THE STATE
OF THE WORLD's

FOREST GENETIC RESOURCES

COUNTRY REPORT

CHINA

This country report is prepared as a contribution to the FAO publication, The Report on the State of the World's Forest Genetic Resources. The content and the structure are in accordance with the recommendations and guidelines given by FAO in the document Guidelines for Preparation of Country Reports for the State of the World's Forest Genetic Resources (2010). These guidelines set out recommendations for the objective, scope and structure of the country reports. Countries were requested to consider the current state of knowledge of forest genetic diversity, including:

- Between and within species diversity
- List of priority species; their roles and values and importance
- List of threatened/endangered species
- Threats, opportunities and challenges for the conservation, use and development of forest genetic resources

These reports were submitted to FAO as official government documents. The report is presented on www. fao.org/documents as supportive and contextual information to be used in conjunction with other documentation on world forest genetic resources.

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The State of China's
Forest Genetic Resources

Main Report

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Table of contents

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Technical Working Group

Team Leader:

Chu Fuxiang	Vice President	Chinese Academy of Forestry

Deputy Team Leader:

Wang Qi	Division Director	Science and Technology Development Center	SFA
Zheng Yongqi	Director	Division of Forest Genetic Resources	CAF

Member:

Li Bin	Institute of Forestry	CAF
Li Wenying	Institute of New Technologies	CAF
Lin Furong	Institute of Forestry	CAF
Zong Yichen	Institute of Forestry	CAF
Yu Xuedan	Institute of Forestry	CAF
Zhang Chuanhong	Institute of Forestry	CAF
Cheng Beibei	Institute of Forestry	CAF
Jia Zhiqing	Institute of Desertification	CAF
Li Diqiang	Institute of Forest Ecology and Protection	CAF
Guo Qirong	International Bamboo and Rattan Center	SFA
Li Wei	Institute of Forestry	CAF
Zhao Han	Institute of Forestry	CAF
Huang Ping	Institute of Forestry	CAF

Notes on tables

The tables given in the FAO guidelines to the preparation of the FGR country report were attached at the end of the main report as appendix tables. Those not given in the FAO guidelines were placed at appropriate locations in the text.

Abbreviations and Acronyms

ABS	Access and benefit sharing for genetic resources
ACIAR	Australia Center for International Agricultural Researches
APAFRI	Asia and Pacific Association of Forestry Research Institutions
APFORGEN	Asia and Pacific Forest Genetic Resources Program
BI	Bioversity International
BJFU	Beijing Forestry University
CAF	Chinese Academy of Forestry
CAAS	Chinese Academy of Agricultural Sciences
CAS	Chinese Academy of Sciences
CBD	Convention on Biological Diversity
CETDR	Center for Eco-tourism Development and Research
CEPF	China Environmental Protection Foundation
CI	Conservation International
CIB	Chengdu Institute of Biology
CIBR	Center for International Bamboo and Rattan
CICEPG	Center for International Cooperation on Environment Protection of Guizhou
CIFOR	Center for International Agricultural Research
CIIW	Convention on International Important Wetland, Especially as Waterfowl Habitat
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EAPVPF	East Asia Plant Variety Protection Forum
EIB	European Investment Bank
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
HNU	Hainan Normal University
HPBF	Hubei Provincial Bureau of Forestry
INBAR	International Network of Bamboo and Rattan
ISA	International Sarch Association
ITTO	International Topical Timber Organization
IUCN	International Union for Conservation of Nature
IUFRO	International Union of Forestry Research Organizations
JICA	Japan International Cooperation Agency
JPBF	Jiangxi Provincial Bureau of Forestry
NFGRP	National Forest Genetic Resources Platform
NEFU	Northeast Forestry University
NJFU	Nanjing Forestry University
NNRTCG	National Nature Reserve of Tree-fern in Chishui of Guizhou
NEAFSTU	Northwest Agriculture and Forestry Science and Technology University
SAUD	Sichuan Agricultural University- Dujiangyan Campus

SFA	State Forestry Administration
SPAF	Sichuan Provincial Academy of Forestry
SPBF	Sichuan Provincial Bureau of Forestry
STNNR	Shan'xi Taibai National Nature Reserve
SUT	Shenyang University of Technology
SWFU	Southwest Forestry University
TEAKNET	Teak Net
TNC	The Nature Conservancy
UNCCD	UN Convention on Combating Desertification
UNDP	UN Development Program
UNFCCC	UN Framework Convention on Climate Change
UNFF	UN Forest Forum
UPOV	International Union for the Protection of New Varieties of Plants
WBG	Wuhan Botanical Garden
WWF	World Wildlife Fund
WI	Wetland International
YPAF	Yunnan Provincial Academy of Forestry

Executive summary

The state of genetic diversity

There are many forest types in China with a wide range of species and rich forest genetic resources (FGR). China has more than 8,000 species of woody plants, of which about 2,000 species are arbor trees, accounting for 54% and 24% of the world's total respectively. Among the woody plants, about 1,000 species are economically important, mainly for timber production, fruit production, ecological protection, gardening and energy production. The large number of tree species and their Inter-species genetic diversity has laid a solid foundation for development of forest resources, forestry ecological construction and forestry industrial development. In recent years, with the implementation of the national key forestry ecological construction programs, China has made significant progress in forest biodiversity conservation, but due to the rapid social and economic development, protecting natural forests are still facing great pressure, genetic erosion in many species is serious, and some even threatened with extinction. Therefore, there is an urgent need to protect threatened species and their genetic resources, to establish a cooperative network of national FGR, to carry out monitoring and evaluation of forest genetic diversity and genetic erosion, to conduct resource assessment and utilization of species with important and potential economic values.

