

鼎湖山南亚热带森林

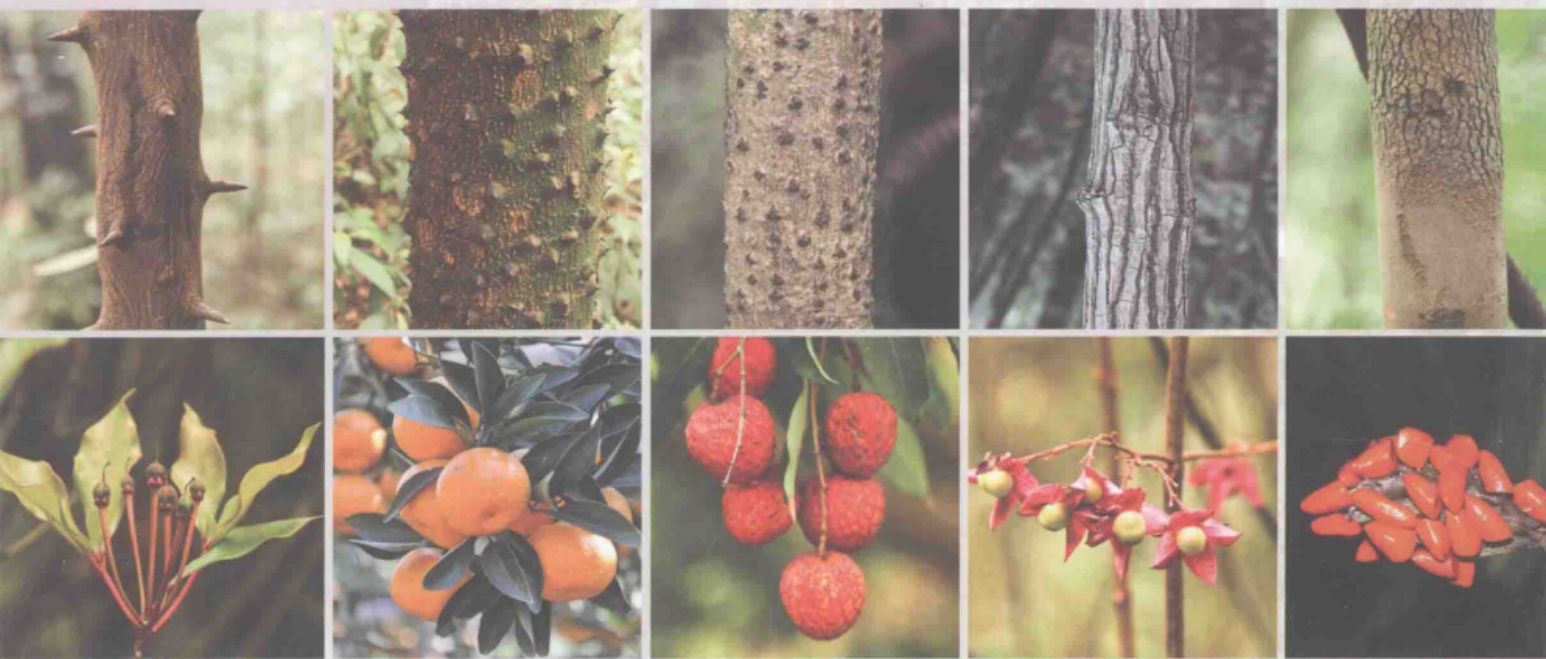
——树种及其分布格局

Dinghushan Lower Subtropical Forest Dynamics Plot:
Tree Species and Their Distribution Patterns



曹洪麟 吴林芳 王志高 黄忠良 李 林 魏识广 练琚愉 叶万辉 著

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内容简介

本书介绍了广东省鼎湖山南亚热带常绿阔叶林常见木本植物195种, 每种植物除了文字描述外, 还配有精美的照片, 展示植物的植株、花序、果实或幼苗等, 方便识别。同时附有每种木本植物在20hm²长期定位研究样地种群分布图以及种群的个体数量和径级结构。对于该样地的地形、土壤、植被等皆有介绍。本书以资料翔实、图片精美为特点, 是南亚热带常绿阔叶林研究不可多得的参考书, 也可以作为植物爱好者了解南亚热带森林、认识森林植物的野外指导手册。

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序言 1

在过去的几十年时间里,中国科学院和林业、农业等相关部门陆续建立了数百个生态系统定位研究站。其中,中国科学院组建的中国生态系统研究网络(CERN)拥有分布于全国包括农田、森林、草地、湿地、荒漠等生态系统类型的36个生态站。国家林业局建立的中国森林生态系统研究网络(CFERN)由29个生态站组成,基本覆盖了我国典型的地带性森林生态系统类型和最主要的次生林、人工林类型。

