

Giant Panda

ex-situ Conservation

Theory and Practice

Zhang Zhihe Wei Fuxun

# 大熊猫迁地保护 理论与实践

张志和 魏辅文 编著



科学出版社

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## 内 容 简 介

本书在参考濒危动物保护最新理论和研究成果的基础上,总结有关大熊猫繁育研究保护多年来的实践经验,全面系统地介绍了大熊猫迁地保护方面的最新成果和实践经验。全书图文并茂,内容涉及大熊猫生态、饲养管理、营养、行为、繁育、疾病以及遗传等诸多领域,兼具理论性与实用性。

本书适于从事野生动物保护生物学研究的科研人员、研究生,大熊猫保护管理第一线的科研、管理和饲养人员,以及大熊猫爱好者参考。

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## 作者简介 (一)

### *Introduction to Primary Authors*

张志和博士，成都大熊猫繁育研究基地主任、书记、研究员，濒危动物繁殖与保护遗传四川省重点实验室副主任，中国大熊猫繁育技术委员会主任，成都大熊猫繁育研究基金会副理事长兼秘书长，中国动物园协会常务理事，国家林业局大熊猫保护管理咨询专家组成员，四川动物学会副理事长，全国青联委员。获“成都市有突出贡献优秀专家”、“成都市十大杰出青年”荣誉称号和“中国十大杰出青年提名奖”，享受国务院颁发的政府特殊津贴。

长期从事大熊猫等濒危野生动物的保护研究和管理工作。先后主持完成国家、省及市级科研合作项目 20 项，成功组织和实施多项国际科技合作项目；获国家级科技成果奖 1 项、省部级科研成果奖 5 项、市级科技成果奖 10 项。在国内外核心期刊发表论文 38 篇。主持国家“863”项目、四川省科技条件基础平台建设项目、省杰出青年科技基金和基础研究项目多项，并负责组织和实施成都大熊猫繁育研究基地与美国、日本相关单位的国际大熊猫合作繁育研究和科研合作项目。



Professor Zhang Zhihe is the director of the Chengdu Research Base of Giant Panda Breeding and the deputy director of the Key Laboratory for Reproduction and Conservation Genetics of Endangered Wildlife of Sichuan Province. He is also the director of the Chinese Committee of Breeding Techniques for Giant Panda, vice president & secretary general of Chengdu Giant Panda Breeding Research Foundation, vice president of Sichuan Zoological Society, permanent council member of Chinese Association of Zoological Gardens (CAZG), and member of the Consultation Specialist Group for Giant Panda Conservation and Management of the State Forestry Administration, People's Republic of China. He has been recognized for his academic excellence and received the following honors: Chengdu Excellent Specialist Award for Prominent Contribution, Chengdu Top Ten Prominent Youth Award, National Top Ten Prominent Youth Nomination Award and Special Allowance Award from the State Council.

In his 17 years of conservation work with giant pandas and other endangered species, Dr. Zhang has designed and directed twenty research projects, and received several state, provincial and civic science and technology awards. He has also published 38 papers in both domestic and internationally recognized scientific journals. He presides over the state Key International Collaboration Project, provincial and civic basic research and platform construction program for endangered species, and the prominent youth science and technology foundation program. Dr. Zhang is also responsible for developing and leading the collaborative research efforts in giant panda breeding between Chengdu, the United States of American, and Japan.

## 作者简介 (二)

### *Introduction to Primary Authors*

**魏辅文**博士，中国科学院动物研究所研究员、博士生导师、所长助理、动物生态与保护生物研究中心主任；中华人民共和国濒危物种科学委员会委员，中国动物学会秘书长，中国动物学会兽类学分会副理事长，中国生态学会动物生态专业委员会副主任委员，《动物学报》、《兽类学报》和《动物学杂志》编委，国家林业局大熊猫保护管理工作咨询专家组成员。2001 年获国家杰出青年科学基金，2004 年入选人事部新世纪百千万人才工程国家级人选，享受国务院颁发的政府特殊津贴。