The state of *in situ* conservation

China has made significant progress in *in-situ* FGR conservation. Up to 2010, there were 2,588 national nature reserves with a total area of 149 million ha, accounting for about 14.9% of China's total land area. 2,035 out of the 2,588 national nature reserves are managed by forestry sector, covering an area of 123.3 million ha and accounting for 12.3% of China's total land area. About 90% of all the natural terrestrial ecosystems, 85% of wildlife animal populations with protection priority, and 65% of community types of higher plants have been well protected. A total of 2,583 forest parks with a total area of 16.78 million ha were established; and a total number of 885 national and provincial-level scenery parks have been established, with a total area of 18.14 million ha; 2.853 million ancient and rare trees have been identified and most of them have been labeled for protection. A total number of 51 *in situ* conservation forests have been established. Future needs were identified to be improvement of the quality of *in situ* conservation, harmonization of protection and economic development, enforcement of dynamic monitoring and evaluation of the *in situ* conservation of FGR.

The state of *ex situ* conservation

China has established a nation-wide network of *ex situ* FGR conservation, including 22 locations of multiple species conservation, 13 locations of single species conservation, 131 locations of

conservation of regional key species and more than 160 arboreta. A total of 420.6 ha of conservation stands have been established, conserving more than 2,000 species including more than 120 priority species. *Cunninghamia lanceolata*, *Pinus tabulaeformis*, *Pinus massoniana*, *Pinus sylvestris* var. *mongolica*, *Larix olgensis*, *Larix kaempferi* and *Betula alnoides* have more than 1,000 accessions have been conserved. A total area of 409,100 ha of seed orchards, seed stands and cutting orchards has been established throughout the country. These seed production bases have become important *ex situ* conservation forests. In comparison, low-temperature storage for FGR in China is relatively lagged behind, and construction of storage facilities has not been given sufficient attention. The main restraining factors for *ex situ* FGR conservation are insufficient baseline information on quantity of resources, poor research support and shortage of funding etc., therefore, it is an urgent need to increase the investment to speed up the construction of conservation banks, and to strengthen information development, in order to continually improve conservation, management, research, use and sharing of FGR.

The state of utilization and sustainable management

Genetic improvement programs have been carried out for more than 100 forest tree species in China. China produces an average of 23 million kg seeds of various tree species and about 30 billion qualified young plant stocks. Significant gains have been achieved due to the use of genetically improved plant materials in plantations, achieving an average growth gain of 10-30% for timber trees and an average yield gain of 15-68% for fruit trees. China imports more than 150,000 kg tree seeds annually, involving more than 50 species; and exports 300,000 kg tree seeds and plant stocks of over 400 species annually. In the past 10 years, China has made significant progress in sustainable management and utilization of FGR, future priority should be given to the maintenance and capital subsidy to the conserved FGR, strengthening supervision of seed market and information services, and further enhancing the supply and use of genetically improved seeds.

The state of national plans, research, education, training and legislation

China has formulated a series of national plans for conservation and management of FGR, and the conservation and management of FGR have been continually strengthened. The SFA is the competent authority of FGR in China. The laws and regulations related to FGR in China have been revised to meet new requirements; Inventory, collection, conservation and utilization of FGR have been carried out; a number of disciplines related to FGR have been set up in the high education in forestry. With extensive dissemination and education activities, public awareness of FGR has been gradually improved. However, the lack of sustained and stable funding to support FGR studies and the need for strengthened capacity building impose urgent demands for increased capital investment to further strengthen the education and training on FGR, to strengthen the research and discipline development of FGR, and to improve and enrich the theoretical and technical systems.

The state of regional and international cooperation

China has established cooperative relations with more than 40 countries and joined more than 20 international networks relevant to FGR. Cooperation activities carried out include information exchange, database development, development of conservation strategies, and seed exchanges etc. China has acceded to international conventions such as CBD, CITES, UNFCCC, UNCCD, UNFF and UPOV Convention and more than 10 multilateral or bilateral agreements, therefore promoting the conservation and utilization of FGR.

The state of access and benefit-sharing (ABS) of FGR

Fair and equitable sharing the benefits generated by the use of genetic resources, is one of the three objectives of the CBD, it contributes to biodiversity conservation and its sustainable use, helps poverty alleviation and promotes sustainable development. China is formulating and revising relevant laws and regulations, aiming to promote the ABS of FGR which supports science-based conservation and utilization of FGR, promote technology innovation in tree breeding and bio-industry development, and to promote sustainable forestry development. China should actively participate in the negotiation and implementation of relevant international conventions, improve relevant laws, regulations and policies as soon as possible, establish an effective ABS mechanism.

Contributions to food security, poverty alleviation and sustainable development

In 2010, China achieved a gross product of RMB 2,277.902 billion in forestry, and the promotion and application of genetically improved species have played an important role in increasing the gross product. Exploitation and utilization of FGR have made important contributions to sustainable socio-economic development, food security and achievement of the Millennium Development Goals. Uses of the multiple values of FGR have resulted in increase of farmer's income, poverty reduction, increase of employment opportunities, increase of schooling rate of children and social status of women. China has more than 100 species of cultivated woody plants for fruits and oil production, for instance, the typical tea-oil tree (*Camellia oleifera*) has been planted in large-scale. In the future, priority will be given to: genetic improvement and increase of variety diversity of various economic species such as woody plants for fruits and oil production, and for production of edible vegetables; market development for plant stocks and rational use of improved trees; development of anti-poverty preferential policies that give priority to supply genetic resources of improved trees and shrubs, and related processing and utilization technologies to poverty-strike and ecologically fragile areas.

Background

1. Natural Conditions

China is located in the eastern part of Asia, west coast of the Pacific Ocean, between longitudes of 73° and 135° east, latitude 4° to 53° north, with a land area of 9.60 million km^2. China has 23 provinces, 5 autonomous regions, 4 centrally-controlled municipalities and 2 special administrative regions. China has complex and diverse landforms, high in the west and low in the east, with the lowest altitude of -155 m and the highest altitude of 8,843 m. Mountainous area accounts for 2/3 of the total land area. The climate is also complex and diverse, including five climate zones: tropical, subtropical, warm temperate, temperate, mid-temperate and cold-temperate zones. Based on the characteristics of geology, geomorphology, hydrology, soil, animals and plants, China can be divided into three major natural geographic regions: the Eastern Monsoon Region, the Northwestern Arid Region and the Qinghai-Tibet Alpine Region. The complex and diverse topography and climate have resulted in rich forest genetic resources. China is the most populous country in the world, its population accounts for about 1/5 of the world's total population. China's population increased by 5.84% in 2010 compared to 2000.

