important international conventions relating to nature conservation were ratified.	Many working guidelines were formulated to facilitate management. Management tended to become standardized.
The idea of management	The basic tenet was to close the land for reforestation.	Open, participative and adaptable management was introduced and popular.	Effect on local people or communities should not be deleterious but rewarding.
Management measure	Protective measures aimed to prevent chopping, depasturing, hunting, firing, and so on.	Zoning management was adopted. A nature reserve may have three separate management zones (core, buffer and experimental zone). A governance system of nature reserve began to take shape.	A nature reserve should be able to serve scientific research, popularization of scientific knowledge, national or international exchange and cooperation and boost the local society-economy.
Others	China National Committee on Man and Biosphere was constituted.	The review committee on national-rank nature reserves came into existence. Nature reserve designation procedures started to become standardized.	

annual growth in the number of nature reserves was about two (ranging from 0 to 8) and the cumulative area had reached 1.93 million ha, or about 1.31% of the total current area of nature reserves in China (DNEC, 2009). No new reserves were added for a while (Fig. 2). Distinguished scientists were the main force to boost the establishment of nature reserves in this period. They presented concrete proposals for their establishment directly to the relevant national or local functional units based on biological field surveys (Jim and Xu, 2004). Those sites were mainly marked out for protecting the pristine and representative vegetation and for conserving rare and important wildlife species and their natural habitat. The designations were accomplished without the guidance and requirement of relevant legislation and, at the time, did not need ratification by law (Jim and Xu, 2004). If a relevant government functional unit had accepted a proposal, a corresponding public document would be issued, in which the site was demarcated as a nature reserve. For example, the first establishment of a nature reserve in Dinghushan was proposed by the Director of the former South China Institute of Botany (now called the South China Botanical Garden), a division of the Chinese Academy of Sciences, Chun Woon-Young in February 1956. Most nature reserves were established for the protection of some special species, while the reason for others was for their unique forest vegetation. Only two categories were recognized at the time: wildlife species and forest ecosystems.

The Draft Resolution (No. 92), i.e., *Please Government Draw the Natural Forest Logging Ban Area and Conserve the Natural Vegetation around the Country in Order to Meet the Need of Scientific Research*, which proposed that the government should establish nature reserves countrywide, was adopted at the third session of the first National People's Congress in June 1956, the start of Chinese jurisprudence on nature conservation. This was followed by *the Draft for Drawing the*