主要从事我国珍稀濒危动物如大熊猫、小熊猫和灵长类动物生态学及保护遗传学研究。1984 年至今，先后在邛崃山、岷山、凉山、相岭和秦岭山系开展大熊猫等濒危物种保护生物学研究。主持完成国家杰出青年基金、国家自然科学基金重点和面上项目、重大国际合作项目、中国科学院知识创新重要方向性项目及横向合作项目，先后赴美国、英国、澳大利亚、法国、西班牙、日本等国从事合作研究。发表论文 140 余篇，其中 SCI 收录刊物论文 30 多篇。

Dr. Wei Fuwen is professor of ecology and conservation biology at Institute of Zoology (IOZ), the Chinese Academy of Sciences (CAS). He is also the assistant director of IOZ, and director of Center for Animal Ecology and Conservation Biology of the institute. Dr. Wei has been engaged in research of endangered Chinese species such as the giant panda, the red panda and primates for more than 20 years. Since 1984, he has been conducting ecological studies on the giant panda in the Minshan, Qionglaihan, Liangshan, Xiangling and Qinling mountain ranges, and has published over 140 scientific papers in English or Chinese. He has been the principal investigator of more than 20 national and international projects for the giant panda, the red panda and primates, and has conducted several international collaborations in USA, UK, Australia, France, Spain, and Japan. Dr. Wei has received several academic rewards from national and provincial levels, especially the National Science Fund for Distinguished Young Scholars by National Natural Science Foundation of China in year 2001, National Allowance Award by State Council of People's Republic of China in 2002. He is the general secretary of China Zoological Society, vice president of Mammalogical Society of China, member of Endangered Species Scientific Commission, People's Republic of China, and member of Giant Panda Conservation and Management Specialist Group of State Forestry Administration, People's Republic of China.

大熊猫之于中华，谓之“国宝”。秉烛饱览浩瀚书卷，乃知其历史至少可追溯至800万年前之中新世晚期，于更新世时历经了从小种大熊猫至大熊猫巴氏亚种等的演化，到全新世时已出现了今日之大熊猫。更新世时期的大熊猫曾盛极一时，分布范围广及我国长江、珠江和黄河三大流域，亦曾一度扩展至东南亚的泰国、缅甸和老挝等地；现今，仅在我国的化石出土地点已达数百个之多，乃我国更新世中晚期华南地区“大熊猫-剑齿象动物群”典型代表。然天灾人祸，劫数难逃——地质与气候的变迁、人类的兴起、天敌、疾病等，令其家园渐被压缩、分割和破碎化，目前仅鲜藏于青藏高原向东过渡的六块长条形的高山峡谷地带中，成为中国特有之珍稀兽类。

洋洋文献多有大熊猫相关之记载，仅古籍名即达几十个，诸如“貔”、“貘”和“食铁兽”等；而文字描述亦不罕见，如“十万貔貅十万兵”（《三国演义》）、“寝之可避瘟疫”（《本草纲目》），可见其早被融入炎黄子孙之传统文化中。然而，其近现代研究历史应肇始于1869年，时法国神甫戴维于四川省宝兴县穆坪镇发现，由此引发世界范围内的首次大熊猫热潮。随之其渐出国门，走向世界。至1961年世界自然基金会（WWF）成立时，大熊猫更被确定为其会旗和会徽，成为一切濒危动物保护之象征。

华夏子孙早在1946年即已认识其生存之虞。时出版之《大公报》曾报“因过度猎杀，熊猫势有绝种之虞”。新中国成立之初，政府亦颁布诸多法令，如《稀有动物保护办法》、《积极保护并合理利用野生动物资源的通令》、《中华人民共和国野生动物保护法》和《国家重点野生动物保护名录》等以加强保护。随之因时就势、举财举力，兴自然保护区之建设，至2005年已达50多处、230万公顷之巨，为大多数野生个体提供了生存保障。同时，又自1980年开始与WWF合作研究大熊猫，并随之也与其他国际组织或机构合作开展了众多保护研究项目。诸多努力，成效甚显。第三次全国范围内大熊猫资源调查数据表明，历经20世纪80年代其种群数量一定程度之下降后，目前野生种群正呈现“稳中有升”态势，实可喜可庆。