2. Forest Resources

Up to 2010, China has a forest area of 195.4522 million ha, with average forest coverage of 20.36%, and a larger proportion (67.25%) of middle- and young-aged forests. The total volume of standing trees was 14.913 billion m^3, and the forest stock volume was 13.721 billion m^3. Forest resources are mainly distributed in Daxin'an Mountains, Xiaoxin'an Mountains and Changbai Mountains in northeastern China; Sichuan, Yunnan, and southeastern Tibet in southwestern China; low mountains and hilly areas in eastern and southern China; and Qinling Mountains, Tianshan Mountains, Altai Mountains, Qilian Mountains and southeastern Qinghai in northwestern China. While in the vast territory of northwestern China, the central and western Inner Mongolia, most part of Tibet, and the densely populated and economically well-developed regions such as the northern China, the Central Plains and the middle and lower reaches of Yangtze River and

Yellow River, distributed less forest resources. China has 181.3809 million ha of forest land area, of which 119.6925 million ha were natural forests, accounting for 65.99% of the total forested land; the volume of natural forests was 11.402 billion m^3, accounting for 85.33% of the total volume of forest stocks. Plantation area was 61.6884 million ha (Appendix Table 1), accounting for 34.01% of the total forested land; the total volume of plantations was 1.961 billion m^3, accounting for 14.67% of the total forest stock volume. According to the forest types, ecological and public welfare forests and commercial forests accounted for 52.41% and 47.59% respectively of the total forest area. Among the ecological and public welfare forests, 83.0838 million ha were protective forests and 11.9782 ha were special purpose forests. Among the commercial forests, 64.1616 ha were timber forests, 1.7473 ha were firewood forests and 20.41 million ha were economic forests. According to the land ownerships, 72.4677 million ha were state-owned forest lands and 108.9132 million ha were collectively-owned forest lands, respectively accounting for 39.95% and 60.05% of the total forest land area. According to the forest ownerships, 71.4358 million ha were state-owned forests, 51.7699 million ha were collectively-owned forests, and 58.1752 million ha were individually-owned forests (Appendix table 2), respectively accounting for 39.38%, and 28.54% and 32.08% of the total forest area.

China has developed a basic system of forest resource management consisting of administrative management as the mainstay and resource monitoring and supervision as the supplements. China has preliminarily created an integrative set of management systems featured with Chinese characteristics, including governance of forest utilization, protection of forest lands, and monitoring of dynamics of forest resources. The system of forestry laws and regulations has been largely improved, leading to a better legal system concerning forest resource management. Since the SFA, as the forestry authority of the State Council, stationed forest resource supervision institutions in key forestry provinces (autonomous regions and municipalities) in 1989, a national framework of forest resources supervision was basically established by 2003, allowing a full coverage of forest resources supervision at provincial level, and making the supervisions more effective. Increasing enhancement of forest resource management provided an important guarantee for achieving sustainable development of forest resources and harmonious coexistence of human and nature.

In recent 10 years, the area and volume of forests continually grow, with a steady increase of forest coverage; the sustainable forest management and resources protection are gradually strengthened, with a significant increase in area and volume of natural forests; the rapid increase

in area and volume of plantations indicated an increasing trend in the forest resources as the reserve; the volume growth of forests increased significantly, harvesting is gradually shifted to plantations; forest quality is improved and the ecological functions of forests are continually enhanced; the proportion of individually-managed forest area increased significantly and reform of the collective forest ownership has achieved remarkable impacts.

3. Timber Production and Forest Products Trade

In 2010, the total timber production in China was 80.8962 million m^3, of which 75.1321 million m^3 were logs and 5.7641 million m^3 were firewood. Timber production was 13.8599 million m^3 by state-owned enterprises and 12.933 million m^3 by state-owned forest farms and corporate institutions within forestry sector. Timber production was 2.6602 million m^3 from self-managed forests by enterprises and corporate institutions outside forestry sector, 4.2369 million m^3 by township (town) collective enterprises, and 47.2062 million m^3 by various organizations at village level and below as well as individual farmers.

The export of forest products in 2010 was $46.317 billion accounting for 2.94% of the total value of commodity exports, and the import was $45.707 billion accounting for 3.41% of the total value of commodity imports. The export of timber forest products was $34.654 billion accounting for 74.82% of the total export of forest products, and the import of timber forest products was $29.321 billion accounting for 64.15% of the total import of forest products. The export of non-timber forest products was $11.662 billion, accounting for 25.18% of the total export of forest products, and the import of non-wood forest products was $17.032 billion accounting for 35.85% of the total import of forest products.

In 2010, among the imports and exports of timber forest products, those of logs were respectively 28,400 m^3 and 34.3475 million m^3; those of saw logs (excluding the special-shaped timber) were respectively 539,400 m^3 and 14.8122 million m^3; the exports of plywood, fiberboard and particleboard were respectively 7.5469 million m^3, 2.5695 million m^3 and 165,500 m^3; the imports of them were respectively 213,700 m^3, 400,000 m^3 and 539,400 m^3; the export of wooden furniture was 298,327 million pieces ($16,157 billion), and the import was 4.3614 million pieces ($388 million); the import of wood pulp was 11,299.952 million kg; the export of paper and paper products (calculated on equivalent wood pulp) was 5,157.993 million kg, while the import was

3,536.533 million kg; the export of waste paper was 621,000 kg, and the import was 24,352.214 million kg.

With rapid social and economic development and the improvement of living standards, the demand for forest products is very strong, but the supply is insufficient, and the import and export of forest products was increasing. However, the import and export of non-wood forest products appeared to decline.

4. Forestry Genetic Resources

China has more than 8,000 species of woody plants, 7 endemic families, 239 endemic genera and about 1,100 endemic species. The majority of tree species have large Intra-species variation and rich genetic diversity, providing basic conditions for genetic improvement and playing an important role in developing new varieties and diverse products, especially in improving production, quality and resistance. The rich FGR also made important contributions to the supply of ecosystem services, adaptation to climate change and poverty alleviation, as well as economic and social development.