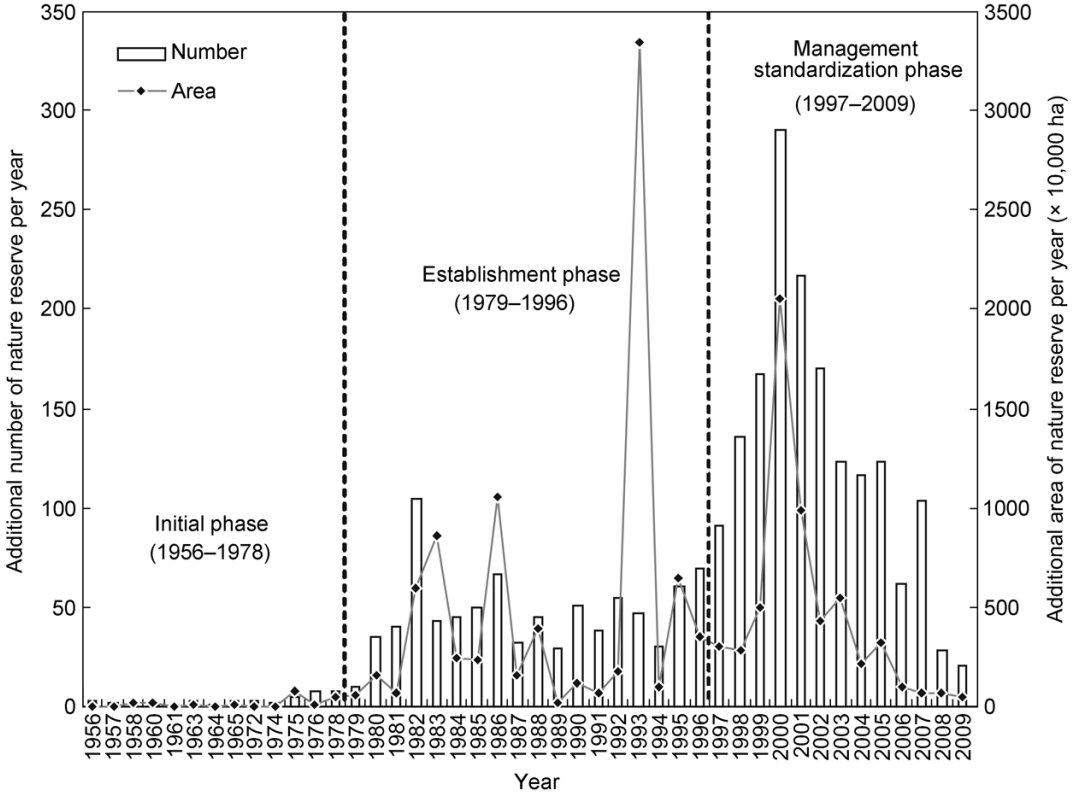

Fig. 2 Annual growth in number and area of nature reserves in China from 1956 to 2009

Natural Forest Logging Ban Area (*Nature Reserve*), which specified what should be protected, how and where to establish a nature reserve. This was finalized by the Ministry of Forestry in October 1956 in order to guide the establishment of nature reserves countrywide. After this, several legal documents relating to the protection of nature were issued.

In February 1959, *the Directive on Developing Energetically Hunting Enterprise* was released by the Ministry of Forestry, which prescribed that some appropriate sites must be demarcated as nature reserves where hunting would be prohibited. The guideline also suggested that research organizations should be set up to carry out research on the relationship between animal activities and hunting. In 1962, *the Directive on Protecting Actively and Utilizing Rationally Wild Animal Resources* (No. 287), released by the State Council, required provincial governments to establish nature reserves inhabited by rare and endemic animals and, as well, to constitute management agencies with the purpose of strengthening protective measures for these animals. This directive was considered the first legal document of building nature reserves in the new China. Articles 13 and 14 of *the Regulations on Protecting Forest*, decreed by the State Council in May 1963, ordained that forests in nature reserves and rare plants must be protected. *The Regulations on Protecting Aquatic Resources* was decreed by the State Council in 1964 and ordained that rare or commercially valuable aquatic organisms must be protected and that areas must be established where all fishing activities would be banned. *The Provisional Regulations on Nature Reserves Management* (trial run) was compiled in August 1973. However, most of these precepts were not brought into effect.

During this initial phase, the government started to set up a few nature reserve management groups. The Hunting Management Division of the Ministry of Forestry was set up in 1958. The Division of Nature Protection resorting under the Ministry of Agriculture and Forestry was set up in 1974. The China National Committee on Man and Biosphere was constituted with the sanction of the State Council in February 1978 in order to keep in touch with international conservation organizations. These management agencies took charge of the reserves guided by the policy of closing the land for reforestation. Their protective measures were mostly issued to prevent chopping, herborizing, depasturing, hunting, fishing and firing.

Establishment phase (1979–1996)

The Circular on Strengthening Management, Regionalization and Scientific Expedition of Nature Reserves was co-released by the Ministry of Forestry and seven other ministries in May 1979. It marked the period where China made serious efforts to establish nature reserves. The first two laws relating to nature reserves, i.e., *the Environmental Protection Law* and *the Forestry Law*, were passed in 1979 by the National People's Congress. *The Forestry Law* acknowledged nature reserves as legal entities for the first time. Then, *the Marine Environment Protection Law* (1982), *the Grassland Law* (1985), *the Water Law* (1988), *the Law of PRC on the Prevention and Control of Atmospheric Pollution* (1988) and *the Law of PRC on the Protection of Wildlife* (1988), specifying how to manage matters of concern to nature reserves from every aspect, were promulgated one after the other. Simultaneously, various professional regulations or government orders concerned with nature reserves were also decreed successively. *The Stipulation for Strengthening Environmental Protection at the National Economy Adjustment Phase* released by the State Council in 1981, became the first administrative legal statute for establishing a geological relics reserve and a scenic interest reserve. *The Measures on the Management of Forest and Wildlife Nature Reserve* (released by the State Council in 1985), *the Regulations of PRC on Nature Reserves* (released by the State Council in 1994), *the Rules on the Protection and Management of Geological Relics* (decreed by the Ministry of Geology and Mineral Resources in 1995), *the Measures on the Administration of Land on Nature Reserves* (co-released by the State Land Administration and the State Environment Protection Administration in 1995) and *the Measures on the Administration of Oceanic Nature Reserves* (released by the State Oceanic Administration in 1995) provided in

detail for the establishment and management of nature reserves. These laws and regulations constitute the principal and rounded legal system of nature reserves in China. In addition, several important international conventions relating to the conservation of nature, such as *the Endangered and Wildlife Species International Trade Agreement* (1980), *the International Convention for Protecting World Culture and Natural Heritage* (1985), *the Convention on Biological Diversity* (1992), *the United Nations Convention to Combat Desertification* (1994) and *the Convention on Wetlands* (1996) were also approved by the Chinese government in those years.

