

A review and assessment of nature reserve policy in China: advances, challenges and opportunities

JILIANG XU, ZHENGWANG ZHANG, WENJING LIU and PHILIP J. K. MCGOWAN

Abstract There were 2,541 nature reserves accounting for c. 15% of China's land territory by 2009. As nature reserves hold the majority of the country's wildlife they play a fundamental role in protecting the country's biodiversity. National policies relevant to nature reserves have had a positive effect on biodiversity although these policies are now facing increasing challenges. We reviewed the development of relevant policy and legislation and identify and assess challenges, using a questionnaire survey and personal interviews. The main challenges identified and assessed included lack of harmonization between government departments, between nature reserves and other protected area designations, and between nature reserves and local communities. In addition, recent transfers of responsibilities between government entities, potential impacts of forest tenure reforms, and issues surrounding natural resource use and ecotourism were identified. These obstacles could undermine the achievements of biodiversity conservation in China if they are not addressed soon. Given these findings, we make recommendations to guide future policy formulation in relation to nature reserve management and development.

Keywords Challenges, China, nature reserve, opportunities, policy, protected area

Introduction

Protected areas have a longer history than many other conservation interventions and their contribution has been much discussed and evaluated (e.g. Bruner et al., 2001; Soutullo et al., 2008). They are widely seen as playing a critical role in maintaining biodiversity in many contexts. In China biodiversity has been negatively affected by the high density of the human population, a long history of cultivation, and an increase in the intensity and extent

of human disturbance (He, 2009; Tang et al., 2009), especially since the 1950s (Ministry of Forestry, 1997). The Chinese government has devoted substantial resources to wildlife conservation and nature reserve management (Liu et al., 2003) and protected areas have been established in key locations (Xu & Melick, 2006).

The first protected area in China, Dinghushan Nature Reserve in Guangdong province, was established in 1956, and > 5,000 protected areas had been established by the end of 2003, covering > 18% of the land area (Xie et al., 2004), including nature reserves, areas of scenic interest, forest parks, geological parks, wetland parks and water conservation scenic areas. These various types of protected area are administered by different government departments (Xu & Melick, 2006); e.g. Ministry of Housing and Urban-Rural Development (areas of scenic interest), State Forestry Administration (forest parks and wetland parks), and Ministry of Land and Resources (geological parks). In addition, the management of nature reserves involves many ministerial sectors, such as environmental protection, forestry, agriculture, land resources, water resources and oceans (Xu & Melick, 2006).

Nature reserves provide the core of China's protected areas (Xie et al., 2004; Xu et al., 2008; He, 2009). By 2009 2,541 nature reserves had been established, accounting for c. 14.7% of the land area (Ministry of Environment Protection, 2010). They play a fundamental role in protecting biodiversity (He, 2009). However, the rapid establishment of these reserves and the scale of the current reserve network have inevitably resulted in the emergence of structural challenges (Jim & Xu, 2004) that may impair the effectiveness of nature reserve management (Ervin, 2003; Jim & Xu, 2004; Xie et al., 2004; Tang, 2005; Xu & Melick, 2006; Harris, 2007; Xu et al., 2008). Given that policy has had an impact on resource management (Zhang et al., 2000; Wang et al., 2007), and continues to do so, the aim of this article is to assess what is needed to allow China's reserves to maximize their potential for biodiversity conservation. Our objectives are to (1) outline government policy related to the designation and management of nature reserves, (2) identify and assess the main challenges that have arisen, and (3) provide recommendations for future policy formulation.

Methods

Development of government policy

We obtained permission to search all published and unpublished official documents of the central government

JILIANG XU (Corresponding author) College of Nature Conservation, Beijing Forestry University, Beijing 100083, China. E-mail xujiliang@bjfu.edu.cn

ZHENGWANG ZHANG Ministry of Education Key Laboratory for Biodiversity Sciences and Ecological Engineering, College of Life Sciences, Beijing Normal University, Beijing, China

WENJING LIU Research Center for Nature Reserves, State Forestry Administration, Beijing Forestry University, Beijing, China

PHILIP J. K. MCGOWAN World Pheasant Association, Newcastle University Biology Field Station, Heddon on the Wall, Newcastle upon Tyne, UK

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on nature reserve management from the 1950s to 2005 in the archive of the State Forestry Administration. We also consulted sections related to nature reserves in the year-books of various departments of central government (e.g. *Chinese Forestry Yearbook*) and searched for relevant information on the websites of central government and its various departments. In addition, we obtained official local government documents from various sources, including annual reports to the central government, published reports, and information through our own networks.