Chapter 1 The State of Diversity

China's vast territory, complex terrain and diverse climate have resulted in a rich and varied vegetation and forest types. According to China's natural geographic features and the distribution of natural forest, China's forest can be divided into 8 types, namely cold-temperate coniferous forest, mid-temperate coniferous and broad-leaved mixed forest, warm temperate deciduous broad-leaved forest, north subtropical evergreen broad-leaved forest, north subtropical deciduous broad-leaved forest, central-south subtropical evergreen broad-leaved forest, tropical monsoon rainforest and rainforest, alpine coniferous forest and mountain coniferous forest (Appendix table 3). The variety types of forests enabled the development of a wealth of species and genetic resources, producing great economic, ecological and social benefits (Appendix table 4, 5 and 6). However, there are also many species facing extinction or endangered. The "List of Rare and Endangered Plants in China" published in 1987 contained a total of 389 species of endangered plants, including 13 species of Pteridophyta, 71 species of Gymnosperms and 305 species of Angiosperms. Among 389 species of the list: 8 species were given level-1 priority for protection, 159 species were level-2 priority and 222 species were level-3 priority for protection. The "List of Wild Plants with National Priority for Protection" announced by the State Council in 1999 included 419 species and 13 categories (refer to taxa above species level), among which 67 species and 4 categories were given level-1 protection priority, 352 species and 9 categories were given level-2 protection priority. The list included 1 species of Cyanophyte, 3 species of fungi, 14 species and 4 categories of Pteridophyta, 40 species and 4 categories of Gymnosperms, 361 species and 5 categories of Angiosperms. All species of 13 categories such as Cyatheaceae, Dicksoniaceae, Isoetes, Ceratopteris, Cycas, Pseudotsuga, Taxus, Torreya, Cryptocoryne, Orchidaceae, Coptis, Peony section (Approximately 1,300 species) were included in the list. Accordingly, the total number of the wild plants with national priority for protection comes to about 1,700 species, displaying a large increase compared to the "List of Rare and Endangered Plants in China". In 2004 the SFA carried out a survey on the 189 species of wild plants with national priority for protection, and found that 57 species of them were severely threatened with extinction (critically

endangered) and 47 species threatened with extinction (endangered), the level of threat remains severe (Appendix table 7).

1.1 Species diversity

The flora of China has an ancient origin and rich species diversity, with a large number of endemic species. China is one of the important centers of plant origins in the world. China has 32,800 species of higher plants, ranking the third in the world. Among them 291 families, 2,946 genera and about 25,000 species are Angiosperms; 10 families, 34 genera and 240 species are Gymnosperms. China has more than 8,000 species of woody plants accounting for about 54% of the total woody plants species in the world, among which about 2,000 species are arbor trees accounting for 24% of the world's total. Most of the mountainous areas in southern, central, and southwestern China were not affected by the Quaternary glacial, therefore allowing the survival of many relict species extinct in other areas of the Northern Hemisphere, such as *Metasequoia glyptosroboides* Hu et Cheng, *Ginkgo biloba*, *Cathaya argyrophylla* Chun et Kuang, *Glyptostrobus pensilis* (Lamb.)K. Koch, *Davidia involacrata*, *Lindera flavinervia* etc. China is abundant in endemic tree species, with 7 endemic families of Ginkgoaceae, Rhoipteleaceae, Sargentodoxaceae, Bretschneideraceae, Eucommiaceae, Tapisciaceae and Davidiaceae, 239 endemic genera such as *Pseudolarix*, *Cathaya*, *Manglietiastrum* etc., and about 1,100 endemic species such as *Pseudolarix kaempferi*, *Pseudotaxus chienii*, *Taiwania cryptomerioides*, *Populus tomentosa* etc. China has more than 1,000 tree species with important economic value, including more than 300 major afforestation species (Appendix table 4).

According to the main functions and usages, tree species will be divided into 5 categories: timber trees, economic trees, protection trees, gardening trees and energy trees.

1.1.1 Species Diversity of Timber Trees

China has a large number of timber tree species, which provided a solid foundation for cultivation

and genetic improvement. Currently, timber species (genus) widely used includes: *Cunninghamia lanceolata*, *Pinus massoniana*, *Pinus tabulaeformis*, *Platycladus orientalis*, *Populus*, *Paulownia fortunei*, *Larix gmelini*, *Pinus koraiensis*, *Picea asperata, Pinus armandii* Franch, *Pinus sylvestris* L. var. *mongolica*, *Pinus yunnanensis* Franch, *Fraxinus mandschurica*, *Salix matsudana*, *Quercus*, *Betula platyphylla*, *Betlua alnoides*, *Ulmus*, *Liriodendron chinense*, *Alnus cremastogyne*, *Catalpa bungei*, Bamboo, *Robinia pseudoacacia* L, *Eucalyptus*, *Acacia*, *Pinus elliotii*, *Pinus taeda*, *Pinus caribaea* etc. (Appendix table 4). Among them, *Larix* has 10 species and 1 variety, accounting for about 60% of the total number of Larix species in the world; *Populus* has 53 species, accounting for more than 50% of the total number of *Populus* species in the world, the area of *Populus* plantations was 3.09 million ha; *Quercus* has 51 species, 14 varieties and 1 form, accounting for 20% of the world's *Quercus* species; Bambusoideae has 500 species, accounting for about 50% of the world's total, and the area of *Phyllostachys edulis* was 3.868 million ha.