作为“旗舰”物种之代表，保护大熊猫意义实已远超过该物种自身。在保护之相关举措上，就地和迁地保护实皆必要，前乃保护之基础，后乃必要之补充，相辅相成，缺一不可。

迁地饲养繁育为该物种迁地保护之重要内容。众多迁地饲养繁殖机构中，成都大熊猫繁育研究基地（含成都动物园）、卧龙中国保护大熊猫研究中心和北京动物园等占突出地位。其中尤以成都大熊猫繁育研究基地（含成都动物园）之饲养繁育历史最为悠久；自其于1980年世界上首次采用冷冻精液繁殖成功大熊猫以来，在原仅6只大熊猫个体基础上，到2004年，共计繁殖大熊猫67胎95仔，成活半岁以上的达66只，为解决所谓“配种难、受孕难、幼仔成活难”等问题奠定了重要基础，做出了重大贡献。更可喜的是，该基地在人工饲养条件下出生的第三代大熊猫已顺利繁育存活并产仔。这些保护机构之努力与成就，无疑谱写了一段濒危物种“枯木逢春”之佳话。

张志和与魏辅文两位研究员多年皆从事大熊猫圈养繁育与保护生物学研究，乃我



国这一研究事业中之青年一代杰出代表。由他们和多名学者合作编著之此书在参研众多濒危动物保护最新理论和研究成果的基础上，兼顾“理论性和实用性”的特点，涉猎大熊猫相关之系统演化、分布与现状、圈养种群饲养繁殖、行为、疾病防治及保护遗传学等众多方面，较全面反映了有关研究（尤其迁地保护上）之新成果和最新进展。故其出版于相关研究及具体保护管理无疑具重要参考价值。同时，他们又在评估圈养大熊猫饲养繁殖状况基础上，系统论及濒危物种放归的理论及经验教训，并针对性地提出了“大熊猫放归指南”，相信其于大熊猫放归工程亦不失为重要参考。

作为引玉之砖，厚望其出版能继续推动大熊猫研究和保护事业不断取得新进展。

吾等深信，大熊猫保护事业定有光明之未来。

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2006年1月

## Foreward

For China, the giant panda is a national treasure. After immersing myself in a vast ocean of books, I began to realize that the natural history of the giant panda could be traced back eight million years to the late Miocene period. In the Pleistocene period, *Ailuropoda microta* evolved into *Ailuropoda melanoleuca baconi*. During the Holocene period, the latter evolved into *Ailuropoda melanoleuca*, the modern giant panda. The giant panda was once prosperous in the Pleistocene period with a distribution that covered the three large river basins of the Yangtze River, Zhujiang River, and Yellow River. Their population also once spread to Southeast Asia, including Thailand, Burma, Laos, and other places. Currently, they are found only in China, hundreds of fossil excavation sites have been discovered in China (i. e., the prototypical *Ailuropoda-Stegodon Fauna* of Southern China from the later Pleistocene period).

In the face of natural calamities and man-made misfortunes, there is no escape for the giant panda from fate. With geologic and climatic changes, as well as a rise in human populations, the giant panda's habitat has been gradually reduced and fragmented. At present, their distribution is only in six mountain ranges where the Qinghai-Xizang Plateau extends eastward. As a result, the giant panda has become the most treasured indigenous Chinese mammal.

Numerous historical documents make reference to the giant panda. Likewise, there are just as many names for the giant panda in ancient books. For example, "Pi", "Mo", and "Iron-eater" to name a few. Moreover, the literal descriptions are also varied. For example, "Ten thousands of Pi Xiu (giant pandas) are like ten thousands of soldiers" from *The Story of Three Kingdoms* and "Sleeping on its fur may protect against pestilence" from *Compendium of Materia Medica*. It is obvious that the giant panda has been a part of Chinese traditional culture for a long time. However, modern research on the giant panda was initiated in 1869 when Armand Père David, a French priest, found the first giant panda in Muping town, Baoxing county, Sichuan province. This began the world's fascination with the giant panda. Since then, the giant panda has emerged from China as a worldwide ambassador. When the World Wildlife Fund (WWF) was founded in 1961, the giant panda was chosen as its logo. The giant panda has since become the universal symbol of wildlife protection.