随着研究的发展,特别是近年来人们对生物多样性和全球变化研究的关注,国际上正在推动生态系统综合研究网络平台的建立。在全球水平上,全球生物多样性综合观测网络(GEO-BON)是一个有代表性的研究网络。它试图把全球与生态系统和生物多样性长期定位研究相关的网络整合起来,通过综合研究,探讨生态系统与生物多样性维持与变化机制以及系统之间的相互作用机理,为生态系统可持续管理与生物多样性的保护提供科学依据和管理模式。

近年来,中国科学院生物多样性委员会组织建立了中国森林生物多样性监测网络(Chinese Forest Biodiversity Monitoring Network,以下简称CForBio)。中国是生物多样性特别丰富的少数国家之一,也是唯一一个具有从北部寒温带南部热带完整气候带谱的国家。CForBio对于揭示中国森林生物多样性形成和维持机制,以及森林生物多样性对全球变化的响应,科学利用和有效保护中国森林生物多样性资源具有重要意义。

截止到2012年,中国森林生物多样性监测网络包括大型监测样地12个。12个建成样地具体如下:黑龙江小兴安岭丰林阔叶红松林30hm²样地、黑龙江小兴安岭凉水典型阔叶红松林9hm²样地和谷底云冷杉林9hm²样地、吉林长白山阔叶红松林25hm²样地、北京东灵山暖温带落叶阔叶林20hm²样地、河南宝天曼暖温带落叶阔叶林25hm²样地、湖南八大公山中亚热带山地常绿落叶阔叶混交林25hm²样地、浙江天童亚热带常绿阔叶林20hm²样地、浙江古田山亚热带常绿阔叶林24hm²样地、广东鼎湖山南亚热带常绿阔叶林20hm²样地、广西弄岗喀斯特季节性雨林15hm²样地、云南西双版纳热带雨林20hm²样地。目前,正在与黑龙江省科学院自然与生态研究所合作建立中国寒温带大兴安岭兴安落叶松林25hm²样地,并与中科院武汉植物园达成协议,拟在2013年建立温带-亚热带过渡区秦岭落叶阔叶林25hm²样地。此外,还有若干5hm²的样地,如吉林长白山白桦林、北京东灵山辽东栎林、浙江百山祖常绿阔叶林和四川都江堰常绿落叶阔叶混交林样地。CForBio是继美国史密森研究院热带研究所建立的热带森林生物多样性监测网络(CTFS)之后又一大型区域生物多样性监测网络。由于CForBio横跨多个纬度梯度,对揭示生物多样性科学的基本规律有特殊意义,在国际生物多样性监测网络中具有重要地位。

目前,CForBio已经有很好的研究进展,各样地研究成果陆续在国际著名生态学刊物如*Ecology*, *Journal of Ecology*, *Oikos*等上发表,受到国内外同行的高度评价。但这些文章都是关于某一具体问题的研究总结,还无法让国内外同行全面了解CForBio各个样地整体情况。因此,出版这套以中英文形式介绍各大样地基本情况的“中国森林生物多样性监测网络”丛书是非常必要的。感谢马克平研究员组织相关专家编写这套丛书。我相信该丛书不仅是国内外同行深入了解CForBio各样地的参考书,同时也将为我我国森林生物多样性监测和森林生态系统联网研究奠定重要的基础。



Foreword 1

In the past few decades, hundreds of Ecosystem Research Stations have been set up by the Chinese Academy of Sciences, State Forestry Administration, Ministry of Agriculture and other relative departments. Among them, 36 ecological research stations were established by Chinese Ecosystem Research Network (CERN), supported by the Chinese Academy of Sciences. The 36 research stations are scattered over the country representing diverse ecosystems, including farmland, forest, grassland, wetland, desert and others. Moreover, the Chinese National Ecological Research Network (CFERN), supported by the State Forestry Administration, consists of 29 research stations, covering typical zonal forest ecosystems and main secondary forests and plantations in China.

With the development of research, especially the growing concern over researches on biodiversity and global change in recent years, the establishment of ecosystem research network have been promoted under international supports. So the Group on Earth Observations Biodiversity Observation Network (GEO-BON) is representative across the world, and it attempts to integrate worldwide networks relating to long-term research on ecosystem and biodiversity. Based on the comprehensive studies, the maintenance and change mechanism of ecosystem and biodiversity and their interactions have been explored, which provide scientific basis and management mode for sustainable development of ecosystem and protection of biodiversity.

In recent years, Chinese Forest Biodiversity Monitoring Network (CForBio) has been built by Biodiversity Committee of the Chinese Academy of Sciences. China is one of the few top “mega-biodiversity countries” in the world, and it is also the only country with full climatic zone spectrum, ranging from northern cool temperate zone to southern tropical zone. Besides, CForBio is of great significance to reveal the formation and maintenance mechanism of forest biodiversity in China and their response to climate change.