1.1.2 Species Diversity of Economic Trees

China has about 1,000 species of economic trees, and the uses of the species are mainly for oil production, medicinal, chemical raw materials, fruit production and woody vegetables (Appendix table 4 and 5). China has more than 200 tree species for oil production, including 50 species producing edibles, such as: Tea oil (*Camellia oleifera*), Walnut (*Juglans regia* L), Oil palm (*Elaeis guineensis*), Apricot (*Prunus armeniaca*), Hazelnut (*Corylus heterophylla*) etc.; more than 100 species of nut trees, mainly including Chestnut (*Castanea mollissima*), Chinese date (*Ziziphus jujuba*), Almond (*Prunus amygdalus*), Pistachio (*Pistacia vera*), Persimmon (*Diospyros kaki*) etc.; about 140 species of fruit trees, including Apple (*Malus domestica*), Pear (*Pyrus communis*), *Peach* (*Prunus persica*), Orange (*Citrus sinensis*), Almond (*Prunus armeniaca*), Plum (*Prunus salicina*), Kiwi fruit (*Actinidia chinensis*), lychee (*Litchi chinensis*), Longan (*Dimocarpus longan*), Red bayberry (*Myrica rubra*), Loquat (*Eriobotrya japonica*) etc., the yields of Apple and Pear account for 50% of the total world's production, both ranking the first in the world； nearly 1,000 species of medicinal plants, such as: *Acanthopanax senticosus*, *Schisandra chinensis*, *Eucommia ulmoides*, *Phellodendron amurense*, *Magnolia officinalis*, *Cinnamomum cassia*, *Lycium chinense*,

Ginkgo biloba,*Taxus chinensis* etc.; tree species for industrial raw materials includes *Platycarya strobilacea*, *Cinnamomum camphora*, *Acacia*, *Hevea brasiliensis*, *Rhus verniciflua*, *Vernicia fordii*, *Gleditsia sinensis*, *Melia azedarach*, *Pinus*, *Quercus variabilis* etc.. Other economic tree species include Tea trees, Mulberry, Chinese toona (*Toona sinensis*), Aralis (*Aralia elata*), Chinese prickly ash (*Zanthoxylum bungeanum*) etc.

1.1.3 Species Diversity of Protection Trees

Tree species for protection purposes have strong adaptability and play an important role in water and soil conservation, desertification combating, farmland and coastal shelterbelt forest construction. Common species of arbor trees for protection purposes include: *Platycladus orientalis, Prunus armeniaca, Robinia pseudoacacia, Casuarina equisetifolia, Populus euphratica, Sonneratia caseolaris, Bruguiera gymnorrhiza, Quercus acutissima, Quercus variabilis, Pinus sylvestris var. mongolica, Salix matsudana, Fraxinus chinensis, Populus bolleana, Populus davidiana, Elaeagnus angustifolia* etc.; shrub tree species include *Hippophae rhamnoides, Calligonum mongolicum, Salix psammophila, Tamarix chinensis, Caragana microphylla, Haloxylon ammodendron, Sabina vulgaris, AmorpHa fruticosa, Nitraria tangutorum, Hedysarum scoparium, Areca catechu* etc. (Appendix table 5, 6). Protection tree species have a wide range of variation, providing a wealth of tree species that can be selected for ecological purposes. For example, China has about 256 species and 63 varieties of *Salix*, accounting for about half of the world's total number of *Salix* trees, and they have widely different salinity tolerance. For mild saline-alkali soils suitable species are *Salix matsudana* and *Salix integra*, for moderately saline-alkali soils the species are *Salix alba*, and *Salix psammophila* etc. The genus *Hippophae* has 7 species and 4 subspecies, accounting for more than 70% of the total number of *Hippophae* species in the world.

1.1.4 Species Diversity of Gardening Ornamental Trees

China has rich ornamental tree species with more than 1,200 species, major ornamental arbor tree species (family, genus) include: *Ginkgo biloba, Davidia involucrate, Cedrus deodara,*

Liriodendron chinense, Pinus bungeana, Sophora japonica, Cupressus funebris, Platanus acerifolia, Podocarpus macrophyllus, Aesculus chinensis, Cinnamomum camphora, Ficus microcarpa, Koelreuteria paniculata, Acer, Magnolia, Osmanthus fragrans, Lagerstroemia indica, Malus spectabilis；major ornamental shrubs and woody lianas species (genus) include: *Paeonia suffruticosa, Rhododendron, Prunus mume, Syzygium aromaticum, Camellia japonica, Buxus sinica, Berberis, Forsythia Suspensa, Jasminum nudiflorum, Kolkwitzia amabilis, Lonicera maackii, Wisteria sinensis, Rosa multiflora, Hibiscus syriacus* etc. (Appendix table 6). China has more than 150 Acer species, accounting for 75% of the world's total; 11 genera and about 140 species of Magnoliaceae, accounting for respectively 73% and 53% of the world's total numbers of genera and species; 15 genera and 500 species of Theaceae, accounting for respectively 50% and 67% of the world's totals; more than 530 species of Rhododendron, accounting for 59% of the world's total; over 20 species of Syringa, accounting for more than 65% of the world's total, and 82 species of Rosa, accounting for 41% of the world's total.

1.1.5 Species Diversity of Energy Trees

China has a wide range of energy tree species, with a large number and a wide distribution range, the total amount of forest biomass energy is more than 18,000 billion kg. There are 60 major fast-growing and high-quality firewood species, including arbor species such as *Pinus massoniana, Pinus elliottii, Eucalyptus globulus, Eucalyptus camaldulensis, Eucalyptus grandis, Eucalyptus tereticornis, Eucalyptus urophylla, Quercus acutissima, Quercus variabilis, Castanopsis hystrix, Lithocarpus glaber, Schima superba, Alnus cremastogyne, Casuarina equisetifolia, Choerospondias axillaries, Melia azedarach, Salix matsudana, Robinia pseudoacacia, Subgenus Armeniaca* etc. (Appendix table 4)；shrub species such as *Lespedeza* (contains 40 species), *Haloxylon ammodendron, Tamarix ramosissima, Tamarix austremongolica* etc.；more than 10 major tree species for oil production, including *Pistacia chinensis, Jatropha curcas, Vernicia fordii, Sapium sebiferum, Xanthoceras sorbifolia, Swida wilsoniana* etc. The area of growing oil production crops is continually expanding, and significant progress has been achieved in the research and development of bio-fuels. In October 2010，bio-fuel produced from

Jatropha curcas has been used as airplane fuel for test.

1.2 Intra-species diversity

Intra-species genetic diversity includes genetic variation at different levels of provenance, populations and individual, it is evaluated by morphological, adaptive and growth characteristics as well as isozyme and DNA markers. Up to 2010, analyses and evaluation of genetic diversity and variation have been carried out for more than 100 arbor and shrub species (genera), such as *Cunninghamia lanceolata*, *Pinus*, *Larix*, *Populus*, *Platycladus orientalis*, *Picea*, *Betula*, *Quercus mongolica*, *Liriodendron Chinense*, *Fagus longipetiolata*, *Alnus cremastogyne*, *Eucalyptus*, *Prunus mume*, *Calyx canthus, Syringa, Paeonia suffruticosa* etc. (Appendix table 9).

