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Wildlife conservation and management in China: achievements, challenges and perspectives

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37 Dramatic global changes to the environment have wrought unprecedented
38 reductions in biodiversity, with more than 26% (31,030) of the 116,177 species assessed
39 by IUCN as threatened with extinction [1]. China, as one of the world's megadiverse
40 countries, plays a critical role in global biodiversity conservation. The upcoming 15th
41 Conference of Parties (COP15) for Convention on Biological Diversity (CBD) serves
42 as a propitious opportunity for China to make ambitious but pragmatic commitments to
43 elevate its wildlife conservation and management activities. The development of
44 “Ecological Civilization”, which endorses the ancient Taoist idea of Unity of Nature
45 and Man (UNM) to achieve the harmony between human beings and nature, has greatly
46 facilitated the mainstreaming of biodiversity conservation in China [2]. Experiences
47 from China will shed light on wildlife conservation worldwide.

48 **STATUS AND ACHIEVEMENTS**

49 **Species recovery and habitat protection**

50 Chinese wildlife is protected and managed by different levels of administrations
51 according to their classification and grading. Class I species under state protection are
52 governed by national administration, while class II species under state protection and
53 species under local protection are managed by local administration. Beginning with the
54 establishment of the first nature reserve in 1956, China took significant measures to
55 protect its wildlife, including the promulgation and revision of laws and regulations,
56 establishment of a legal framework with specific species listed due to endangerment or
57 ecological, scientific or social value, signing international conventions and multilateral
58 agreements, and implementing national bans, projects and surveys (Fig. 1). Flagship
59 species, such as giant pandas, big cats, monkeys, gibbons, dolphins and ungulates, are
60 afforded additional protection. After the outbreak of the COVID-19, China's top
61 legislature immediately made the decision to ban wildlife consumption throughout the
62 country, crack down on illegal wildlife trade, and increase promotion of environmental
63 protection. Subsequently, the government updated National Catalogue of Livestock and
64 Poultry Genetic Resources in 2020, and Lists of Wildlife Under Special State Protection
65 in 2021, with number of protected species increased from ~500 to ~1500, covering
66 more threatened species (Table 1).

67 This direct regulatory protection of wildlife is supplemented by a large portfolio of
68 measures designed to protect habitat in support of wildlife. Although China had a
69 relatively late start in developing its Protected Area (PA) system, it has already
70 surpassed the Aichi Target 11 of 17% of terrestrial and inland water. By the end of 2019,
71 China had established 11,800 PAs, covering about 18% of its entire land surface (Fig.
72 2a) and 89% of species under special state protection [3]. Nature reserves are afforded
73 the highest level of protection and have increased rapidly from 1990 to 2007, currently
74 covering about 15% of the land surface (Fig. 2b). Other types of PAs—including scenic
75 spots, forest parks, geological parks, wetland parks, and desert parks— have also been
76 established to meet multiple conservation goals (Fig. 2c) and are integrated with the PA
77 system to protect China’s natural heritage in a wider sense.

78 China supplements habitat protection with other measures such as eco-restoration
79 and eco-compensation. Two of the world’s largest initiatives—the Natural Forest
80 Protection Project and the Grain to Green Program, provide economic incentives for
81 human communities to protect and restore habitat in support of wildlife conservation.
82 Moreover, these *in situ* efforts have been supported by a growing *ex-situ* conservation
83 portfolio advanced by the establishment of over 240 zoos and about 250 breeding
84 centers [3]. Several reintroduction projects have been successfully established for the
85 giant panda, Pere David's deer, crested ibis and Chinese alligator. National wildlife
86 monitoring networks have been established, and national evaluation of threatened
87 species have been implemented, which greatly improve the scientific basis for decision
88 makings. Considering the severe impact of human activities on fresh water and oceanic
89 biodiversity [4], China has implemented a 10-year fishing ban in pivotal waters of the
90 Yangtze River and summer fishing moratorium in oceans.

91 With the implementation of these national laws, PAs, and conservation projects
92 (Fig. 1), a number of species have experienced population increases and habitat
93 expansion, and more than one hundred mammalian species improve the national
94 threatened status [5]. Some flagship species such as the giant panda, snow leopard,
95 Tibetan antelope and crested ibis, have recovered from the brink of extinction, and been
96 downlisted from “Endangered” to “Vulnerable” or from “Critically Endangered” to

97 “Endangered” by IUCN.