Twelve permanent plots with area more than 9 hm² have been set up by CForBio till 2012. The 12 permanent plots are as follows: 30 hm² mixed broadleaved Korean pine forest plot at Fenglin in Xiaoxing'an Mountains in Heilongjiang; 9 hm² mixed broadleaved-Korean pine forest plot and 9 hm² Spruce-fir valley forest plot at Liangshui in Xiaoxing'an Mountains in Heilongjiang; 25 hm² deciduous broadleaved Korean pine forest plot at Changbai Mountain in Jilin; 20 hm² deciduous broadleaved forest plot at Dongling Mountain in Beijing; 25 hm² deciduous broadleaved forest plot at Baotianman in Henan; 25 hm² mid-subtropical mountain evergreen and deciduous broadleaved mixed forest plot at Badagong Mountain in Hunan; 20 hm² subtropical evergreen broadleaved forest plot at Tiantong Mountain in Zhejiang; 24 hm² subtropical evergreen broadleaved forest plot at Gutian Mountain in Zhejiang; 20 hm² lower subtropical evergreen broadleaved forest plot at Dinghu Mountain in Guangdong; 15 hm² karst seasonal rain forest plot at Longgang in Guangxi; 20 hm² tropical rain forest plot at Xishuangbanna in Yunnan. A 25 hm² dahurian larch forest plot in Daxinganling in Heilongjiang is now under construction in the collaboration with Institute of Natural Resources, Heilongjiang Academy of Sciences. Wuhan Botanical Garden, CAS, is going to establish a 25 hm² deciduous broadleaved forest plot in Qinling Mountain in Shannxi. Besides, a number of 5 hm² plots have also been built, including birch forest plot in Changbaishan, Jiling province, oak forest plot in Donglinshan, Beijing, evergreen broadleaved forest plot in Baishanzu, Zhejiang province and evergreen and deciduous broadleaved mixed forest plot in Dujiangyan, Sichuan province. Now, CForBio is another regional biodiversity monitoring network after the Center for Tropical Forest Science (CTFS). As being across several latitudinal gradients, CForBio is not only important to examining the fundamental mechanism of biodiversity maintenance, but also plays an important role in Global Biodiversity Monitoring Network.

Encouraging progress has been made in this area since the network built, for lots of research findings have been published in the international peer reviewed ecological journals, such as *Ecology*, *Journal of Ecology* and *Oikos*, etc., which brought about positive response from colleagues in the field of plant ecology. However, the published papers mostly focus on research of specific problems; scientists and public still can't understand the whole situation

of each plot in details. So it is really necessary to publish this series, which introduce basic information of permanent forest plots in both Chinese and English. I am grateful to Professor Keping Ma for organizing related specialists to prepare the series. And I believe that this series would be a valuable reference book for scientists and public to further understand CForBio, and it will also lay a foundation for the forest biodiversity monitoring and forest ecosystem research in China.

Honglie Sun

The former Vice-President for the Chinese Academy of Sciences

序 言 2

森林在维持世界气候与水文循环中起着根本性的作用。森林是极为丰富多样的动物、植物与微生物的家园，而人类正是依靠这些生物获取各种产品，包括食品与药物。尽管对人类福祉如此重要，森林仍然遭受着来自土地利用与全球气候环境变化的巨大威胁。在这种不断变化的情况下，为了更好地管理全球剩余的森林，迫切需要树种在生长、死亡与更新方面的详细信息。

中国森林生物多样性监测网络（CForBio）正在中国沿着纬度与环境梯度建立大尺度森林监测样地。通过这个重要的全国行动倡议与来自中国科学院及若干其他单位的研究者的努力，CForBio开始搜集关于中国森林的结构与动态的关键信息。现在CForBio与史密森研究院及哈佛大学阿诺德树木园的热带森林监测网络（CTFS）形成了合作伙伴。CTFS是个在21个热带或温带国家拥有长期大尺度森林动态研究样地的全球性网络。CForBio与CTFS合作的目标是通过合作研究，了解森林是如何运作的，它们是如何随着时间而改变的，以及如何重建或者恢复，以确保森林提供的环境服务能可持续或者增长。森林及其提供的服务的长期可持续性有赖于我们预测森林对全球变化，包括气候与土地利用变化的响应的能力，以及我们去理解与创建适当的森林服务市场的能力。通过拥有34个森林大样地的全球网络及大量项目的训练与能力建设，CForBio与CTFS的伙伴关系是发展这些预测工具的重要基础。这种伙伴关系也将促进为全球各地的当地社区、林业管理者与政策制定者在森林的保育与管理方面发展应用性的林业项目建议，发展与示范利用乡土物种进行森林重建的方法，以及从经济学角度评估森林在减缓气候变化、生物多样性保护和流域保护上的价值的方法。

我祝贺作者们创作了这部关于样地植物的优秀丛书。本丛书为将来的森林监测提供了基准信息，是涉及森林恢复、碳存储、动植物关系、遗传多样性、气候变化、局地与区域保育等研究内容的研究者、学生与森林管理者们有价值的参考资料。

S. J. 戴维斯

主任

史密森热带研究所&哈佛大学阿诺德
树木园热带森林科学研究中心

Foreword 2

Forests play an essential role in regulating of world's climatic and hydrological cycles. They are home to a vast array of animal, plant and microorganism species on which humans depend for many products, including food and medicines. Despite the importance of forests to human welfare they are under enormous threat from changes in land-use and global climatic conditions. In order to better manage the world's remaining forests under these changing conditions detailed information on the dynamics of growth, mortality and recruitment of tree species is urgently needed.