1.2.1 Evaluation techniques

Intra-species genetic variation of forest trees is mainly evaluated by morphological, growth and adaptive characteristics as well as wood properties (Appendix table 9). Variation of morphological characteristics was usually evaluated through sample surveys of the wild natural populations using those characteristics usually without environmental influences such as shapes of seed and fruit. Intra-population variation was usually evaluated with parameters of standard deviation, coefficient of variation, variance, Shannon information index etc.; the evaluation of inter-populations variation should be based on such parameters as variance components, genetic distance and phenotypic differentiation coefficient. The analyses and evaluation of geographic variation patterns of different provenances were usually based on the provenance/family trials, progeny trials and clonal tests.

Isozyme and DNA markers have been widely used in the evaluation of genetic diversity (Appendix table 9). Before the 1990s, isozyme analysis was mainly used to evaluate genetic diversity, and more than 20 enzyme systems, for example ADH, PGM, PGD, have been frequently used. After the 1990s, with rapid development of molecular techniques, analysis of DNA markers became the

major method, frequently used DNA markers include RFLP, AFLP, RAPD, ISSR, SSR and others. In recent years, new technologies such as molecular chip and sequencing have been gradually applied. Frequently used parameters for isozyme and DNA analyses include allele frequencies and their distribution, variance of genotypic frequencies, average number of alleles per loci, effective number of alleles, percentage of polymorphic loci, Wright's inbreeding coefficient and Nei's diversity index, Shannon information index, coefficient of genetic differentiation and genetic distance.

1.2.2 Geographic variation of provenances

Most tree species in China are still in wild conditions and distributed in a wide geographical area with diverse growing conditions. Long-term adaptation, evolution and systematic development have resulted in significant differences in morphology, growth and adaptability, thus forming a rich Intra-species genetic variation. From the beginning of the 1980s China started to carry out a series of provenance trials for tree species. Up to now, provenance trials have been conducted for more than 70 important afforestation species such as *Pinus tabulaeformis, Pinus massoniana, Pinus taeda, Pinus koraiensis, Larix principis-rupprechtii, Pinus elliottii, Pinus yunnanensis, Larix gmelinii, Pinus armandii, Casuarina equisetifolia, Picea koraiensis, Taxodium distichum, Taxodium ascendens, Taiwania flousiana, Platycladus orientalis, Sassafras tsumu, Acacia mearnsii, Betula platyphylla, Ulmus pumila* etc. The research results showed: the majority of tree species in China had significant or very significant inter-population and intra-population genetic variation, and the variance components of inter- and intra-population genetic variation varied a lot among different species; most species displayed a significant geographical variation mainly reflected in morphological characteristics, growth, adaptability, and wood properties. The growth and adaptability were correlated to the locations and climatic factors of provenances, and most species manifested a clear pattern of latitudinal variation, while very few species showed a pattern of both latitudinal and longitudinal variation. Intra-species genetic variation of some typical species was summarized below:

Cunninghamia lanceolata is one of the major timber tree species in China's subtropical regions.

Research results showed: most traits of the species revealed a gradient trend from south to north, the adaptive traits such as phenological phases and cold tolerance were in close negative linear correlation with the latitudes. Growth and stress resistance were related to the climatic and ecological conditions and mainly in a trend of latitudinal variation. Clinal variation was found in growth, wood properties and branching characteristics.

Pinus massoniana is one of the major timber tree species in China's subtropical regions, the results of range-wide provenance trails showed: differences existed in growth, growth rhythm, phenological phases, disease and pest resistance, and the differences were related to the latitudes of provenances; the Intra-species genetic variation was in a gradient trend from south to north. The wood basic density displayed significant provenance differences, and its correlation with latitude was highly significant, gradually decreasing from north to south, but has nothing to do with longitude.

Pinus tabulaeformis is mainly distributed in northern China, and an important afforestation and gardening ornamental tree species. The results of range-wide provenance trails indicated: significant geographic variation existed in germination, phenophase, growth, morphology and cold resistance, and mainly in a pattern of continuous variation. Based on the climate ecotypes, at the same time taking the variation of parental generation into consideration, Pinus tabulaeformis was divided into 9 seed zones and 22 sub seed zones.

Platycladus orientalis is an important afforestation species in rocky mountain areas. Geographic variation of main traits was mainly in a latitudinal pattern, eastern and southern provenances grew faster than the Western and northern provenances, but with poorer drought and cold resistances. From north to south, the distribution area of the species can be divided into 5 provenance zones and 2 provenance regions, northeast and southwest. Significant differences were found among provenances in survival rate of planting and growth of young trees, with a higher survival rate of eastern and southern provenances than of western and northern provenances; in areas free of freezing damages, growth southern provenances was higher than northern provenances.

Populus tomentosa is endemic to China, mainly distributed in the region of Huang, Huai and Hai rivers, playing an important role in the forestry industry and ecological construction in the middle and lower reaches of the Yellow River. Research showed that, phenotypic variation in the species is extremely large; significant genetic variation existed both between and within provenances, and

the intra-provenance variation (80.26%) was significantly higher than the inter-provenances variation (19.74%); clonal variation within provenance was the main source of genetic diversity of *Populus tomentosa*. The species has a variety of forms of natural variation, e.g. Jiangan, Yixian, Pyramidalis, Truncate, Xiaoye, Henan, Mikong, Jingxi etc.

Ulmus pumila is an important timber species for afforestation in northern China. Range-wide provenance trials showed that, significant differences existed among provenances, and the growth decreased with latitudinal increase of provenances; provenances in the southern distribution in the basin of Yellow River and Huai River grew faster, and the northern provenances grew slower, revealing a pattern of one-way clinal variation while the cold resistance was in the opposite.