98 **Combating wildlife trade**

99 Significant headway has recently made major inroads into combating wildlife
100 trade in China. To further mitigate impacts on Chinese wildlife from international trade,
101 China has proposed adding endemic species for protection under the Convention on
102 International Trade in Endangered Species of Wild Fauna and Flora (CITES), providing
103 additional protections for ~830 animal species. Trade ban on tiger bones and rhino
104 horns has been implemented since 1993 (Fig. 1). The last few years have witnessed a
105 large shift in regulatory activity, with several trade-related regulations and
106 enforcements established (Fig. 1): wholesale bans on elephant ivory and all rhino and
107 target products have recently been supplemented with a full ban on international trade
108 in live wildlife. The Inter-Ministerial Joint Conference for Combating Illegal Wildlife
109 Trade comprised of 25 ministries was established to combat illegal wildlife trade,
110 indicating China’s intolerance of wildlife trafficking and determination to crack down
111 on illegal wildlife trade. Moreover, China has increased collaboration with other nations
112 to counter wildlife trafficking and multilateral wildlife law enforcement operations. In
113 2014 a law enforcement activity dubbed “Cobra II”, wildlife officials, customs, and
114 police officers from 28 countries collaborated in the investigation of more than 350
115 cases, leading to the arrest of ~400 suspects.

116 **Corporate social responsibility and conservation practice**

117 Another recent development in China is the rise of corporate social responsibility
118 and contributions to biodiversity conservation. Roles have varied across different
119 industries, but corporations have begun supporting a number of conservation initiatives,
120 including monitoring at-risk species and natural resources, establishing breeding
121 centers, developing conservation breeding and reintroduction programs, creating
122 charitable foundations to promote wildlife conservation, establishing green industrial
123 supply chains to promote eco-friendly products, developing digital technological
124 innovations to facilitate biodiversity conservation [6]. The Alipay Ant Forest project is
125 a good illustrative model of corporate involvement in conservation. Launched in 2016
126 by Alibaba’s Ant Financial Services Group, this program enlists public participation to

127 reduce their carbon footprint and support tree planting. By 2020 more than 500 million
128 users had participated, resulting in 122 million trees planted in arid and semi-arid areas
129 in China. These achievements earned the program top honors for the United Nations'
130 environmental action category. In 2017, a consortium of 26 organizations including
131 SEE Foundation and the Alibaba Foundation launched the "Commonwealth Nature
132 Reserve Alliance" to enlist the public to protect 1% of the country's land area by 2030.
133 By the end of 2019, more than 140 million people have contributed to the establishment
134 of 39 PAs, covering an area of 7,630 km², 0.079% of the country's land area.

135 **Community participation and traditional knowledge**

136 Community-based biodiversity conservation initiatives are another area of growth
137 in China. The public has been engaged through surveys of environmental beliefs and
138 attitudes, engagement in the establishment of natural protection zones, and citizen
139 science, as well as broad environmental education initiatives. Traditional belief has also
140 been enlisted in the service of biodiversity conservation. Community Conserved Areas
141 (CCA), like Feng Shui Forests, capitalize on spiritual beliefs to protect sites with
142 religious significance or mitigate exploitation of resources protected by religious or
143 cultural taboos. These CCAs are typically small in size but may contain key habitats
144 for endangered species, or serve as corridors connecting larger PAs facilitating wildlife
145 dispersal or migration. Community engagement in these PAs leads to better protection
146 within sacred mountains than outside [7].

147 **CHALLENGES AND PERSPECTIVES**

148 **Top-level design of protected area**

149 The early construction of PA in China aims to rescue species from extinction.
150 Although areas of PAs greatly increase in past decades, the ecosystem integrity and
151 structure connectivity are not well addressed. The lack of top-level design has resulted
152 in problems such as spatial mismatch of PAs and wildlife, spatial overlap of different
153 types of PAs, fragmentation and isolation of PAs, and ineffective management [8].
154 Terrestrial nature reserves in China capture only 17.9% and 16.4% of the available
155 habitat area for threatened mammals and birds, and even worse, 10.0% and 8.5% for
156 amphibians and reptiles [9]. Marine PA network needs much more attention in both area

157 and connectivity [10].