The Chinese Forest Biodiversity Monitoring Network (CForBio) that aims to establish large-scale forest monitoring plots across latitudinal and environmental gradients in China. Through this important national initiative, researchers from the Chinese Academy of Sciences and several other research institutions in China, CForBio has begun to gather key information on the structure and dynamics of China's forests. The CForBio initiative is now partnering with the Center for Tropical Forest Science (CTFS) of the Smithsonian Research Institute and the Arnold Arboretum of Harvard University. CTFS is a global program of long-term large-scale forest dynamics plots in 21 tropical and temperate countries. The goal of the partnership between CForBio and CTFS is to work together to understand how forests work, how they are changing over time, and how they can be re-created or restored to ensure that the environmental services provided by forests are sustained or increased. The long-term sustainability of forests and the services they provide depend on our ability to predict forest responses to global changes, including changes in climate and land-use, and our ability to understand and create appropriate markets for forest services. The CForBio-CTFS partnership is ideally poised to develop these predictive tools through a global network of 34 large forest plots and an extensive program of training and capacity building. The partnership will also lead to the development of applied forestry programs that advise local communities, forest managers and policy makers around the world on conservation and management of forests, to develop and demonstrate methods of native species reforestation, and to economically value the roles that forests play in climate mitigation, biodiversity conservation, and watershed protection.

I congratulate the authors on the production of this excellent new series of stand books. In addition to providing a baseline for future forest monitoring, these books provide a valuable resource for researchers, students, and forest managers dealing with issues of forest restoration, carbon storage, plant-animal interactions, genetic diversity, climate change, and local and regional conservation issues.



Director

Center for Tropical Forest Science / SIGEO

The Smithsonian Tropical Research Institute &

The Arnold Arboretum of Harvard University

前言

常绿阔叶林是指在亚热带湿润季风气候条件下,由常绿阔叶树组成的森林植被。分布于地球表面热带以北或以南中纬度亚热带区域,在北半球其分布位置大致在北纬 $22^{\circ}\sim 34^{\circ}$ (40°)。在欧亚大陆东南部,常绿阔叶林主要分布于中国的长江流域至珠江流域一带;朝鲜半岛、日本列岛南部也有分布。此外,非洲的东南沿海和西北部大西洋中的加那利与马德拉群岛;北美洲的东南端和墨西哥;南美洲的智利、阿根廷、玻利维亚及巴西的一部分;大洋洲东岸以及新西兰的北岛等地均有常绿阔叶林分布,其中,以中国长江流域至珠江流域的常绿阔叶林区最为典型,面积也最大。

常绿阔叶林以其富饶的生物资源、丰富的物种多样性和巨大的环境效益,引起世人越来越多的关注,对它的研究已成为国际植被科学界关注的主题之一。我国对常绿阔叶林的研究,可追溯到20世纪30年代胡先骕、钱崇澍、樊庆笙等对我国南方植被的描述,但在1949年以前只有一些零星的相关论文发表。具有一定规模的研究始于20世纪50年代,当时的研究大都结合热带、亚热带生物资源考察,如1952~1955年华南垦殖勘察,1958~1961年华南热带生物资源综合考察,1957~1961年云南热带、亚热带生物资源综合考察,以及一些省区组织的野生生物资源考察(如福建省1957年的考察)等。这些调查研究积累了很多有关常绿阔叶林群落的组成结构和类型分布的丰富资料,并陆续出版了《中国植被》和各省植被专著,但此时的常绿阔叶林研究仍处于以定性调查为主的阶段。

随着一批有关数量生态学和种群生态学等著作的引入和翻译,近三十年来我国在常绿阔叶林方面做了不少定量研究工作,对常绿阔叶林的物种组成、空间结构、分布特征和生态系统功能等开展了一定的研究,积累了相当丰富的资料和经验。但是这些数据仅局限于少数几个定位研究站(如广东的鼎湖山、重庆的缙云山、浙江的天童山等),是在小面积样地(一般小于 1hm^2)和短时间监测等基础上获得的,难以涵盖众多的稀少物种和不同的生态环境,较难反映群落内不同尺度上的生物多样性格局和过程,不足以认识群落水平上生物多样性的维持机制。因此,有必要在我国广大的常绿阔叶林地区的不同地带,建立相应的大面积长期监测样地,对常绿阔叶林从植物开花与结实、种子形成与扩散、幼苗更新与定居、种群建立与维持、个体生长与死亡的整个过程进行监测研究,分析影响这些过程的各种生物和非生物因素,探讨常绿阔叶林生物多样性形成与维持的机制。