1.2.3 Genetic diversity

Isozyme and DNA marker analyses showed that most tree species have a wealthy genetic diversity, and the intra-species genetic diversity is mainly distributed within populations (60-90%), e.g. *Pinus tabulaeformis*, *Pinus massoniana*, *Larix principis-rupprechtii*, *Larix gmelinii, Larix olgensis*, *Pinus koraiensis* Sieb et Zucc etc. Different tree species have different distribution of diversity among populations, and species with no obvious inter-population differences include *Pinus massoniana* and *Larix gmelinii* etc.; species with significant inter-population differences include *Pinus tabulaeformis*, *Pinus armandii*, *Larix olgensis*, *Pinus koraiensis* Sieb et Zucc, *Quercus mongolica* etc. In recent 10 years, China has carried out analyses of genetic diversity using isozyme or DNA markers for more than 100 species, such as *Pinus massoniana*, *Pinus tabulaeformis*, *Cunninghamia lanceolata*, *Ulmus pumila*, *Davidia involucrata*, *Larix*, *Populus*, *Picea*, etc. (Appendix table 9). The results of the analyses of typical species are summarized as follows:

RAPD markers analysis of 12 geographical provenances of *Cunninghamia lanceolata* showed that the genetic distances among provenances ranged from 0.1932 to 0.4667. The cluster analysis showed that provenances of Guangdong Xinyi, Guangxi Wuzhou, Hunan Huitong, Hunan Jianghua, Guizhou Jinping and Jiangxi Quannan were in a group, provenances of Fujian Shaxian, Zhejiang Kaihua, Hubei Xianning and Anhui Xiuning were in a group, and Sichuan Yaan

and Shaanxi Nanzheng were respectively independent from other groups.

An isozyme analysis of natural populations of *Pinus massoniana* showed that the species has a wealthy Intra-species genetic variation, but the extent of differentiation among populations was relatively small, and most of the variation existed within populations, inter-populations variation accounted for only about 2% of the total variation, and population differentiation was not significantly related to geographic distances among populations.

An isozyme analysis of *Pinus tabulaeformis* showed that genetic diversity of *Pinus tabulaeformis* in natural populations had negative correlations with the latitude and longitude; genetic diversity was high in the central-western and southern parts of the natural distribution and was low in the northeastern part. Analysis of genetic structure of natural populations through RAPD and ISSR markers showed that certain degrees of variation and differentiation existed among populations, and more than 85% of the total genetic variation was found within populations, only 15% of the variation was among populations.

A study of isozyme variation of *Populus tomentosa* showed that: high similarity existed among provenances, 97.26% of genetic diversity was found among clones within provenances. The analysis by AFLP markers showed that: the percentage of polymorphic loci was 65.17%, the average number of alleles per locus was 1.991, the average effective number of alleles was 1.479, and the Nei's genetic diversity index was 0.289, the Shannon information index was 0.445. The average number of polymorphic bands of 9 provenances was 280.7, the average percentage of polymorphic bands was 60.49%, and significantly differences were found among provenances.

Isozyme analysis of *Quercus mongolica* found that: genetic diversity of natural populations was low (He = 0.099), lower than the average (He = 0.211) of natural populations of North American and European oaks. Analysis AFLP markers of natural populations of *Pinus bungeana* showed a relatively high genetic diversity mainly existing within populations (about 89.8%). A PCR based ISSR study of natural populations of *Betula platyphylla* found a relatively high genetic diversity within the species, the proportion of polymorphic loci was 80%, and the Shannon information

index was 0.4045.

1.3 Values of FGR

1.3.1 Main values of diversity

Forest genetic resources not only have direct values of providing products and ecological services, but also have indirect value of genetic diversity.

The diversity of genetic resources is the basis of genetic improvement. The genetic improvement can increase yield, improve quality, enhance resistance, and develop varieties through selection and breeding to meet the specific needs. For instance, the fast-growing provenances of *Cunninghamia lanceolata*, Rongshui and Sanjiang; over 300 chestnut varieties for edible and timber uses; more than 1,300 peony varieties for ornamental and medicinal uses; various types of thin-shelled, thick-shelled and leatheroid walnut; a number of different walnut varieties for edible, oil-yielding, beverages, antiques and timber uses. In addition, many other species also have diverse varieties.

Diversity of genetic resources is a driving force for evolution and adaptation to future changes, allowing tree species to adapt to environmental and climatic changes, and providing basic materials for developing different varieties adaptive to a wide range of environments and multiple uses. For example, the natural distribution of *Larix chinensis* has extended upwards by more than 50 m due to its adapted to the climate changes in recent several decades.

1.3.2 Priority for conservation

Based on the importance of species, current status of genetic resources and the extent of threat, a total 478 specie grouped into 4 categories are identified for priority conservation: 1) 87 timber species such as *Pinus massoniana*; 2) 38 economic, sand-fixing and water conservation species

such as *Hippophae rhamnoides*; 3) 43 exotic tree species such as *Robinia pseudoacacia*; 4) 310 species listed as level 1, 2, 3 of rare and endangered tree species by the government such as *Taiwania flousiana*. Species of the first 3 categories are currently the main species for forestry industry development and ecological construction, and those of the fourth category must be conserved in rescue (Appendix table 4).

The 478 tree species identified for conservation were divided into three priority levels: 1) 73 species which need urgent conservation. These species are important for forestry industry development and ecological construction. Populations of species are threatened or endangered, therefore the resources urgently need to be conserved, or species were listed as level 1 or 2 priorities for conservation. 2) 173 species, their genetic resources are important, but can be considered in a long-term point of view, or their importance is slightly low than the species with level 1 conservation priority, or listed as the level 2 conservation priority species. 3) 232 species, important to the forestry industries, or important to ecological environment and renewable resources, or listed as level 3 conservation priority.

1.4 The state of conservation

Since the early 1990s, China began to carry out FGR conservation and related researches. Up to date, a conservation system of FGR in line with China's actual condition has been preliminarily established by forming a framework of conservation and utilization frameworks backboned by the National FGR Platform and the national production bases of genetically improved seeds and plant stocks. Combination of *in situ*, *ex situ* and facility conservation was identified to be an effective and safe model of FGR conservation.