158 Currently, China is establishing a system of protected natural areas with national
159 parks as its mainstay, supported by nature reserves as the foundation and complemented
160 with various natural parks. Moreover, Ecological Conservation Redline which is
161 coordinated and aligned with other land-use-planning frameworks is also underway.
162 These top-level designs will integrate and optimize existed PAs to cover more key areas
163 for wildlife and ecosystem services, and expand to improve niche representation. In
164 addition, the establishment of marine national park is urgently needed to strengthen the
165 protection of marine biodiversity [10]. Meanwhile other type of lands with conservation
166 value, such as farmland, should be incorporated into protection plans [11].
167 Transboundary conservation reserves and corridors should be established for migratory
168 species that traverse international borders like the red panda, Asian elephant, the
169 Myanmar snub-nosed monkey, and eastern black crested gibbon, to build a shared
170 future for all life in transboundary areas.

171 **Science-based conservation and management**

172 Lack of information about the demographic history, genetic diversity and adaptive
173 strategies of endangered species has limited conservation solutions and recovery
174 actions. A notable counterexample is the giant panda, where science-informed policy
175 and management contributed to downlisting of the species from Endangered to
176 Vulnerable [12]. Therefore, future policy and management decisions should rest on the
177 quality of the underlying science. A multi-disciplinary scientific committee is needed
178 to provide analysis, assessment and recommendations for decision-making, such as
179 revising wildlife protection laws, setting conservation targets, and formulating national
180 conservation programs. Taxonomic changes among listed species should be addressed
181 timely, and lists of protected species requires regular updating so that gaps can be closed,
182 and that management interventions can be established for all species at-risk. Besides
183 the science-based management of common species should be enhanced. With the
184 implementation of national projects, and the absence of large and medium-sized
185 carnivores, the rapid growth of some herbivores, such as wild boar, are adversely
186 affecting ecosystem stability. Scientific management intervention is required for species

187 exceeding carrying capacity.

188 **Long-term monitoring, information sharing and evaluation**

189 Although several wildlife monitoring networks are running, monitoring gaps and
190 overlaps are common in practices, and indicators, methods and guidelines for regulating
191 these networks are inconsistent due to the lack of top-level design. Most importantly,
192 monitoring data could not be fully shared, integrated and analyzed to guide
193 management decisions and policy. In addition, although the terrestrial wildlife epidemic
194 monitoring network which composed of 350 national, 768 provincial, and many
195 county-level monitoring stations has also been established for more than ten years, the
196 capacity of wildlife disease control and monitoring is still insufficient.

197 To fill the gaps, further optimization and integration of current wildlife monitoring
198 networks are needed where information could be freely shared. New technologies such
199 as low-altitude remote sensing by unmanned aerial vehicles or small satellites, and
200 thermal infrared remote sensing should be incorporated with traditional monitoring
201 methods to obtain fine-scale integrated observations for better understanding of
202 dynamic changes in wildlife and habitat. Besides species diversity, genetic diversity
203 should also be monitored for the formulation of scientific and reasonable conservation
204 strategy [13]. Given wildlife-borne infectious disease is an important driver of species
205 decline and extinction [14], new scientific frameworks such as updating current
206 monitoring systems, establishing national key laboratories and genetic resource banks
207 for detection of zoonotic diseases in the early stages are required. Furthermore, China
208 has implemented many conservation programs, however, an indicator-based scientific
209 index system to evaluate the effectiveness of these programs has not been established.
210 Documenting outcomes of management interventions and protective measures on a
211 regular basis is needed to guide the design and implementation of future conservation
212 measures.

213 **Promote increased contribution by citizens and corporations**

214 Citizen science and other forms of public engagement have great potential for
215 raising public awareness, advancing scientific knowledge, and improving natural
216 resource management and environmental protection [15]. Chinese policymakers,

217 researchers and academics should make greater use of these forms to leverage public
218 involvement in conservation science and practices, promoting the internalization of
219 environmental ethics and cultivating ambassadors that champion conservation causes.
220 CCAs are often more cost-effective compared to nature reserves because compliance
221 with environmental stewardship comes from the community's attitudes rather than
222 governmental regulation. The government should incorporate and promote this
223 community-based approach and education initiatives whenever feasible. Further, China
224 now has good models for corporate social responsibility and green practices (e.g.,
225 Alipay Ant Forest), and these approaches should be promoted widely and adopted by
226 other corporations. Corporate uptake of biodiversity conservation initiatives, awareness
227 campaigns, green industrial chains, and green products will be vital for the future of
228 China's natural heritage.