中国科学院鼎湖山国家级自然保护区建立于1956年,是我国最早建立的自然保护区,保存有400多年历史的地带性森林群落,是开展南亚热带常绿阔叶林生物多样性形成与维持机制研究的理想场所。2004~2005年,在中国科学院生物多样性委员会的支持下,我们参照CTFS (Centre for Tropical Forest Science) 样地建设标准,在鼎湖山庆云寺后山至三宝峰之间保存最好的南亚热带常绿阔叶林内,建立了 20hm^2 的永久监测样地,以期对南亚热带常绿阔叶林生物多样性进行长期监测与研究。按照5年复查一次的要求,我们于2010年完成了对大样地的第一次复查,并在大样地周边地区建立了5个不同群落类型 1hm^2 的附属样地,附属样地的建设标准与大样地相同。同时根据复查结果对2005年的调查数据进行了修正。

本书详尽描述了修正后的鼎湖山 20hm^2 大样地(DHS大样地)树种的分布格局、径级结构和生物学特性,容易混淆树种的野外识别特征等,为今后的深入研究提供了必需的基本信息。而精美的样地植物照片将对读者认知鼎湖山森林和植物提供更加感性的材料,以期吸引更多的年轻学子加入森林生态学的探索行列。

在地形复杂的鼎湖山建设 20hm^2 大样地,是一个前所未有的挑战。在样地建设及后来的科研活动过程中,得到了方方面面的大力支持与帮助。借此机会,对这些单位和同事为鼎湖山样地建设及研究作出的贡献表示诚挚的感谢:加拿大Alberta大学何芳良教授、东华大学孙义方教授、中国科学院植物研究

所马克平研究员，不仅在建设样地过程中提出宝贵意见，并且在样地选址、调查工作中亲临现场给予指导；美国热带森林研究中心（CTFS）生态学家Richard Condit教授在数据整理上给予重要的指导和帮助；武汉江韵勘测工程集团有限公司精确与辛勤地完成了样地的测点工作；中国科学院华南植物园的黄忠良研究员、陈炳辉高工、练琚愉副研究员、黄玉佳、莫定升、孟泽、张佑昌、吴林芳、叶育石、陈银洁、蔡文波、方晓明、向传银，华南师范大学林正媚博士，浙江古田山自然保护区的方腾，中国科学院华南植物园研究生：王志高、史军辉、张池、李林、魏识广、沈浩、李静、穆宏平、韩玉洁、林国俊、刘文平、廖凌娟、李小意、马磊、沈勇、许淑君、李博文、王兰英、牛红玉、王冉、董蕾；华南师范大学、华南农业大学与广州中医药大学本科生：施悦谋、陈达丰、谢腾芳、黄婷、陈裕喜、李胜强、陈水莲、温远香、郭阿琴、庞冯连、杨国强、梁国晖、刘肇基、古敬锋、何淑兰、李新达等，在样地建设、植物调查与复查、数据录入等方面付出了许多艰辛的劳动；吴林芳、叶育石、林正媚、董安强等为本书提供了许多精美的照片；中国科学院华南植物园叶华谷研究员为本书编写提出了许多宝贵的意见。

本书收录了鼎湖山大样地木本植物195种（含变种），隶属于55科111属。本书裸子植物按郑万钧1975年系统、被子植物按哈钦松系统排列。植物的生物学特性描述主要参考《中国植物志》和*Flora of China*。

由于时间仓促，水平有限，错误疏漏在所难免，敬请各位读者不吝赐教。

叶万辉 曹洪麟

2011年12月

Preface

Evergreen broadleaved forests are the vegetations consisting of evergreen broadleaved trees in the subtropical zones with moist monsoon climate. They distribute in the north and south of the equator, and in the Northern Hemisphere between 22° and 34° (40°) N. In southeast Eurasia, they mainly occur in Yangtze River and Pearl River Basins in China, and they are also found on Korean Peninsula and in southern Japan. In addition, they also grow in the regions along the sea in southeast Africa, on the Canary and Madeira Islands in northwest Atlantic, in Mexico and southeast of North America, in Chile, Argentina, Bolivia and Brazil in South America, and in the east coast of the Oceania and the northern islands of New Zealand. Among all these, the forests in China are the most typical and cover the largest area.