Identification and assessment of the main challenges

To assess the potential challenges we conducted (1) an analytical review of nature reserve policy documents and relevant literature, (2) interviews (see below), and (3) questionnaire surveys (see below). We first searched the China National Knowledge Infrastructure (CNKI, 2011), which are the databases of the Chinese scientific literature, with two keyword combinations: 'nature reserve in China' and 'management', and 'nature reserve in China' and 'construction'. All keywords used in our searches were Chinese, and > 1,200 papers were identified. We also included several papers from the international literature that discuss challenges currently facing nature reserve development in China (Ervin, 2003; Jim & Xu, 2004; Xu & Melick, 2006), and obtained a preliminary report (DWCNRM, 2007) on the challenges to nature reserve policy in China. This body of literature was also used to identify key issues for the semi-structured interviews and questionnaire surveys.

We selected nature reserves from 22 provinces and the managers of these reserves were requested to complete questionnaires or to be interviewed (Table 1). The selection of the provinces was based on the size, number and management levels of nature reserves in each and also upon recommendations from the State Forestry Administration. The nature reserves in each province were selected on the basis of the recommendations of the provincial forestry departments, the management level (national, provincial or other), and representativeness and location in the province.

From 2007 to 2009 we carried out semi-structured interviews using open-ended questions and discussions with nature reserve managers, local government officials, and scientists. We contacted the managers of 67 nature reserves for an interview, and 39 responded (Table 1). The local government officials in Yunnan and Guangdong were selected specifically for interview because of the large number of nature reserves in these provinces and because they had been singled out for the quality of their management (DWCNRM, 2007). We interviewed local government officials and scientists whose work gave them insights into reserve management. These individuals were identified

TABLE 1 The number of nature reserves contacted in 22 provinces with a request to conduct a questionnaire survey or interview and the number that replied to the questionnaire or facilitated an interview.

Province	No. of reserves contacted for questionnaire (no. that replied)	No. of reserves contacted for interview (no. agreed)
Anhui	20 (12)	2 (0)
Beijing	5 (1)	2 (1)
Chongqing	0	2 (2)
Gansu	5 (1)	0
Guangxi	0	4 (4)
Guizhou	45 (44)	7 (3)
Heilongjiang	20 (9)	4 (1)
Henan	15 (4)	2 (2)
Hubei	20 (17)	3 (1)
Hunan	20 (13)	3 (0)
Inner Mongolia	10 (9)	8 (8)
Jiangsu	0	1 (1)
Jiangxi	15 (7)	4 (4)
Liaoning	0	1 (1)
Qinghai	6 (1)	0
Shanghai	2 (1)	1 (1)
Shaanxi	0	4 (4)
Shanxi	10 (3)	3 (0)
Sichuan	40 (37)	5 (2)
Xinjiang	10 (2)	0
Yunnan	40 (35)	5 (0)
Zhejiang	5 (2)	6 (4)
<i>Total</i>	288 (198)	67 (39)

using a snowball approach (Patton, 1990), which builds a study sample by asking interviewees to identify others who could be of interest to the research. Twenty interviews were conducted with local government officials and scientists dealing with nature reserve management (one official each in Guangxi, Anhui, Shanxi, Shaanxi, Liaoning, Zhejiang, Hubei, Sichuan, Chongqing and Guizhou, and 10 scientists from institutes, universities and NGOs). The questions in interviews with nature reserve managers, local government officials and scientists focused on the current status of the nature reserve(s), especially the challenges faced by the institution(s) in establishing and managing the reserves.

From June to October 2009 we sent questionnaires to the managers of 288 nature reserves, of which 198 replied (Table 1): 71 national nature reserves, 77 provincial nature reserves and 50 nature reserves of lower level designation. The questionnaire covered the main aspects of nature reserve management in China: contextual issues, such as management level (national, provincial or other), area, year of establishment, and management authorities; and management capacity, including number and education background of the managers and workers, status of land tenure,

finance mechanisms, natural resource use and participation of neighbouring communities in decision-making.

