Biodiversity conservation status in China's growing protected areas

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ABSTRACT

The past 40 years witnessed a boom of protected areas (PAs) in China. To date, China has established 11 types of PAs, whose conservation objectives vary from protecting biodiversity and geological features, preserving scenic landscapes and seascapes, to restoring and maintaining ecosystem services. Covering over 17% of the land and 3.5% of the marine territory of China, the PAs have had beneficial effects on conservation in this country. However, the success of these PAs is largely restricted by ecological gaps in PA structure, defects of the management system, and is also negatively influenced by local development and urbanization driven by a growing economy. To improve the conservation efficiency of China's PAs, we suggest structural adjustment based on integrative research, practical strategies to alleviate administrative conflicts, increased engagement of local communities, transparent allocation of conservation funding, strengthened supervision and penalty mechanisms for destructive activities, and improved large-scale designation to coordinate demands of conservation and socioeconomic development.

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1. Introduction

A protected area (PA) is a clearly defined geographical space established to achieve long-term conservation of nature with associated ecosystem services and cultural values, and is recognized, dedicated, and managed through legal or other effective means (Dudley, 2013). Establishment and maintenance of PAs is a key strategy in preserving the functions and values of nature (Mace et al., 2008). PAs play fundamental roles in the conservation of biodiversity, and also provide benefits for people (Juffe-Bignoli et al., 2014). However, managing PAs in developing countries presents profound challenges, given the widespread conditions of poverty, rapid population or economy growth and political instability (Naughton-Treves et al., 2005).

China is the fastest developing country in the world (World Bank, 2015). It started to establish PAs in the mid-1950s. During 1956–1984, 274 Nature Reserves (NRs) were set aside by the Ministry of Forestry (now State Forestry Administration; SFA) for protecting rare wildlife such as the giant panda (*Ailuropoda melanoleuca*), relic plants such as *Cathaya argyrophylla*, and endemic primary forests (Wang et al., 2004). At that time there were no official regulations on NR management, and biodiversity features in these NRs were protected mainly through hunting and logging bans. Since 1980s, influenced by concepts of environmental protection promoted at the United Nations Conference on the Human Environment (UNEP, 1972), China's environmental policy has gradually changed from "conquering nature" to "sustainable development based on harmonious co-existence of human and nature" (Liu and Diamond, 2005). In 1993, China became a signatory party to the United Nations *Convention of Biological Diversity* (CBD). One year later, the first regulations on PAs—*Regulations of the People's Republic of China on Nature Reserves* (hereafter *Regulations on NRs*, State Council of PRC, 2005)—were enacted. From the late 1990s to the beginning of 21st century, both the number and total area of NRs in China increased rapidly. In 2004, the number of NRs had reached nearly 2000, accounting for 13% of China's land area (Wang et al., 2004). To date, China has developed other 10 types of PA besides NRs: namely Scenic Spots, Forest Parks, Wetland Parks, Geoparks, Aquatic Germplasm Resources Conservation Zones, Community-based Protected Areas, Special Marine Reserves, no-logging areas of Natural Forest Conservation Project (NFCP), no-grazing areas of the Return Grazing Lands to Grasslands Project, and National Park Pilots (NPPs). In 2014, the backbone of China's PAs—NRs, accounted for 15% of China's terrestrial area and 1% of its marine area (MEP of PRC, 2014, Fig. 1), and the total coverage of 11 types of PAs currently reaches the 17% target set out in Aichi Target 11 for terrestrial areas (CBD, 2010). However, while this target has been reached, the effectiveness of these PAs is largely restricted by various structural and management issues, and also threatened by local development and urbanization, driven by the growing economy.

Given the great importance that conservation strategies attach to PAs, we present an overview of the progress and drawbacks of PAs in China, thereby outlining possible countermeasures and challenges in the future.

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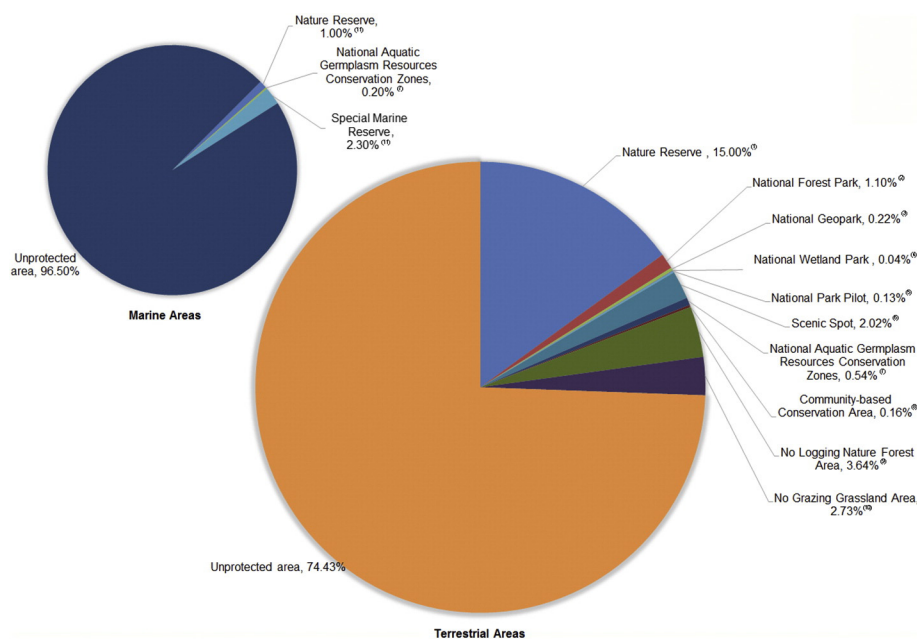
Fig. 1. Coverage proportion of each type of PAs in China. The area of China's terrestrial territory (including inland waters) is 9.6×10^6 km^2, marine territory is approximately 3.0×10^6 km^2. PAs in Taiwan, Hong Kong, and Macao are not included. Overlaps among PAs are not subtracted from each type. (1) Total area of Nature Reserves (MEP of PRC, 2014) subtracted the area of marine Nature Reserves (Wang, 2015); (2) SFA of PRCb; (3) CAGSb; (4) SFA of PRCa; (5) the Forestry Department of Yunnan Province; (6) Xue (2015); (7) Yang et al. (2011); (8) SFA of PRC (2014a); (9) SFA of PRC (2010b); (10) MEP of PRC (2014); (11) Wang (2015).