Early in 1946, the Chinese people realized that the survival of the giant panda was being critically threatened. During this time, the published newspaper *Kakungpao* reported that "the giant panda may become extinct" due to over-hunting. During the initial establishment period of the People's Republic of China, the government reinforced giant panda protection by issuing a number of legislative acts, such as *The Protection Methods for Rare Animals*, *The Circular Order for Active Protecting and Using Wild Animal Resources in Reason*, *The Protection Law Preface for Wild Animals of People's Republic of China*, *The Protection Directory for State Key Wild Animals*, and many others. The government tried its best to spend an appropriate amount of



money on labor to establish giant panda nature reserves. There are now more than fifty nature reserves for giant pandas. This provided a survival refuge for 60% ~70% of the wild population. Meanwhile, in cooperation with WWF, the Chinese government began to conduct giant panda ecological research in Wolong Nature Reserve in 1980. As a result, many conservation projects have been developed in cooperation with other international organizations. With these prodigious efforts, there have been significant results. The Third National Giant Panda Survey in China indicated that the giant panda population was stabilizing and increasing after a slight decrease in the 1980s. These results have been very encouraging and have been the cause for much celebration.

The giant panda has become a flagship species—the significance of its conservation goes far beyond protection efforts. Conservation should consist of both *in-situ* projects for the basis of conservation and *ex-situ* efforts for essential supplemental support. Both the strategies are complementary; one cannot exist without the other.

Captive breeding is an important part of *ex-situ* conservation strategies. Of the many institutions for captive breeding and reproduction, the Chengdu Research Base of Giant Panda Breeding (including the Chengdu Zoo), the Wolong China Research and Conservation Center for the Giant Panda and Beijing Zoo retain significant status. The Chengdu Research Base of Giant Panda Breeding (including the Chengdu Zoo) has had the longest captive husbandry and breeding history in China and was the first facility worldwide to succeed in giant panda reproduction using frozen semen in 1980. From its humble beginnings with six giant pandas, this research base has, by 2004, reproduced 67 litters with 95 individuals, with 66 individuals having survived past the half-year mark. This success has reduced the number of difficulties in mating, gestation, and neonatal survival, and has made a great contribution to the conservation of this species. It is very encouraging that a third generation of giant pandas has been bred and born in captivity and has thrived at the Base. The efforts and achievements of these conservation institutions have brought new life to an endangered species.

Two outstanding young research scientists, Zhang Zhihe and Wei Fuwen, have been engaged in research in the field of captive breeding and conservation biology of the giant panda for years. They, with other scholars, compiled this publication based on many of the latest theories and research results in endangered animal conservation. This book contains both the theory and practices of conservation relating to giant pandas and includes: phylogeny, distribution, status, breeding and reproduction of the captive population, behavior, disease control, and conservation genetics. It highlights the new achievements and progress in giant panda research, especially in *ex-situ* conservation. Therefore, the publication of this volume is an important resource for related research and the development of conservation management strategies. Furthermore, I believe that the evaluation of breeding and reproduction of the giant panda in captivity, taken with the experiences and lessons of reintroduction biology discussed in this work, will be invaluable tools for the future creation of a proposed guide for giant panda reintroduction.

As this brick attracts jade, I expect greatly that this publication will continue to promote giant panda research and conservation while fostering new progress.

We sincerely believe that giant panda conservation has a bright future indeed.