We then combined information received from the interviews, questionnaire surveys, and the review of official documents and relevant literature to identify and describe the challenges facing nature reserve management and policies. These were grouped into related categories, such as management regime, deficiencies in laws and regulations, financial support, community management and development. This descriptive analysis of issues and challenges provides the basis for recommendations for increasing the effectiveness of Chinese protected areas. We offer the recommendations as guidelines for future policy formulation.

Development of government policy

Table 2 summarizes the legislation and regulations, promulgated from 1956 to 2006, relevant to nature reserves in China. The first piece of legislation was the Plan of Natural Forest Nature Reserve Construction (1956), which was suggested by five biologists to the central government. Following this the State Council has required provinces to establish nature reserves in the habitat of rare and endemic species, and authorized the forestry department to be responsible for the overall management of nature reserves. By the end of 1966 there were 13 nature reserves with a total area of 0.437 million ha (Fig. 1).

TABLE 2 The legislation and regulations, promulgated from 1956 to 2006, relevant to nature reserves in China.

Year	Name of legislation or regulation	Main focuses or issues
1956	Plan of Natural Forest Nature Reserve Construction	Provided forestry standards & boundaries for 40 natural forest nature reserves in 15 provinces
1963	Regulations on Forest Conservation	Provided legal requirement to protect forests in wildlife refuges & nature reserves
1964	Regulations on Aquatic Resources Conservation	Provided for establishment of fishing ban areas or nature reserves for aquatic resources
1973	Temporal Regulations on Nature Reserve Management	Provided, for the first time, the legal requirement for nature reserve establishment & management
1984	Forest Law ¹	Prohibited forest logging in nature reserves; authorized the central forestry department & provincial governments to establish nature reserves in forest ecosystems, forests as rare wildlife habitats, & natural tropical forests; authorized the central forestry department to formulate nature reserve management
1985	Regulations on Forest & Wild Animal Nature Reserve Management	Provided a comprehensive framework for nature reserve establishment & for the management of forests & wildlife
1985	Grassland Law ²	Provided for legislation on grassland management & uses, & established some grassland nature reserves
1988	Law on the Protection of Wildlife	Provided for legislation for wildlife management, uses & conservation; nature reserves are considered as an important tool to protect wildlife; hunting prohibited in nature reserves & wildlife refuges
1989	Environment Protection Law	The cornerstone of environment protection; provided for legislation on environment protection, including in nature reserves
1994	Regulations of Nature Reserves	Provided a legislative framework for nature reserves, including: (1) hierarchical system of nature reserves (national, provincial, city & county); (2) statutory procedures for establishing nature reserves; (3) sub-zones of nature reserves (core area, buffer area & experimental area); (4) restrictions on entering the core & buffer areas without appropriate permission; (5) prohibition of some extractive activities in nature reserves, including logging, mining, fishing, grazing, medicine gathering & hunting; (6) allowing ecotourism, business management & operation only in the experimental area
1996	Regulations on Wild Plant Protection	Nature reserves enshrined as an important tool to protect wild plants
1996	Mineral Resources Law	Prohibited mining in nature reserves
1999	Marine Environment Protection Law	Authorized the central oceanic department to manage oceanic nature reserves
2005	Animal Husbandry Law	Prohibited animal husbandry in the core & buffer areas of nature reserves
2006	Regulations on Scenic Interest Areas	Provided guidance for solving the problem of overlap between nature reserves & scenic interest areas

¹Amended in 1998

²Amended in 2003

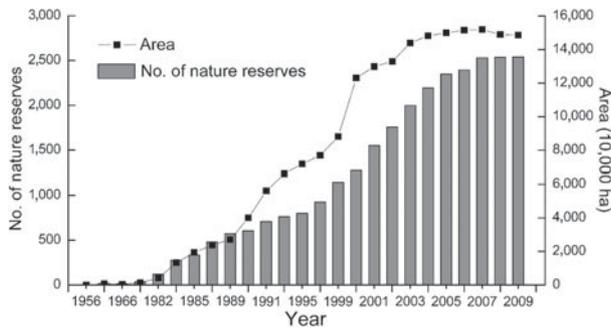


Fig. 1 The number and area of the nature reserves in China from 1956 to 2009. Note the uneven divisions on the x-axis.