In this period, professional governmental sectors were established. The Ministry of Geology and Mineral Resources, the Ministry of Agriculture, Stock Raising and Fishing and the State Oceanic Administration set up professional divisions to take charge, respectively, of geological, grassland and oceanic reserves. The governance system of nature reserves in China began to take shape. The State Council was the top policy- and decision-making body (Qiu et al., 2009). The Ministry of Environmental Protection oversaw the development and management of the overall system of nature reserves, while the other ministerial sectors, such as forestry, agriculture, land and resource, water resources, oceans and construction, were officially charged with the overall planning and supervision of their own system of nature reserves.

The various categories of nature reserves, such as the geological or paleontological heritage and the sea and coastal ecosystem, began to be ratified after 1980. An official designation procedure, entitled *Application, Assessment and Ratification Method for Nature Reserve Seeking a National-rank*, specifying that a three-stage procedure must be followed to cover nature reserves designated at all levels of government, was adopted in 1991 and was then incorporated in *the Regulations of PRC on Nature Reserves*. The first National Committee on Nature Reserve Assessment came into existence in February 1992. *The National Principles for Categories and Grades for Nature Reserves* were issued in July 1993. The procedures for nature reserve designation began to become standardized (Jim and Xu, 2004).

The average annual growth in the number of reserves was about 47 (ranging from 10 to 105); 851 nature reserves had been established from 1979 to 1996 (Fig. 2). The areas accumulated during this period reached 86.52 million ha, which is about 59% of the current total area of nature reserves in China (DNEC, 2009). The government was the main force for establishing nature reserves in this period. In addition, to protect rare and commercially valuable wildlife species, the central government had to expand the system in response to growing domestic and international pressure for enhanced nature conservation (Crookes et al., 2001). Local governments were urged to take over the role of nature reserve designation and management by trying to meet central government targets. Local officials also perceived a nature reserve both as a symbol of administrative achievement and as a potential source of tourism income (Jim and Xu, 2004). Under these conditions and during this phase, 319 national-rank nature reserves were established, i.e., over 73.3% of the total.

Conflicts between the exploitation of tourism and conservation were widespread and escalating, due to the rapid development of the national economy in this period. The management idea on biosphere reserves, or open, participative and adaptable management for short, was introduced and popular. Zoning management, meaning that a nature reserve may have three separate management zones, i.e., a core area, a buffer zone and an experimental zone, was adopted in *the Regulations on Nature Reserves*.

Management standardization phase (1997–2009)

The Planning Framework for Nature Reserves Development in China (1996–2010) was promulgated by the State Council Committee for Environmental Protection in 1997. It suggested that the development of Chinese nature reserves began entering a new period. About 1200 new nature reserves should have been established and the total area of nature reserves should have reached 10% of China's territorial area by 2010. Over six billion yuan (RMB) of central financial funds were allocated for new nature

reserves. The political and financial incentives, including research grants, overhead subsidies, capital investment and networking with foreign aid donors, were used to encourage local governments to formulate a designation plan with a list of potential nature reserves. This national program also stressed that the funds to conduct management activities in nature reserves should mainly root in governments and that all levels of government should take into account the needs of establishing and managing nature reserves when making national economic and societal development plans in the future. These modi operandi were the first expressions of national policy. A new expansion of nature reserves began in China.

Moreover, *the Overall Planning of Wildlife Protection and Nature Reserve Development Program in China* officially came into effect in December 2001, with the aim to have 2500 nature reserves covering 172.8 million ha (18% of China's land area) by 2050. Total funding of 135.654 billion yuan (RMB) was arranged for wildlife protection and nature reserve development for the period from 2001 to 2030. This national plan gave a further boost to the national program. Afterwards, the National Compensation System of Ecological Public Welfare Forest was announced in central government directives, i.e., *the Decision to Expedite Forestry Development* (Chinese Communist Central Committee and the State Council in 2003). These documents witnessed the creation of a financial fund to support nature reserves directly. The central government had built the system of nature reserves for the purpose of guaranteeing national ecological security (Zeng, 2006). The enthusiasm for establishing nature reserves was also aroused by the political and economic interests of local governments, because economically poor provinces and counties often possessed the best natural areas for biodiversity or for natural vegetation (PATF, 2004).

