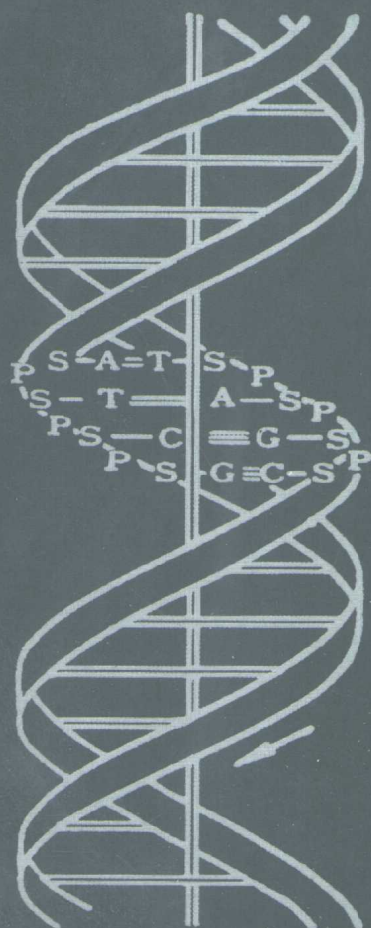


森林遗传资源学概论

Introduction of Forest Genetic Resource Science

顾万春 王棋 游应天 孙翠玲 编著



森林遗传资源学概论

INTRODUCTION OF FORESTRY GENETIC RESOURCES

顾万春 王棋 游应天 孙翠玲 编著

Gu Wanchun Wang Qi You Yingtian Sun Cuiling

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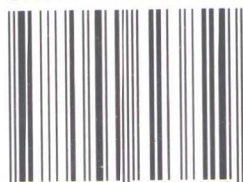
万春 男 1965年7月毕业
南京林学院(现南京林业大
学)。中国林业科学院林业研
究所研究员、室主任、研究生
导师。东北林业大学兼职教
授。黑龙江林科院特约研究
员,全国林木良种审定委员会
针叶树专业委员会副主任。

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王棋 男 1963年毕业于北京林业大学。现任林业部国有林场和林木种苗工作总站总站长,南京林业大学兼职教授,近年来与专家合撰专著两本,担任中国林科院学术委员会委员,中国林学会遗传育种专业委员会副主任、常委。中国森林公园评价委员会副主任等职。

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森林遗传资源学是研究森林遗传多样性、保护森林遗传多样性、利用森林遗传多样性的应用研究与基础研究相结合的学科。她运用遗传学和育种学常规方法及高新技术,移植和吸收相关学科理论和有用方法,研究森林遗传(林木种质)资源保存利用的理论、方法和技术,包括遗传、生态、生产等方面属性和规律,遗传多样性及其信息参数描述,判别保存价值;研究保存和利用的策略,保存评价和利用的方法论;根据遗传、生态和生产利用背景制定样本策略,筛选保存技术及其各类保存模式设计,研究遗传资源及多样性的优化配置保存与利用技术;选择并推荐新、特、优育种材料或生物工程材料的配套技术;研究资源数据库、信息库及国内外联网信息服务系统等相关技术。在内涵方面,她对林木育种学研究是补充、提高和保护,遗传资源测定研究丰富了遗传学尤其是群体遗传学研究的实验范例及依据;在外延方面,遗传资源保存与利用强化了生物多样性研究的内容和基础。

90年代以来,国际上对于森林遗传资源研究进入了新阶段,除了FAO主办《森林遗传资源情报》(杂志)大量研究报道外,各国相关研究论文的广度和深度显著地提高,Adams等(1992)、Loeschoke等(1994)、Zin-sick Kim等(1995)先后出版了3部有关森林遗传资源研究论文集,收集了有价值的论文百多篇,形成了森林遗传资源(保存)学的框架和新学科的雏形。在前人研究和利用的基础上,结合“八五”科技攻关“林木种质资源库保存技术研究”专题及相关研究,在“实验、归纳、理想、演绎”认识论的过程中,撰写该书,本意在于总结、提高和推动森林遗传资源保存和利用事业的发展。