The development of nature reserves was hampered during the Cultural Revolution (1966–1976) but after participation in the UN Conference on the Human Environment in Stockholm in 1972 international conservation concepts became more influential (DWCNRM, 2007). The government gradually implemented the Temporal Regulations of Nature Reserve Management of 1973, which led to 34 nature reserves being established, with a total of 1.27 million ha by the end of 1978 (Fig. 1).

A symposium on agricultural and natural resources in 1979 provided a major boost to the development of the country's nature reserve estate (DWCNRM, 2007). The resulting publication summarizing results of resource surveys, nature reserve management and a plan for the future was implemented in that year, and promoted the continued establishment of nature reserves. By the end of 1984 274 nature reserves with an area of 13.27 million ha had been created (Fig. 1).

The Regulations on Forest and Wild Animal Nature Reserve Management (1985) provided a relatively complete legislative framework for nature reserve construction and management for forests and wild animals. In 1987 the Environmental Protection Committee of the State Council issued the Programme for Natural Protection, which was the first document to guide conservation of natural resources and habitat at a large scale, and the creation and management of nature reserves were its main components. Subsequently, several relevant laws became effective, such as the Law on the Protection of Wildlife, and the Regulations on Nature Reserves.

In 1992 the Chinese government representative signed the Convention on Biological Diversity (CBD). As part of the CBD the participating governments agreed to establish a system of protected areas, with special measures to be taken for conserving biodiversity. Subsequently, the government publicized China's Agenda 21 (1994) and the Action Plan of Biological Diversity Protection (1994). In particular, the Regulations of Nature Reserves (1994) was put into practice and nature reserves continued to expand in number

and area. There were 1,276 reserves, with a total area of 123 million ha, by 2000 (State Forestry Administration, 2001; Fig. 1).

These regulations established a hierarchical system of protected areas and, as a result, some provinces (e.g. Yunnan, Guangdong, Zhejiang) developed provincial policies. The governments of the cities and the counties managed these nature reserves according to these policies and there were no major differences in the policies between the provinces and the central government (Xie et al., 2004).

In 1998 the Natural Forest Protection Programme came into force (Wang et al., 2007). The forests in National Nature Reserves became classified as national commonwealth forests under the Programme, and the central government provided annual compensation of RMB 75 ha⁻¹ to these forests, c. RMB 70 ha⁻¹ of which was dedicated to the forest owners (Treasury Department of PRC & State Forestry Administration, unpubl. data). The compensation level is now > RMB 300 ha⁻¹ in some regions (e.g. Zhejiang and Guangdong provinces).

Five additional programmes were established to promote a more sustainable forest policy (Wang et al., 2007), and all had a positive effect on the development of nature reserves. The Wildlife Conservation and Nature Reserve Development Programme is the most relevant to nature reserves. It was implemented in 2001 and has driven a dramatic increase in the number of reserves (State Forestry Administration, 2006a). The central government invested RMB 1.128 billion over 2001–2005 (State Forestry Administration, 2006b), and this programme invested > RMB 300 million to nature reserve creation and management in 2009 (DWCNRM, 2010). The Wetland Conservation Programme was launched in 2006. According to the Planning Proposal for the Wetland Conservation Programme (2005–2010), approved by the State Council in 2006, the central government also invested RMB 4.236 billion in this programme during 2005–2010, including RMB 1.602 billion in wetland nature reserve construction.

These nature reserves provide habitat for > 300 species of threatened wild animals and > 130 species of rare and threatened wild plants listed as first and second class protected species in China. Eighty-five percent of the wild animal populations and 65% of higher plant communities are believed to be protected in nature reserves (State Forestry Administration, 2006a), and some threatened wild species exist only or mainly in nature reserves, such as the golden monkey *Rhinopithecus roxellanae* and Chinese alligator *Alligator sinensis* (Tang, 2005). In addition, > 90% of the terrestrial ecosystem types, 20% of the area of natural forests (State Forestry Administration, 2006a) and c. 49.6% of the total area of natural wetlands are under the protection of nature reserves (Ministry of Environment Protection, 2010).