Chen Yiyu

Academician, the Chinese Academy of Sciences  
President, National Natural Science Foundation of China  
President, China Zoological Society  
Jan., 2006

20 世纪飞速发展的工业经济给人类带来了高度发达的物质文明。令人啼笑皆非的是，我们挥舞了一把双刃剑，在千方百计追求到物质文明之后，却又迎来了人类进步本身带来的诸多灾难，如生态环境遭到巨大的破坏，生物多样性减少。有资料表明，目前每年有大量生物从地球上消失，大约四分之一的哺乳动物正处于濒临灭绝的危险，大熊猫就赫然名列其中。

20 世纪末期，是中国历史进程中一段极不平凡的岁月，古老的土地经受着“天翻地覆慨而慷”般的洗礼和激荡。国家改革开放、经济飞速发展、人民生活水平提高和生态意识转变，我们也逐渐对大熊猫——这个世界上现存的古老“活化石”的过去、现在和未来真正关切起来。

四川是大熊猫故乡，由于这种得天独厚的条件，成都对大熊猫的保护和研究起步比较早。自 1953 年起，成都动物园就开始饲养大熊猫，是解放后中国最先饲养大熊猫的单位。1987 年，在国家建设部、国家林业部（现国家林业局）和国家财政部的支持下，成都市人民政府（成都市园林管理局）在成都动物园的基础上，建立了成都大熊猫繁育研究基地。多年来，在各级政府的领导和支持下，在有关国际组织和国外研究机构的合作与协作下，成都大熊猫繁育研究基地与成都动物园、北京动物园和卧龙中国保护大熊猫研究中心等大熊猫圈养单位、自然保护区、大专院校和科研院所的科技和饲养管理人员通力合作，从生物学、生态学、饲养学、营养学、繁殖学、遗传学、兽医学、生理学、病理学、管理、营养需求与日粮配方、疾病防治、发情鉴定与妊娠诊断、遗传多样性与亲仔鉴定及组织病理等各个方面开展了大量不同层次并卓有成效的研究，特别是在圈养大熊猫繁育方面，突破了圈养大熊猫饲养、繁殖和疾病防治等方面的不少技术难关，积累了大量经验，使圈养大熊猫种群数量逐步趋于稳定增长。

我们在 20 世纪 80 年代先后从学校毕业并在不同的岗位开始了大熊猫保护研究工作。共同的兴趣和目标使我们常有机会互相学习和共同探讨野生及圈养大熊猫保护工作中的一些问题，并合作开展了相关研究。在合作过程中，我们深感有必要对现有大熊猫保护——特别是迁地保护方面的研究成果进行系统总结和分析，同时也需要引入近年来有关珍稀濒危动物保护的相关理论和方法，以方便从事大熊猫保护相关研究人员——特别是在保护研究第一线的科技和管理人员在具体工作中参阅。因此，我们便萌生编著这样一本书的想法，并得到了张安居、胡锦矗两位教授的支持。这两位长者都是著名的大熊猫研究专家，他们的道德风范、学问文章，像润物春雨，灌溉着我们，使我们受益至深。正是在他们不断的鼓励和支持下，四年前我们便着手开始了本书的编撰工作。

四年来，我们和同事们一道尽力收集了国内外有关大熊猫保护研究——特别是迁地保护研究方面的研究论文、专著等有关资料，以求尽可能全面、系统地反映大熊猫迁地保护方面的研究成果。同时还参阅了濒危动物保护方面的最新理论和进展，引入近年来诸如动物行为学、保护遗传学、繁殖生物学、兽医学和营养学等方面的新理论