229 **CONCLUSION**

230 Progress in wildlife conservation and management in China is founded on the
231 establishment of a legal framework and the implementation of laws, regulations, and
232 science-based conservation programs during the past 40 years. Population recovery and
233 reintroduction of some flagship species, and recent intensified efforts to combat illegal
234 wildlife trade set a good precedent for others. However, the effective conservation and
235 management of wildlife still presents challenges, many of which mirror challenges
236 faced around the globe. China has the good fortune of a long historical legacy of human-
237 nature coexistence in the philosophy of Unity of Nature and Man. Conservations should
238 work to mainstream this belief system to promote urgently needed progress in
239 biodiversity conservation. The Ecological Civilization building on this historical legacy,
240 provides an opportunity for the government to leverage people's beliefs to meet the
241 conservation challenges articulated here. We believe that ancient Chinese beliefs have
242 relevance today, and will help China and other countries to realize the harmonious
243 coexistence of humankind and nature to build a shared future for all life on earth.

244

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252

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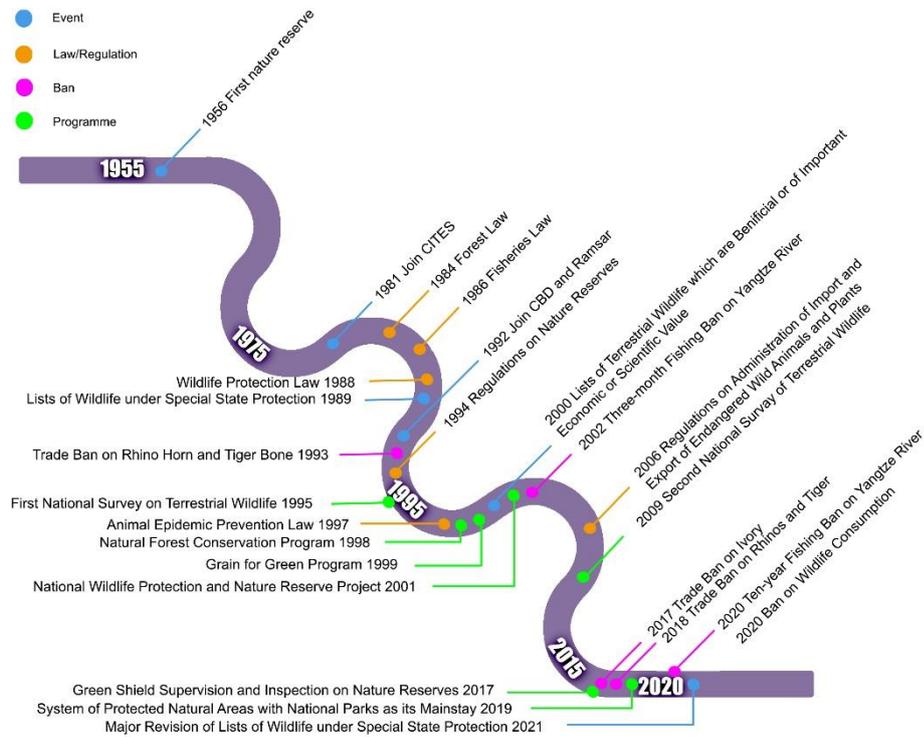
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290 **Figures and Figure legends**

291



292

293 **Figure 1.** Timeline of Laws/Regulations (orange circle), national programs (green
294 circle), bans (purple circle), and big events (blue circle) related to wildlife conservation
295 and management in China.