The main challenges

The interviews suggested that the main challenges to the efficient functioning of nature reserves are the management regime (see Xu & Melick, 2006), extremely strict regulations, conflicting responsibilities of various levels of government, finance mechanisms, land tenure arrangements and management, use of natural resources, ecotourism, conflicts between nature conservation and development of the local economy, human communities living in the reserves, poaching and illegal logging. Almost all of the local government officials and scientists considered the management regime to be the biggest problem facing nature reserve management, and the majority of the local government officials and nature reserve managers interviewed also considered the extremely strict regulations to be a substantial difficulty. These issues can be classified into six categories: overlap and conflicts between government departments, conflicts with other types of protected areas, the transferring of management responsibility to local government, the relationship with local people inside reserves, forest tenure reforms, and use of natural resources and ecotourism.

Overlap and conflicts between government departments

The Regulations on Nature Reserves state that the Ministry of Environmental Protection is responsible for the overall integrated management of nature reserves and that ministerial sectors such as forestry, agriculture, land and resources, water resources and oceans are responsible for nature reserves within their territories (Table 3). However, the roles and responsibilities of government departments have been redefined in recent years (Xu & Melick, 2006; Wang et al., 2007) and there is now overlap between government departments. As a result there is conflict resulting from differing values being held by nature reserve decision-makers, including the relevant officials from different government departments (Ervin, 2003; Xie et al., 2004).

Discussions with some interviewees indicated that this situation is further complicated in some nature reserves. For example, the Xilinguole National Nature Reserve in Inner Mongolia is designated to protect natural grasslands and is managed by the Ministry of Environmental Protection. However, according to the laws on natural resources management, the birds and the other wild animals on the land should be managed by the forestry department, the grassland and fishes managed by the agricultural departments, the water resources managed by the water resources department, and the land and the mines managed by the land and resources department. As a consequence, the Ministry of Environmental Protection is not able to manage this reserve effectively.

Conflicts between nature reserves and other types of protected areas

Nature reserves in China can be classified into nine types (Xie et al., 2004) and they may overlap with other protected area designations. For example, 102 national scenic interest areas overlapped with nature reserves in 2009, and the boundaries of 18 such areas were the same as the corresponding nature reserve (State Forestry Administration, unpubl. data). The Regulations on Scenic Interest Areas (2006) state that natural resource use and ecotourism are the principal objectives of these scenic interest areas, followed by deriving economic benefits, in contrast to the biodiversity conservation objectives of nature reserves (DWCNRM, 2007).

Because of the strict regulations on nature reserves some local governments consider these reserves as obstacles to economic development and have tried to promote other protected area types. In particular, some local nature reserves have been redesignated as scenic interest areas (Department of Nature and Ecology Conservation of Ministry of Environmental Protection, 2008) partly because of the implementation of the Regulations on Scenic Interest Areas in 2006. As a result there was a small decrease in the total area of nature reserves in 2008 and 2009 (Fig. 1).

TABLE 3 The status of nature reserves managed by different ministries or administrations in China in 2007, based on data from the Ministry of Environmental Protection.

Departments of the central government	All nature reserves		National nature reserves	
	Number	Area (10,000 ha)	Number	Area (10,000 ha)
The whole country	2,531	15,188.18	303	9,365.58
Ministry of Environmental Protection	265	2,334.68	46	1,644.67
State Forestry Administration	1,818	11,744.09	223	7,547.43
Ministry of Agriculture	83	180.38	9	105.93
State Oceanic Administration	93	526.56	11	31.57
Ministry of Land & Resources	75	132.88	11	28.75
Ministry of Water Resources	60	146.46	2	7.10
Others	137	123.13	1	0.11

Transfer of responsibilities to local government

In the early 1990s the central government enacted statutory procedures to encourage local government to establish nature reserves. Since the implementation of Regulations on Nature Reserves in 1994 more responsibilities, including personnel matters and funding, have been transferred from the central to provincial governments (Xu et al., 2008) and only three national nature reserves, of the total of 322, are managed directly by the central government.