2. Methods

We conducted a review of international and local literatures on PAs of China which were published from 1950 to 2015. Information on the history, development, and management of PAs in China was extracted from peer-reviewed papers, official reports, yearbooks, and validated documents from government departments including the Ministry of Environmental Protection (MEP), the Ministry of Agriculture (MOA), the Ministry of Housing and Urban-Rural Development (MOHURD), the Ministry of Land and Resources (MLR), the Ministry of Water Resources (MWR), the State Forestry Administration (SFA) and the State Oceanic Administration (SOA). Definitions and the management framework for individual PA types were extracted from the relevant laws and regulations of the Chinese government. We performed a literature search using the online search engines Web of Science™, and the China Integrated Knowledge (CNKI) Resources Database. We searched available fields including the title, the topic or research area (in Web of Science™), and the title, the abstract, the topic or key words (in the CNKI Resource Database) containing "China", "protected area" and one or more of the following terms: "nature reserve", "forest park", "wetland park", "geopark", "national park", "marine protected area", "scenic spot", or "community co-management area", "National Forest Conservation Project", "Grain-to-Green", "distribution", "pattern", "effectiveness", "management" or "management strategy". The literatures were excluded when the abstracts revealed they were not appropriate for our research topic.

3. PAs in China and IUCN categories

Based on management objectives and outcomes, IUCN proposed a system for global PAs which classifies PAs into six management categories: Strict Nature Reserve (Ia), Wilderness Area (Ib), National Park (II), Natural Monument or Feature (III), Habitat/Species Management Area (IV), Protected Landscape/Seascape (V), and Protected Areas with Sustainable Use of Natural Resources (VI) (Dudley, 2013).

The primary framework of China's PA network was formed before IUCN launched its PA categorization, which designates management responsibilities of different types of PAs to different government agencies.

The PAs with high conservation values are assigned to "national level", which are approved and supervised by national government agencies such as MEP, SFA and MOA. Non-national-level Forest Parks, Wetland Parks, Geoparks, Aquatic Germplasm Resources Conservation Zones and Special Marine Reserves are not included in this study, because most of them lack mechanisms of supporting operations or specialized management organizations to fulfill conservation actions. In order to draw inspirations from the world's authoritative resource for PA management, we attempt to apply the IUCN PA categories to PAs in China according to their management objectives set out by the Chinese government (Table 1). Such an application is expected to encourage

Table 1
Application of IUCN PA management categories to PAs in China.

Protected areas of China	IUCN categories	Management agency
Nature Reserve (the core zone and buffer zone)	Ia, Ib or III	SFA, MEP, SOA, MOHURD, MLR, MWR, MOA, CAS
Nature Reserve (the experimental zone)	V or VI	SFA, MEP, SOA, MOHURD, MLR, MWR, MOA, CAS
National Park Pilot	II	The Government of Yunnan Province
Scenic Spot	II, III, V	MOHURD
National Forest Park of China	V	SFA
National Wetland Park of China	II or V	SFA
National Geopark of China	III	MLR
Special Marine Reserve	III, IV, V or VI	SOA
Community-based Conservation Area	IV	Coordinated by SFA
No-logging natural forest area	V	SFA
No-grazing grassland area	V	MOA
National Aquatic Germplasm Resource Conservation Zone	VI	MOA

MEP: the Ministry of Environmental Protection, MLR: the Ministry of Land and Resources, MOA: the Ministry of Agriculture, MOHURD: the Ministry of Housing and Urban-Rural Development, MWR: the Ministry of Water Resources, SFA: the State Forestry Administration, and SOA: the State Oceanic Administration. The Supplementary Figure shows detailed suggestions on how to classify NRs (Fig. A1a), Scenic Spots (Fig. A1b) and Special Marine Reserves (Fig. A1c). As this classification is general, we suggest applying the IUCN categories according to the specific conditions of each PA in practice.