The average annual growth in the number of nature reserves was about 127 (ranging from 21 to 290) and 1648 nature reserves had been established from 1997 to 2009, over 64.8% of the total number of nature reserves (Fig. 2). The area accumulated over this period amounted to 59.29 million ha, which is about 40.13% of the total nature reserve area in China (DNEC, 2009). However, most of the new nature reserves resorted under municipal-rank, county-rank or small-area (below 5000 ha) and forest ecosystem categories. Municipal-rank and county-rank reserves, areas of less than 5000 ha and forest categories of nature reserves accounted for 64.8%, 51.8% and 55.0% of the total number of new nature reserves, respectively.

With the expansion of nature reserves, conservation activities affected more and more people living in and around nature reserves (Harkness, 1998). Increasing numbers of people began to debate the issue: what function should a nature reserve perform? Which local people or communities should not be adversely affected but rewarded? What is the proper basis for the establishment of nature reserves? The idea that a nature reserve should be able to serve the scientific research, should popularize scientific knowledge, aid conservation publicity and public education took hold. National or international exchange and cooperation to boost the local economy and society became popular (Yang and Cui, 1992; Huang, 1998; Lv et al., 2003b). Guided by the idea of sustainable use, some management agencies took action to deal with the use versus conservation conflict. For example, the income from tourism in the Jiuzhaigou Nature Reserve, Sichuan Province, gave a further boost to conservation efforts. Many nature reserves became a base not only for environmental education activities but also for student field teaching. A number of research stations were based at nature reserves, such as Dinghushan in Guangdong Province (Kong et al., 1993) and Changbaishan in Jilin Province (http://www.cern.ac.cn/ssyz/detail1.asp?sid= changbaishan&tsortid=2&gjgl=1&channelid=170).

At this stage, the ministries or administrations, overseeing the management of the overall or branch system of nature reserves, took responsibility for formulating working guidelines to facilitate their management. For example, the Ministry of Environmental Protection promulgated *the Organization and Working System of the Committee on National-rank Nature Reserve Assessment* (1999), *the Accrediting Criterion of the*

National-rank Nature Reserve (1999), *the Application Form for Constructing a National-rank Nature Reserve* (2001), *the Measures for Supervision and Inspection of National-rank Nature Reserves* (2006), *the Provisional Management Measure of the Chinese Nature Reserve Emblem* (2007), *Guidelines for Standardization Construction and Management in National-rank Nature Reserve* (trial run) (2009), successively. The State Forestry Administration issued *the Criterion for Project Construction in Nature Reserve* in 2002, *the Management Measures of Central Fund in Forest Ecological Compensation* in 2004 and *the Technical Criterion for Effective Management Evaluation of Nature Reserves* in 2008. The *Technical Specification for the Management of Marine Protected Areas* was released in 2004. All of these releases induced management standardization of nature reserves.

Summary

We suggest that the developing process to date of China's system of nature reserves be divided into three distinct phases, i.e., the initial phase (from 1956 to 1978), establishment phase (from 1979 to 1996) and the management standardization phase (from 1997 to 2009). The characteristics of each phase, including annual growth in the number of reserves, the type of nature reserve established, motives to build a nature reserve, legal instructions and the constitution of government sectors in charge of nature reserves, have been clearly identified. After the three-phase development, the number and total area of nature reserves in China has increased considerably. A comprehensive structural framework of the system of nature reserves has been set up. These nature reserves seem sufficient to meet the needs of protecting China's biodiversity and maintaining national eco-security in the terms of the number of reserves, their distribution, type and structure (Jiang, 2005). However, the Chinese government has been more concerned with numbers and total area of reserves, rather than with their effectiveness during these passing phases (Xu and Melick, 2007). Recent research on the evaluation of management effectiveness of 535 Chinese nature reserves showed that management of 69.35% of the surveyed areas disclosed major deficiencies across many management effectiveness indicators, such as management regulation, infrastructure and equipment, monitoring and evaluation, budget and community involvement (Quan et al., 2009, 2011). As a result, we conclude and recommend that China's system of nature reserves should be undergoing a new development phase. As of now, more attention should be paid on how to guarantee effective management and how nature reserves can maintain their value and fulfill their objectives.

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