本书15章内容,包括两个层次,第一章至第八章属于“归纳、演绎”性质的研究结果;第九章至第十五章属于“实验、理想”性质的研究结果。分章内容组合是:第一、二章,简述森林遗传资源保存的现状和认识,论述森林遗传资源学的使命、研究内容及样本策略,遗传多样性与林木育种的关系等;第三、四、五章介绍林木遗传资源保存的相关应用理论,用于遗传多样性的参数定义和功能,林木遗传多样性研究的现状、技术及有关评价结果等;第七、八章概述林木遗传资源保存的策略、方法和相关技术,国际森林遗传资源保存的命题、机构、计划和方案。前八章内容着力阐述关于森林遗传资源学研究一般性理论、方法、技术和实施的全貌。第九、十、十一、十二章内容,是“八五”国家科技攻关“重要针阔叶树种种质资源库保存技术研究”(85—018—01—16)专题的研究成果,包括中国林木遗传(种质)资源保存策略,种质资源库保存技术研究的攻关计划和实施计划,种质资源保存库保存技术研究结果的3方面7项组合技术,种质保存与评价的配套样本策略。第十三、十四章是本攻关专题的相关研究结果,综述了在林木种苗生产中种质保存和利用的地位、现状、途径和有关技术,珍稀濒危树种遗传(种质)资源保存的概念、意义、现状、对策、措施和7个有代表性的珍稀濒危树种繁殖保存状况。第十五章介绍林木种质资源库信息管理的设计和有关规范。原定稿的第十六章“信息库管理文件及程序设计”计算机软件系统,因本书容量有限,留待以后另行出版。

全书由顾万春、王棋等组织稿件。各章撰写人员如下:

顾万春:第一章,第二章,第三章,第四章,第五章第一、第三、四节,第六章,第七章,第九章第三、四、五节,第十章,第十一章,第十二章,第十四章第三节,第十五章。

王 棋:第九章。

游应天:第十三章。

孙翠玲:第八章,第六章第二节,第七章第三节。

唐 谦:第五章第二节、第十一章附录。

李 斌:共同撰写第七章和第十五章内容。

汪政科:共同撰写第十五章内容。

陈英歌:第十四章第一、二节。

郭文英:第十四章第四、五节,并负责全书的制图。

洪宝亮:共同撰写第十五章内容。

书中的部分章节内容,由南京林业大学施季森教授、北京林业大学续九如教授、东北林业大学杨传平教授审稿,特此感谢。李志君、王军辉、黄秦军、张辉、刘丹等同志为本书校稿。

在书稿撰写过程中,得到中国科学院院士庄巧生教授、林业部副部长刘于鹤教授的悉心指导,林业部科技司司长刘效章先生、副司长寇文正教授、计划处杨林梅处长、计划司张佩昌副司长、中国科学院遗传研究所李向辉研究员、北京林业大学沈熙环教授等多方面专家给予热心指导和帮助,在此一并致谢!

书中浸透“重要针阔叶树种种质资源库保存技术研究”(85-018-01-16)专题组 28 个单位 79 名科技人员的辛勤劳动和汗水。参加专题研究报告的写作单位和负责人是:

中国林业科学研究院 亚热带林业试验中心

夏良放

中国林业科学研究院 热带林业试验中心

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李火根、葛成立、黄敏仁

陕西省林木种苗站等

杨宏藩、王志军

最后,书中错漏和不当之处,恳望读者指正。

顾 万 春

1996 年 12 月于北京

Introduction of Forest Genetic Resource Science

Foreword

Forest genetic resource is the most important fundamental natural resource that has been conserved most completely with its characteristic of regenerable and sustainable, but is also a living resource that can be destroyed and extinguished easily. Generally, the forest genetic resource includes all living genetic resources in the forest ecosystem. Along with the reduction and decline of forest land, the loss of forest genetic resource, including the loss of species, population and individual, has been more and more serious, which has resulted in the extinction or being threatened of some species. Though many species have not become threatened according to their biodiversity class, many populations of them have become nearly threatened or under threatened sometimes. Based on prediction made by FAO in 1995, about 170 species will disappear from the earth each day in the future years. The extinction of one species will threaten the survival of 10—30 species. Therefore, it has become an extremely important lesson in the world to protect and conserve forest genetic resource, improve forest quality and maintain biodiversity.