与实用技术，并结合我们多年来对大熊猫保护研究工作的实践，提出了一些未来大熊猫迁地保护方面的研究方向与发展趋势，竭力使本书兼具理论性和实用性。

本书的完成，离不开长期以来国内外各方的支持。谨此，我们首先感谢长期以来为大熊猫保护和研究而辛勤耕耘和无私奉献的人们，正是他们的经验和成果才使此书能得以告竣。衷心感谢成都市人民政府、国家建设部（中国动物园协会）、国家林业局（中国野生动物保护协会）、国家科技部、国家环境保护总局、四川省林业厅、四川省科技厅、成都市科学技术局和成都市建设委员会等多年来对大熊猫（迁地）保护工作——特别是成都大熊猫繁育研究基地工作的支持、领导和部署。特别感谢赵学敏先生、胡懋洲先生、黄寅逵先生、李春城先生、葛红林先生、王少雄先生、郝康理先生、何华章先生、舒銮逸女士、白心和先生、杨国安先生、邓全忠先生、孙平先生、杨冬生先生、艾毓辉先生、邓工力先生、郑淑玲女士、李东序先生、卓榕生先生、柳尚华先生、严旬先生、王伟先生、赵庆国先生、谭建明先生、范志勇先生、刘德望先生、张陕宁先生、王维胜先生、吕小平先生、阮向东先生、李如生先生、谢钟女士、张德辉先生、邓祥绪先生、唐代旭先生、李建国先生及王鸿加先生等领导的鼓励和支持；感谢赵尔宓院士、朱睦元教授、冯文和教授、李光汉研究员、何光昕研究员、冯祚建研究员等专家长期以来的教诲和指导；感谢陈宜瑜院士百忙之中为本书作序，对我们的工作进行了充分的肯定和热情勉励。

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成都大熊猫繁育研究基金会、美国奥克兰市市政府、美国加州奥克兰（东湾）动物园协会和美国加州奥克兰中国野生动物保护基金会、美国奥克兰大熊猫基金会、美国动物园与水族馆协会大熊猫基金会以及台湾中华两岸大熊猫保育交流协会同时为本书的写作和出版提供了多方面帮助，我们谨致诚谢。

在本书编著过程中, Dr. Copper Aitken-Palmer, Dr. Maria Crane, Dr. Rita McManamon, Dr. Kati Loeffler, Dr. Rebecca Spindler, Dr. Rebecca Snyder, Ms. Jaye Allan, Ms. Denise O'Toole, Ms. Sarah Wakamiya, Ms. Rebecca Wilson, Ms. Emily Huei King, Ms. Sarah M. Bexell 和潘璇女士在英文审校, 李健先生在图片绘制, 廖明娟博士、牛李丽女士、王强先生和费立松先生在资料提供, 周育才教授和杨菲菲女士在前言和序的校审等方面提供了大力帮助, 在此一并致谢。

在本书中, 我们以综述性方式全面涉猎, 重点部分着墨细描, 力求内容、格式、体例与风格等有所突破, 再生新意。但因所涉学科较多, 难求著者风格完一, 加之受眼界所囿、学识所限, 书中定有诸多挂一漏万、偏颇错失之处, 甚望读者批评指教。诚愿我们这抛砖引玉之作, 能引来各方英杰的风云之会, 大家共同努力, 国宝大熊猫定有光明之未来。



张志和 魏辅文

2006年1月

## Preface

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The industrial economy, which developed by leaps and bounds during the twentieth century, brought highly developed prosperity and progress. However, advancements can often be a double-edged sword. After the rise of the industrial economy, the world has faced many dilemmas related to human expansion, such as heavily destroyed ecological environments and decreases in biodiversity. Some data indicate that many species on the Earth disappear each year, and that a quarter of mammalian species are endangered. Unfortunately, the giant panda is one of them.

The end of the twentieth century was a period unlike any other in Chinese history. During this time, an ancient kingdom was experiencing great changes. In addition to the nation's reformation and the opening of its doors to the world, the rapid development of the economy and the improvement of the people's living conditions caused a change in ecological consciousness. As a result, humans sincerely care more and more about the past, present, and future of the giant panda, a living fossil.