The central government now provides only a subsidy for the infrastructure and development of the management capacity of national nature reserves. For example, the State Forestry Administration invested c. RMB 300 million in the infrastructure development of 69 national nature reserves and RMB 60 million to the development of management capacity in c. 100 national nature reserves in 2009 (DWCNRM, 2010). However, there was no financial support for infrastructure development for 31.5% of the nature reserves we surveyed in 2009, including 4.2% of the national nature reserves surveyed and 24.7% of the provincial nature reserves.

Financial support from the national and provincial governments was the main source of income for 85% of the nature reserves that we surveyed, including 98.6% of national nature reserves and 77.5% of provincial nature reserves. Therefore, it is seen as important to increase investment from local governments, especially from provincial governments. Our respondents stated that the ability for provinces to provide funds for nature reserves varies and this is especially difficult for the poorer provinces. There is therefore no guarantee of continued funding for these nature reserves.

Local people in nature reserves

Legislation and regulations promote the exclusion of humans from nature reserves (Xie et al., 2004; Ma et al., 2009). It is, however, difficult to pursue this policy given the pressure of human population increase and a history of use (Zhang et al., 1999) even in relatively remote areas because many nature reserves were established without a clear message about their relationship with local people (Jim & Xu, 2004). Consequently, there have been conflicts between nature reserves and local communities, such as overuse of resources (Han, 2000) and human-wildlife conflicts (Xu & Melick, 2006). Although some nature reserves have carried out community co-management projects (DWCNRM, 2009) 45.2% of those we surveyed in 2009 had no such projects and 14.7% did not incorporate local communities into policy- or decision-making.

There were c. 10 million people resident in c. 2,000 nature reserves in 2008 (Li et al., 2009). Over 250,000 people, for example, are resident in Sanjiangyuan National Nature

Reserve in Qinghai Province, which was established to contribute to the ecological safety of the Yangtze, Yellow and Mekong rivers. Use of natural resources in nature reserves is restricted by current policies. This is causing considerable difficulties for rural communities because most people in nature reserves are poor and no mechanisms for providing adequate compensation have so far been found (see Wan et al., 2005). Some nature reserves have promoted emigration, with the help of the local government. For example, 1,085 villagers were resettled from the core areas of Wuyanling National Nature Reserve, Zhejiang Province, and similar programmes have been conducted in Shennongjia National Nature Reserve in Hubei province and Zhalong National Nature Reserve in Heilongjiang province.

Forest tenure reforms

The legal basis of forest tenure includes state-owned and community-owned forest. The latter means that the forest is owned by traditional users, i.e. typically communities and not individuals, and community-owned forests cover an area of > 7.9 million ha of China's nature reserves (Li et al., 2009). Some nature reserves consist almost entirely of community-owned forests, e.g. Huangsang and West Eerduos National Nature Reserves in Hunan and Inner Mongolia, respectively. Uncertainty over forest tenure and rights in nature reserves is a major issue (Xu & Melick, 2006), and it may have increased as a result of the implementation of the Real Right Law in 2007.

Since 2004 several provinces in southern China have started to reform forest tenure policies (Wang et al., 2007) and this has been extended to large parts of the country since 2008 (State Council, 2008). Forest tenure reforms allocate community-owned forests to farmers based on the membership of their families. Local farmers benefit considerably from this change and the average annual cash income for each farmer increased by 13%, or just over RMB 75 (Six Joint-Department Investigation Task Force, 2007). However, community-owned forests are temporarily excluded from reforms in most nature reserves (Li et al., 2009), and some nature reserves are now searching for an effective solution to this problem. The government of Zhejiang Province, for example, has launched a pilot project in Gutianshan National Nature Reserve, with the community-owned forests in core areas rented at RMB 555 per ha.

Natural resource use and tourism

Legally, the use of natural resources is confined to certain types and areas of nature reserves, and this guideline also imposes restrictions on traditional uses of natural resources

by local people (DWCNRM, 2007). This had led to some conflicts between nature reserves and local communities or local government, such as excessive mining in Xilinguole National Nature Reserve in Inner Mongolia.