The protection and conservation of forest genetic resource is to protect biodiversity and forest productivity, maintain forest sustainable development, conserve national resource and protect environment. Forest genetic diversity results from the matching of tree species genetic variation to their ecological space under the natural selection depending on their environment volume, which are the basic raw materials of the tree breeding engineering. Being influenced by the global climatic change, environmental pollution and natural resource degradation, forest genetic resource is the expected natural beauty and the indispensable valuable property of human being. Recently, the initiation and progress of breeding engineering for the improved planting materials of industrial timber forest and economic forest continuously required the supply of forest genetic resources. Meanwhile, the application of genetic diversity for providing planting materials for the forest ecological engineering is more convenient and effective than developing suitable planting materials by using stress resistant breeding methods. Hence, the scholars and researchers on tree breeding, genetics, ecology, resource sci-

ence and environmental science began to focus on the forest genetic resource conservation and utilization, which resulted in a lot of research and operation activities on the conservation background, strategy, methodology and techniques. Some of the researchers started working on the integrated issues about forest genetic resource conservation, testing, evaluation and utilization for the more effective conservation and reasonable utilization, which has become the hot points emphasized by more and more people.

In the past, the forest genetic resource conservation was only partly studied by the tree breeders. Up till latest years, more and more researchers on genetics, ecology, botany, resource science, environmental science and social science etc. have jointed in the studies on the forest genetic resource.

The research progress on forest genetic resource has indicated the importance of genetic resource conservation as well as the limitation of past studies. Comparing the research of forest genetic resource to that of forest tree breeding, following similarities and differentiation can be found. On the research objectives, the forest genetic resource study is to effectively conserve and reasonably utilization of genetic resource for the sustainable development, while the forest tree breeding study is to improve forest planting material for increasing forest productivity, which developed from one generation to multiple generation breeding. On the research contents, the forest genetic resource study is to deal with the various genetic materials of each tree species as well as conserve all tree species in thier ecological regions, while the forest tree breeding study is to deal with the useful genetic materials (or breeding materials) for the genetic improvement of the tree species. On the research components, the forest genetic resource study is to conduct the test, evaluation and utilization of genetic diversity with the application of conservation and evaluation theory and methods to continuously recommend different breeding materials with various purpose for the successive conservation and utilization, while the forest tree breeding study is to work on the improvement of tree species with various genetic materials by use of common tree breeding techniques and high-technology concerning the variation and quantitative selection of breeding characters, which shows apparently periodical genetic improvement. The practice has indicated that it can not meet the needs of genetic resource research and development to conduct the conservation, evaluation and utilization of forest genetic resource under the guidance of existing tree breeding or forest improvement theory and methodology. According to

the principles of integration and limitation, it is urgent to establish and improve the academic field to serve the forest genetic resource conservation and development, i. e. forest genetic resource science. Forest genetic resource science deals with mainly applied theory and methodology, including the applied techniques on the strategy, objectives and contents of the forest genetic resource conservation and utilization, which not only relates to knowledge of many other fields, but also has its own unique specialty in theory and methodology as a new academic field with existing significance and future prosperity.

Forest genetic resource science focuses on studying forest genetic diversity, conservation of forest genetic diversity and utilization of forest genetic diversity, which is a integrated academic field dealing with both fundamental and applied research subjects. It adopts both common genetic breeding methods and modern high-technology, with absorption of the theory and methodology of related academic fields, to study forest genetic (or forest germplasm) resource conservation and utilization theory, methods and techniques, including the characters and rules of genetics, ecology and production, expressing genetic diversity and its information parameters and evaluating the conservation activities. It also studies the conservation and utilization strategy, evaluation and utilization methodology. According to the genetic, ecological and productive background, it develops sampling strategy, selects conservation techniques and designs various conservation models for the optimal matching of forest genetic diversity to the conservation and utilization techniques and the continuously recommending of new, specific and superior breeding materials or biological engineering materials. The information technology, such as resource database, information system and international network, will be used for establishing forest genetic resource information management system. In one hand, it is a supplement to forest tree breeding technology with various genetic resource testing ways, experimental examples and evidents for enriching genetics, especially population genetics. In other hand, it can strengthen the biodiversity study with its contents and basis through genetic resource conservation and utilization.

Since 1990s, the research on forest genetic resource has gone to a new stage in the world. In addition to the journal entitled Forest Genetic Resource Information edited by FAO, many related journals have published a great number of research papers on the subject in most countries. Adams et al(1992), Loeschke et al(1994) and Zim-sick Kim et al(1995) have published 3 research paper collec-

tions on the forest genetic resources, comprising more than 100 valuable papers, which formed a framework of new academic field of forest genetic resource (conservation). Based on the researches and practices on forest genetic resource conservation conducted in the past, especially under the National Key Research Program-Research on Forest Germplasm Resource Conservation Technology during the eighth "Five-year Plan" period, the book was written with summarizing and deducting the previous research achievements for promoting the development of forest genetic resource conservation and development.