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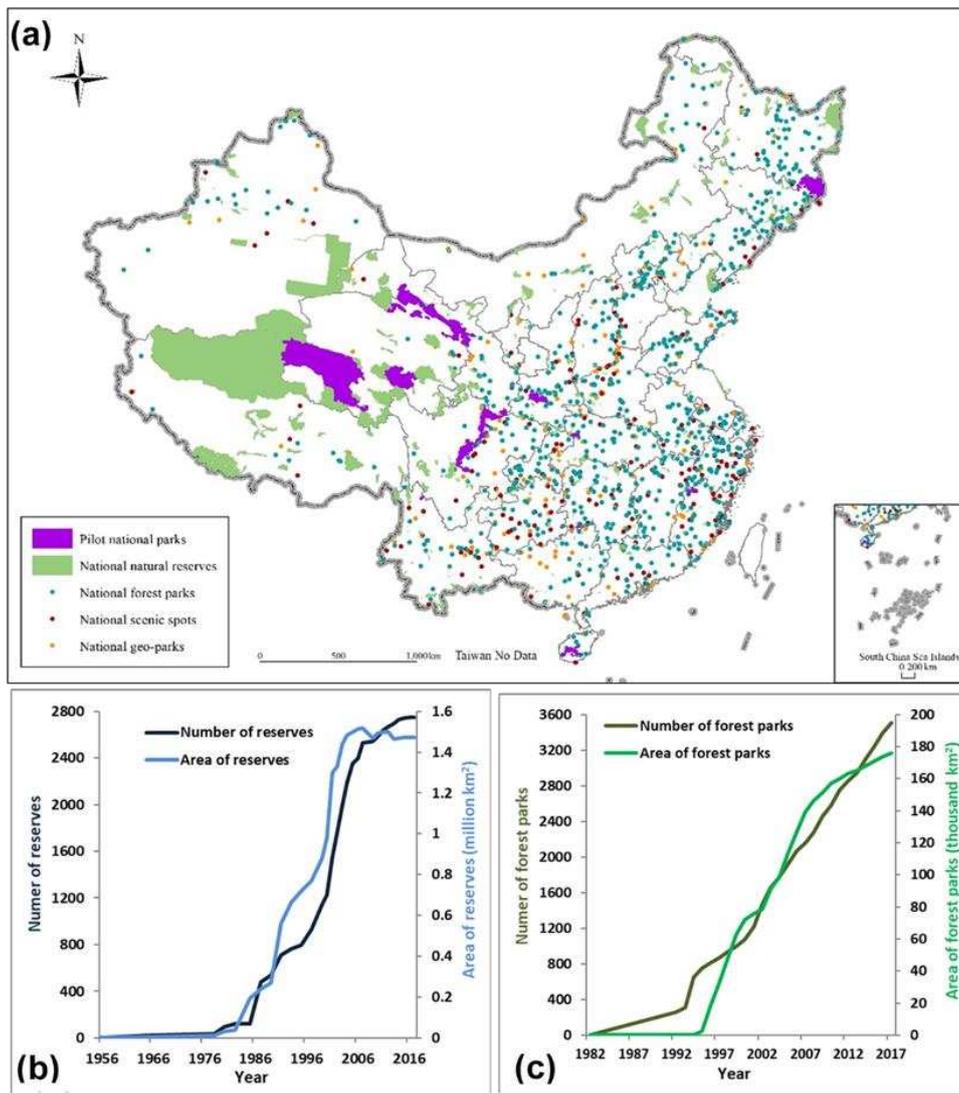


Figure 2. Distribution, area and number growth of major types of protected areas in China. (a) Distribution of major types of protected areas; (b-c) Area and number growth of nature reserves (b) and forest parks (c).

Table 1. Number of animal species included in old (1989) and updated (2021) Lists of Wildlife Under Special State Protection (WSSP) and threatened species in China Biodiversity Red List which are not included in WSSP. Data source: China Biodiversity Red List; CITES Appendices in China (Species+ and Chinese Version of CITES Appendices (enter into force on Nov, 26, 2019)); Ping & Zeng (2020) Changes in nomenclature of animals included in Lists of Wild Animals under Special State Protection in China and impacts on wildlife conservation. SCIENTIA SINICA Vitae. 50(1): 33-43.

Taxa	I		II		Total		Threatened species Not included [Number(ratio)] [#]	
	Old	Updated	Old	Updated	Old	Updated	Old	Updated
Mammal	68	99	90	86	158	185	69 (38.76%)	65 (36.52%)
Aves	43	92	204	302	247	394	67 (45.89%)	9 (6.16%)
Reptile	6	19	11	83	17	102	119 (86.86%)	78 (56.93%)
Amphibian	0	7	17	86	17	93	167 (94.89%)	110 (62.5%)
Fish	4	10	11	149	15	159	282 (95.59%)*	234 (79.32%)*
Invertebrate	13	14	25	480	38	494		
Total	134	241	358	1186	492	1427	704 (75.43%)	496 (53.22%)

[#] Threatened species in China Biodiversity Red List included those species assessed as Critically Endangered, Endangered and Vulnerable.

* Only freshwater fishes are included in China Biodiversity Red List.