With rich biotic resources, abundant biodiversity and enormous environmental benefits, the evergreen broadleaved forests have attracted the attention of the world, and they have become the major research targets in the scientific community vegetation science in the world in decades. Studies on them in our country can be traced back to the 1930s when Xiansu Hu, Chongshu Qian, Qingsheng Fan, et al., described the vegetations in South China, but there were only a small number of relevant papers published sporadically before 1949. In the 1950s, a large number of scientific research projects were initiated, and they were mainly combined with the biological resource surveys in the tropical and subtropical zones, such as the cultivation survey in South China from 1952 to 1955, the comprehensive survey of the tropical biological resources in South China from 1958 to 1961, the comprehensive survey of the tropical and subtropical biological resources in Yunnan Province from 1957 to 1961, and the surveys of wild biological resources in other provinces (i.e., the survey in Fujian province in 1957), and so on. These surveys collected much information on the structure, types, and distributions of evergreen broadleaved forests and published "Vegetation of China" and documentations on vegetations in different provinces continuously. However, these surveys and researches were descriptive, and this period may be considered a qualitative phase in the studies of such forests in China.

Following the introductions and translations of foreign references on quantitative and population ecology, many quantitative researches were conducted on evergreen broadleaved forests in the last 30 years in China focusing on the species composition, spatial structure, distribution characteristics and ecological functions. Consequently, much data and experience were obtained. However, these data are limited to the forests in several forest ecosystem research stations (i.e., Dinghushan in Guangdong, Jinyunshan in Chongqing, Tiantongshan in Zhejiang) based on small sampling areas, usually smaller than 1 hm² and short-time observations. It is impossible for them to contain many rare species and environmental conditions and to understand biodiversity patterns and processes at different spatial scales in a forest community. Therefore, they are insufficient to understand the mechanisms of biodiversity maintenance at community level. Thus, it is necessary to establish large-scale and long-term evergreen broadleaved forest dynamic plots in different geographical zones in China, to observe and study the whole processes from flowering to fruiting, from seed formation to dispersal, from seedling recruitment to establishment, from population establishment to maintenance, and from individual growth to death of plants, to analyze the biotic and abiotic factors influencing these processes and to explore the mechanisms of biodiversity formation and maintenance of the evergreen broadleaved forests.

The Dinghushan National Nature Reserve of the Chinese Academy of Sciences (CAS) was founded in 1956. It is the earliest one in China. Its vegetation has been protected for more than 400 years, and it is representative of its geographical zonal vegetations. Thus, the Reserve is an ideal place to study the mechanisms of biodiversity origin and maintenance of evergreen broadleaved forests in the south subtropical zones. From 2004 to 2005, following the recommendations of the 2004 Beijing Workshop and with the support of the Biodiversity Committee of CAS, we, the conservation ecology research group at the South China Botanical Garden, established the Dinghushan 20 hm² forest dynamic plot (DHS Plot) in the best protected south subtropical evergreen broadleaved forests between Qingyun Temple

and Sanbao Mountain in the Dinghushan Reserve following the standard census protocol of CTFS (Center for Tropical Forest Sciences), with the hope of monitoring and studying the biodiversity of south subtropical evergreen broadleaved forests on a long term basis. According to the census standard of surveying once every five years, we conducted the first re-census of the DHS plot in 2010. At the same time, we established five associated 1 hm² plots with different types of forest communities in the adjacent areas along the edges of the DHS plot using the same standards as those used for the DHS plot. Meanwhile, we corrected the survey data of 2005 based on our first re-census.

This book describes in details the distribution patterns, DBH structures and biological characteristics of the tree species based on the corrected survey data and the field identification guides for the trees that can be easily misidentified in the DHS plot and its associated plots. It provides the necessary baseline information for further studies. It contains beautiful photos of the plants in the plots, and these provide readers with perceptual materials to know the forests and plants in the plots. All these will help to attract more and more the young and educated to join the research team in forest ecology.

It was an unprecedented challenge to establish the large 20 hm² forest dynamic plot in terrain-rugged Dinghushan. During the establishment of the plot and research work carried out in it later, many people and organizations gave us great support and help. Hence, we would like to take this opportunity to greatly acknowledge the followings for their admirable contributions. Professor Fangliang He in University of Alberta, Canada, Professor I-Fang Sun in Dong Hwa University and Professor Keping Ma in the Institute of Botany of CAS not only provided us with valuable ideas for establishing the plot, but also gave us help personally in the location selection of the plot and census work. Dr. Richard Condit in CTFS gave us important guidance and assistance in data management. With hard work, Jiangyun Surveying and Mapping Exploration Co. Ltd. accurately measured and located the geographical coordinates for the plot. Professor Zhongliang Huang, Senior Engineer Binhui Chen, Associate Professor Juyu Lian, Yujia Huang, Dingshen Mo, Zhe Meng, Youchang Zhang, Linfang Wu, Yushi Ye, Yinjie Chen, Wenbo Cai, Xiaoming Fang, Chuanyin Xiang and postgraduates Zhigao Wang, Junhui Shi, Chi Zhang, Lin Li, Shiguan Wei, Hao Shen, Jing Li, Hongpin Mu, Yujie Han, Guojun Lin, Wenping Liu, Linjuan Liao, Xiaoyi Li, Lei Ma, Young Shen, Shujun Xu, Bowen Li, Lanying Wang, Hongyu Niu, Ran Wang and Lei Dong in South China Botanical Garden of CAS, Dr. Zhengmei Lin in South China Teachers Training University, Fang Ten in Gutianshan Nature Reserve of Zhejiang province, undergraduate students Yuemou Shi, Dafeng Chen, Tenfang Xie, Ting Huang, Yuxi Chen, Shengqiang Li and Shuilian Chen in South China Teachers Training University and South China Agricultural University, and graduate students Shulan He, Xinda Li in Guangzhou University of Chinese Medicine Guohui Liang, Zhaoji Liu, Jingfeng Gu in South China Agricultural University, Yuanxiang Wen, Aqin Guo, Fenglin Pang, Guoqiang Yang in South China Teachers Training University worked hard during the establishment of the plot, the first and the second surveys of plants and the data collection. Linfang Wu, Yushi Ye, Zhengm Lin & Anqiang Dong provided us with the beautiful photos in this book. Professor Huagu Ye in South China Botanical Garden gave us valuable advice on the writing of this book.