In this book, fifteen chapters are included that describe two levels of contents, i. e. , Chapter 1 to Chapter 8 discuss the research achievements from summarization and deduction and Chapter 9 to Chapter 15 discuss the research results from the experimentation and analysis. The Chapter 1 and 2 brief the current status of forest genetic resource conservation, including the tasks, contents and sampling strategy of genetic resource science, as well as the relation of genetic diversity and forest tree breeding etc. The Chapter 3, 4, 5 and 6 introduce the relevant applied theories of forest genetic resource conservation, the definition and function of parameters for expressing genetic diversity, the current status of forest genetic diversity research as well as some related techniques and evaluation results. The Chapter 7 and 8 discuss the strategy, methodology and technology of forest genetic resource conservation and the international lessons, organizations, plans and schemes of forest genetic resource conservation. In general, the first eight chapters mainly describe the overall vision of common theory, method, technique and implementation of forest genetic resource science. The Chapter 9, 10, 11 and 12 describe the research achievements of the National Key Research Program, i. e. , entitled the Research on Germplasm Conservation Techniques for Important Coniferous and Broad-leaved Tree Species (85-018-01-16), which includes the conservation strategy of forest genetic resource, the program proposal and the operation plan of the Research Program as well as the research results containing 3 aspects and 7 items of conservation techniques and the combined sampling strategy of germplasm conservation and evaluation. The Chapter 13 and 14 describe the related research results being worked out from the National Key Research Program, review the position, status, measures and related techniques of forest germplasm conservation and utilization in tree seed and seedling production, as well as the concepts, significance, status, strategies and methods on the genetic (germplasm) resource conservation of rare and

threatened tree species with brief account of the conservation practices for the 7 representative rare and threatened tree species. The Chapter 15 describes the design and application of the information management system on forest germplasm resource conservation banks. The originally planned Chapter 16 that describes the designing and programming methods for the information management system as well as its computerized software, has not been included in this book because of the limit room of the book, which will be published in the future.

The book is written by a group of authors, under the organization of Prof. GuWanchun and Wang Qi. The authors and their responsible contents of the book are as follows.

Gu Wanchun: Chapter 1—4, division 1,3,4 of Chapter 5, Chapter 6—7, division 3—5 of Chapter 9, Chapter 10—12, division 3 of Chapter 14 and Chapter 15

Wang Qi: Chapter 9.

You Yingtian: Chapter 13.

Sun Cuiling: Chapter 8, division 2 of Chapter 6 and division 2 of Chapter 7

Tang Qian: Division 2 of Chapter 5, the annexes of Chapter 11.

Li Bin: Assisting Gu Wanchun for Chapter 7 and Chapter 15.

Wang Zhengke: Assisting Gu Wanchun for Chapter 15.

Chen Yingge: Division 1 and division 2 of Chapter 14.

Guo Wenying: Division 4 and division 5 of Chapter 14, and responsible for making all figures in the book.

Hong Baoliang: Assisting Gu Wanchun for Chapter 15.

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The research achievements included in the book were produced with the implementation of the National Key Research Program, i. e. the Research on Germplasm Resources Conservation Techniques for Important Coniferous and Broad-leaved Tree species (85—018—01—16) under the efforts of 28 members of the research team of the Program. The main team members are as follows in addition to the authors.

Xia Liangfang, from the Experimental Center of Subtropical Forestry under the Chinese Academy of Forestry (CAF).

Guo Wenfu and Liang Ruilong, from the Experimental Center of Tropical Forestry, CAF.

Zhao Jianmin and Song Youyi, from the Tree Seed Station of Heilongjiang Province.

Xu Guangtian, Xu Shenbo and Wang Qihe, from the Forestry Academy of Sichuan Province.

Niu Jiguo and Tan Yunde, from the Forestry Division of JiaoZuo District in Henan Province.

Mo Zhongzhi and Wei Zengjian, from the Tree Seed Station of Guangxi Autonomous Region.

Li Huogen, Ge Chengli and Huang Minren, from the Nanjing Forestry University.

Yang Hongfan and Wang Zhijun, from the Tree Seed and Seedling Station of Shaanxi Province.

The authors welcome readers to point out the shortages in the book and give us valuable comments.

Gu Wanchun

Beijing, December, 1996

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