Because Sichuan is the home to the giant panda, Chengdu, the capital city of Sichuan, has been a pioneer in its research and conservation. In 1953, the Chengdu Zoo became the first unit for giant panda breeding in China after the New China was established. In 1987, under the support of the Ministry of Construction, the State Forestry Administration (formerly the Ministry of Forestry) and the Ministry of Finance, Chengdu City Government (Chengdu Garden & Landscape Administration) established the Chengdu Research Base of Giant Panda Breeding on the foundation of the work from the Chengdu Zoo. For many years, under the leadership and support from all levels of government branches, and in cooperation with related international organizations and research institutions abroad, the Chengdu Research Base of Giant Panda Breeding has worked by a collaborative effort for the research of giant pandas. Personnel for the giant panda research and breeding management were from related enclosed breeding units, such as the Wolong China Research and Conservation Center for the Giant Panda, Chengdu Zoo, Beijing Zoo, nature reserves, colleges, universities, and scientific institutes. By utilizing multiple subjects such as biology, ecology, nutrition, reproductive science, genetics, veterinary science, physiology, pathology, genetic endocrinology, a multi-faceted approach to research on the giant panda has been carried out. The following research areas have been explored: biological peculiarities, reproductive biology, breeding management measures, nutritional requirements and daily food recipes, disease control, estrus authentication and gestation diagnoses, genetic diversity, paternity identification, and tissue pathology. The results of our research have been abundant, especially in the area of captive giant panda reproduction. Our findings have reduced the difficulties in such areas as postnatal care, reproduction, and disease control. These advances have resulted in a steady increase in the captive population of giant pandas.

We graduated from different universities in Sichuan province and became involved with giant panda conservation and research in the 1980s. Brought together by common interest and goals, we discussed some problems we had encountered with the conservation of wild and captive giant pandas. As a result, we have combined our efforts in collaborative research. During



this time, we realized that a systematic summary and analysis of giant panda research was greatly needed, especially in the area of *ex-situ* conservation while incorporating the latest theories and methods on rare and endangered animal conservation. This publication will be a convenient reference for giant panda researchers and technical and management personnel in the front lines of conservation and research.

From its conception, our concept for this publication has been supported by Prof. Zhang Anju and Prof. Hu Jinchu, two senior giant panda experts. Their noble characters and profound knowledge have inspired us. We have enjoyed the great benefit of working with them. With their encouragement and support, we began writing this book four years ago.

In four years, together with our colleagues, we have compiled references related to giant panda conservation, especially to *ex-situ* conservation. The literature collected should completely and systematically reflect the research results in the giant panda *ex-situ* conservation. Meanwhile, we have consulted the most current theories and results in the conservation for endangered animals and introduced new theories and practical technologies in the fields of animal behavior, conservation genetics, reproductive biology, veterinary science and nutrition, all in an effort to go in innovative directions and develop new trends for giant panda *ex-situ* conservation in the future.

The accomplishment of this book was dependent on support from different internal and external quarters. For this, first we thank the people who worked hard and contributed unselfishly to the conservation of and research on the giant panda. Their experience and achievements helped immeasurably in the writing of this book. We wholeheartedly thank: the Chengdu Municipal Government, Ministry of Construction (The Chinese Association of Zoological Gardens), China State Forestry Administration (China Wildlife Conservation Association), Ministry of Science & Technology, State Environmental Protection Administration of China, Sichuan Forestry Bureau, the Sichuan Bureau of Science and Technology, and others for their leadership and support in the work for giant panda *ex-situ* conservation.

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During the compilation of this book, major efforts were devoted by Dr. Copper Aitken-Palmer, Dr. Maria Crane, Dr. Rita McManamon, Dr. Kati Loeffler, Dr. Rebecca Spindler, Dr. Rebecca Snyder, Ms. Jaye Allan, Ms. Denise O'Toole, Ms. Sarah Wakamiya, Ms. Rebecca Wilson, Ms. Emily Huei King, Ms. Sarah M. Berell and Ms. Pan Xuan with examination and correction of English translation, Mr. Li Jian with the drawing of illustrations and maps, Dr. Liao Mingjuan, Ms. Niu Lili, Mr. Wang Qiang, and Mr. Fei Lisong with additional literature resources, Prof. Zhou Yucai and Ms. Yang Feifei with proofreading of the manuscript. Many thanks are given to them here.

This book not only summarizes comprehensive disciplines, but also emphasizes the important parts. We tried to be innovative and original in content, format, and style. However, there were so many disciplines involved, it was hard to keep all writing styles consistent. Because our field of vision may have been limited, this book may be far from complete and may exist with some bias and mistakes. Therefore, we sincerely welcome your input. It is our hope that this volume will continue to inspire researchers in different fields to work diligently together for the bright future of the giant panda.



Zhang Zhihe, Wei Fuwen

Jan., 2006

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