In this book, we describes a total of 195 woody species including some varieties, belonging to 55 families and 111 genera. We identified and arranged gymnosperms and angiosperms according to the systems of Wanjun Zheng (1975) and Hutchinson, respectively. We described the biological characteristics of plants on the basis of *Flora of China* (Chinese and English version).

Due to the limitation of our time and knowledge, there might be unavoidable mistakes and oversights in this book, and we welcome comments and suggestions from our readers.

Ye Wanhui & Cao Honglin
2011.12

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鼎湖山国家级自然保护区
Introduction to Dinghushan National Nature Reserve

I





1.1 地理位置和自然环境

中国科学院鼎湖山国家级自然保护区位于广东省肇庆市鼎湖区，地理坐标为北纬 $23^{\circ}09'21'' \sim 23^{\circ}11'30''$ ，东经 $112^{\circ}30'39'' \sim 112^{\circ}33'41''$ 。面积 1155hm^2 ，属低山丘陵地貌。最高峰鸡笼山海拔 1000.3m ，山体陡峭，坡度多在 $35^{\circ} \sim 45^{\circ}$ 之间。

本区属亚热带湿润季风气候，冬夏气候交替明显。年平均温度 20.9°C ，最热月（7月）平均温度 28.0°C ，极端最高温度为 38.0°C ，最冷月（1月）平均温度 12.6°C 。霜冻平均每年4次，每次持续1~2天，极端最低温度 -0.2°C 。1975~1995年年均降雨 1985mm ，4~9月为主要降雨季节，月降雨量均超过 200mm ，11月至翌年1月为旱季，月降雨量不足 100mm 。年平均蒸发量 1115mm ，年平均相对湿度 80.3% 。灾害性天气是寒潮和台风，寒潮常出现在11月至翌年3月，年平均约3次，寒潮时气温迅速下降，并偶有霜冻。7~9月为台风季节，平均每年有4次到达本地区。

区内地带性土壤为发育于砂岩和砂页岩的赤红壤，山地垂直分布有黄壤和山地灌丛草甸土。赤红壤分布于海拔 300m 以下的丘陵低山，黄壤分布于海拔 $300 \sim 900\text{m}$ ， 900m 以上为山地灌丛草甸土。此外，尚有局部分布的耕型赤红壤。

1.1 Location and description of Dinghushan National Nature Reserve

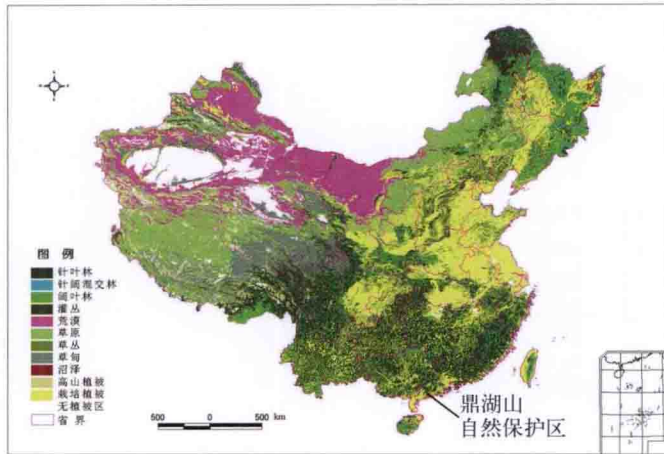
Dinghushan Nature Reserve, Chinese Academy of Sciences is located in the mid-part of Guangdong Province in South China, northeastern suburb of Zhaoqing city, about 84 km away from Guangzhou, with the geolocation of $112^{\circ}30'39'' \sim 112^{\circ}33'41''\text{ E}$ and $23^{\circ}09'21'' \sim 23^{\circ}11'30''\text{ N}$. It occupies 1155 hm^2 , covered mostly by hills and valleys. The altitude of the station ranges nearly from 100 to 700 m above sea level, with the highest of 1000.3 m at Jilongshan.