Tourism is legally confined to the experimental areas of reserves but this is difficult to adhere to in practice. Tourism in many reserves has happened in buffer areas and even core areas (Tang et al., 2009). More than 65% of the nature reserves have facilities to accommodate tourists, including 77% of the national nature reserves (Tang et al., 2009).

Some nature reserves have benefited financially from ecotourism and this is now seen as a major way of raising funds, contributing > 50% of the income of some nature reserves (MAB, 2000). Reserve managers reported that the income from ecotourism has attracted the attention of local governments, and a lot of ecotourism in nature reserves is now managed by local government agencies. These agencies are more powerful than the nature reserve management bureaux and can override decisions of the nature reserve management (DWCNRM, 2007).

Discussion

China has made progress in the development of a legislative framework of environmental and ecological laws and regulations for creation and management of nature reserves (He, 2009). The pace of this legislative programme and the scale and complexity of the country mean, however, that issues that weaken their effectiveness are emerging (Xie et al., 2004). Some of the major threats to nature reserves cannot be solved within the existing legislative framework (Ervin, 2003).

There needs to be a rethink about where the responsibility for directing nature reserve policy and management lies. Jim & Xu (2004) suggested that the centralized approach could be a major cause of reserves failing to meet their conservation objectives. The potential for decentralizing management should therefore be investigated by, for example, establishing demonstration sites in which a bottom-up approach is implemented and evaluated. This would allow lessons to be learnt adaptively and, if a successful model developed, a strong case could be made to the government for expanding the approach.

This approach is likely to prove especially fruitful where there are people living in ecologically unique and undisturbed habitats in nature reserves. Ideally, such people should be cooperatively resettled wherever possible. This would, however, require considerable financial support and most nature reserves do not have the means to provide this. Therefore, incorporating these communities into nature reserve management is likely to provide a realistic way forward. Some nature reserves in China have

explored co-management (DWCNRM, 2002) and it is time to develop effective mechanisms that will achieve this (e.g. management boards; Parr et al., 2008) and encourage more stakeholders to participate in nature reserve management, including relevant government agencies and communities. In addition, measures need to be taken to reconcile forest tenure with existing forest legislation and policy, and this may include renting land. The pilot project in Gutianshan National Nature Reserve has resulted in a compromise between conservation of natural resources in the Reserve and the economic benefits to the local communities (e.g. forest owners) and has thus been acceptable to both parties.

The responsibilities of different administrations and ministries, and the roles between central government and local governments need to be clarified. Given the considerable financial expectations now placed on tourism to generate the funds for managing a significant part of the nature reserve system, it is critical that a planned approach is adopted to ensure that income generation and biodiversity values are balanced. If tourism is promoted without any management controls, significant disturbance of wildlife and/or habitat degradation will occur (e.g. Kelly et al., 2002; Keribiriou et al., 2009). In addition, a holistic approach to natural resource use could identify areas where concessions could be granted for subsistence use of resources, commercial harvest, livestock grazing and other economic activities (Harris, 2007).

Overall, nature reserve development in China is facing policy challenges that could undermine the achievements so far made for biodiversity conservation in the country, and the existing policy framework requires reform. However, China is planning to amend the Forest Law and enact the Law of Nature Reserves (DWCNRM, 2007), and experiences of policy reforms (Zhang et al., 2000; Liu et al., 2003; Wang et al., 2007; Muhammed et al., 2008) were taken into account in drafting the new Law. The promotion and implementation of policies based on the active participation of stakeholders and integration and coordination with them, and a strategic approach to ensure that nature reserves have the appropriate long-term capacity to meet their conservation objectives, could have a positive effect on the future of nature reserves in China.

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Biographical sketches

JILIANG XU has been working on ecology, management and conservation of pheasants since 1999, and is currently working in

nature reserve management and on policies for biodiversity conservation. ZHENGWANG ZHANG is a member of the National Nature Reserves Consultant Committee of the State Forestry Administration and has also conducted research on the management and conservation of threatened species of birds. WENGJING LIU has carried out research for the last 7 years on nature reserve management in China. PHILIP MCGOWAN is Director of the World Pheasant Association and is concerned with promoting the conservation of all 300 species of Galliformes by developing appropriate policy and targeted projects.