This area shares the typical monsoon climate, with the temperature alternate markedly between summer and winter. The annual mean temperature is 20.9°C , with the lowest of 12.6°C in January and the highest of 28.0°C in July. The frosts average 4 times a year which lasting out 1-2 days at a time. From 1975 to 1995 in the region the annual average precipitation was 1985 mm , the mean relative humidity was 80.3% and the mean amount of evaporation was 1115 mm . In summer, monthly rainfall is over 200 mm from April to September, whereas in winter, from November to January, monthly rainfall is less than 100 mm . Cold wave and typhoon are severe weather, with 3 cold waves from November to March and 4 typhoons from July to September.

The soil in Dinghushan is composed mainly of lateritic red earth and mountain yellow-brown earth in vertical distribution. The lateritic red earth occurs in hilly land below an altitude of 300 m , and also distributes in hills and low mountains at an altitude of 300 to 900 m above sea level, the mountain yellow-brown earth occurs partially on the tops of hills.

1.2 地带性植被类型

鼎湖山国家级自然保护区的地带性植被类型为亚热带常绿阔叶林，主要分布于以庆云寺为中心的周围海拔 $75 \sim 500\text{m}$ 的山坡，组成种类复杂多样且热带性植物较多。海拔 $500 \sim 800\text{m}$ 的地段，分布着山地常绿阔叶林或灌丛林类型植被。海拔 800m 以上的山脊、山顶部分，只分布着灌木草丛类型植被。在海拔 $50 \sim 300\text{m}$ 的沟谷中还分布着小面积的沟谷常绿阔叶林。在亚热带常绿阔叶林的外围丘陵山地上，分布着较大面积的处于演替各阶段的针阔叶混交林。主要类型包括：



A



B

鼎湖山自然保护区的位置及20 hm²样地在鼎湖山保护区中的位置

Map of China showing the location of Dinghushan Nature Reserve and the 20 hm² Dinghushan permanent plot, southern China

A. 鼎湖山自然保护区的位置 The location of Dinghushan Nature Reserve in China

B. 20 hm²样地在鼎湖山保护区中的位置 The location of 20 hm² forest plot in Dinghushan Nature Reserve

1.2.1 常绿阔叶林

I. 南亚热带常绿阔叶林

1. 锥—黄果厚壳桂—云南银柴群落
2. 格木—黄果厚壳桂—鼎湖钓樟群落
3. 锥—黄果厚壳桂—黑桫欏群落
4. 木荷—锥—广东假木荷群落

II. 常绿阔叶林

5. 少叶黄杞—密花树—短序润楠群落

III. 沟谷常绿阔叶林

6. 九丁榕—青果榕—鱼尾葵群落
7. 橄榄—肥荚红豆—鱼尾葵群落

IV. 溪边林

8. 水翁蒲桃—蒲桃群落

1.2.2 针叶、阔叶混交林

V. 马尾松—阔叶混交林

9. 木荷—锥—马尾松群落
10. 广东润楠—鼠刺—马尾松群落
11. 木荷—岭南山竹子—马尾松群落
12. 木荷—马尾松—杜鹃花群落
13. 马尾松—木荷群落
14. 马尾松—木荷—桉树群落

1.2.3 热性针叶林

VI. 热性常绿针叶林

15. 马尾松—桃金娘—芒萁群落

1.2 Zonation of vegetation

Owing to its particular geographic location and ideal weather condition, Dinghushan Nature Reserve has rich vegetation types and is abundant in biological diversity. Vegetations can be divided into pine forest, mixed pine and broadleaved forest and south subtropical broadleaved evergreen forest along the horizontal level, and river-bank forest, ravine broadleaved evergreen forest, montane evergreen broadleaved forest, shrub-grasslands along the increasing vertical gradient. The seminatural forests include evergreen broadleaved forest, coniferous and broadleaved forest. The following are main vegetation types:

1.2.1 Broadleaved evergreen forest

I. South subtropical broadleaved evergreen forest

1. *Castanopsis chinensis* - *Cryptocarya concinna*-*Aporosa yunnanensis* Association
2. *Erythrophleum fordii* - *Cryptocarya concinna* - *Lindera chunii* Association
3. *Castanopsis chinensis* - *Cryptocarya concinna*-*Alsophila podophylla* Association
4. *Schima superba* - *Castanopsis chinensis*-*Craibiodendron scleranthum* var. *kwangtungense* Association

II. Broadleaved evergreen forest

5. *Engelhardtia fengelii* - *Myrsine seguinii* - *Machilus breviflora* Association

III. Ravine broadleaved evergreen forest

6. *Ficus nervosa* - *Ficus chlorocarpa* - *Caryota maxima* Association