Priority of choosing conservation methods is set according to the following principles:

1) Priority is given to in situ conservation when target species has comparatively integral natural forests in its original distribution; ex situ conservation acts as the supplement or duplication for evaluation and utilization; and facility conservation acts as backup of the conservation.

2) *Ex situ* conservation is give priority when natural forests of the target species were severely destructed in the original distribution, or in a defective state, or with occasional artificial cultivation, the natural or secondary forests should be conserved as far as possible; and facility conservation acts as a backup of the conservation.
3) If target species remains only scattered individual trees, clumps of very few secondary defective forests in the original distribution, priority is given to *ex situ* conservation of the defective populations, at the same time the defective natural forest (land) should be conserved *in situ*; facility conservation acts as a backup conservation.
4) For species undertaken breeding or genetic improvement, all the breeding materials (including varieties) should be conserved, and priority should give to *ex situ* conservation; facility conservation can be carried out at the same time.

Since 2003, *in situ* conservation sites with population as conservation unit were set up in Heilongjiang, Hebei, Inner Mongolia (Autonomous Region), Shanxi, Ningxia (Hui Nationality Autonomous Region), Henan, Guizhou, Sichuan, Hubei provinces, and a total of 51 *in situ* conservation sites for species such as *Pinus bungeana*, *Thuja sutchuenensis*, *Tetraena mongolica* and other species were established. A network of *ex situ* conservation has been established based on existing forest flora and tree breeding zones with focuses on genetic variation within species which is the conservation unit. An *ex situ* conservations network consisting of 22 sites of multi-species ,13 sites of single-species with national priority, 131 sites of single-species with regional/local priority, 160 arboreta and botanic gardens have been established respectively in 5 climatic zones, i.e. cold temperate, temperate, subtropics, south subtropics and north tropics. In addition, a cold storage with limited capacity has been built. Up to date, a total of about 150,000 accessions of major tree species in form of large populations, provenances (stands), families, plus trees, clones and other genetic resources, and more than 2,000 species of arbors and shrubs, flower plants, bamboo and rattan have been conserved throughout the country.

1.5 Influencing factors

The main factors affecting diversity of FGR include over-exploitation and irrational utilization of forest resources, habitat deterioration, land use changes, genetic erosion and extreme weather events.

1) Over-exploitation and irrational utilization of forest resources lead to fragmentation and severe degradation of natural forests, loss of genetic resources of many rare species, and dramatic reduction of genetic diversity. For example, species like *Pterocarpus indicus*, *Phoebe bournei*, *Erythrophleum fordii*, *Dalbergia hupeana*, *Thuja sutchuenensis*, *and Castanopsis hystrix* have scattered defective natural stands only in some local areas, their forest resources almost exhausted and genetic resources are seriously threatened.

2) Habitat deterioration and land use changes lead to destruction of growing conditions, decline of adaptability, and accelerated loss of FGR. During the five years from 2004 to 2008, the area of forest land shifted to non-forest land due to deforestation, natural disasters, development preprograms reached 8.32 million ha, of which nearly 85% was reversed into agricultural uses. Forest degradation and habitat deterioration accelerated the loss of FGR.

3) Single model of afforestation, single species in plantations, large scale artificial plantings of single species or single clones and irrational transfer of seeds have worsened genetic erosion, leading to decline of species diversity and within-species genetic diversity. In existing plantations, just over 20 species were utilized, and *Cunninghamia lanceolata*, *Populus*, *Pinus massoniana*, *Larix* and *Eucalyptus* account for over 40% of the total plantation area. The diversity of plantations is increasingly lowered, and the stability of plantation stands is declined, imposing potential threat to sustainable forest management.

4) Frost, snowstorm, continuous drought and other extreme climates together with diseases and pests as well as forest fires constituted the cause for decline of FGR diversity. The snowstorm catastrophe occurred in south China in early 2008 damaged 18.60 million ha of forests, and the

wide-range severe drought occurred in the end of 2008 caused damages to 7.86 million ha of forests. In 2009, subject to extreme weather conditions and other factors, 11.57 million ha of forests were influenced by the occurrence of forest pests. With the accelerated pace of afforestation, the area of plantations increased rapidly, but forest disease and pests will also enter a period of frequent occurrences which will cause even more severe damages to forests, therefore, breeding for disease and pest resistance from the FGR will become more important.

1.6 Major problems, needs and priorities for future work

1.6.1 Major problems and needs

1) Collection and conservation of FGR is a basic, long-term, public welfare and strategic work, it needs to formulate policies concerning FGR conservation and sustainable utilization. Collection and conservation of FGR also requires long-term and stable financial support, it needs to increase the financial investment to promote effective conservation and rational utilization of FGR.

2) The dynamic changes of inter- and intra-species diversity of FGR are not clear, and there is a lack of technology for systematic dynamic monitoring. It needs to establish the monitoring and evaluation system of FGR as soon as possible, thus to realize the dynamic monitoring efficient management and sustainable utilization of FGR.

3) Collection, conservation and utilization of FGR involve multi-disciplines and multi-sectors, and severe interdisciplinary overlaps. It needs to establish a research and development center specially engaged in FGR research and conservation as soon as possible, to organize and coordinate nationwide FGR research and development activities, and to build a long-term and stable professional team.

1.6.2 Priorities for future work

1) Intensify FGR conservation, research and utilization, develop the system of technical standards for FGR, establish a national FGR cooperative, and continue to develop the National FGR Platform and the network of conservation banks, to promote ABS of FGR.

2) Carry out FGR surveys, documentation and cataloging, monitoring and evaluation. Identify priority species for conservation, carry out the protection, monitoring and evaluation of genetic diversity, strengthen monitoring of genetic erosion, and develop technical measures to prevent or reduce genetic erosion.

3) Carry out gene discovery and innovative utilization of the FGR. Carry out the evaluation and utilization of species with important and potential economic values, identify and exploit genes determining critical characteristics, develop new and superior germplasms, and to promote its utilization, improve the efficiency of FGR uses.

4) Intensity of dissemination and training of FGR, and improve public awareness towards its importance as well as to promote public participation and awareness of protection.

Chapter 2 The state of *in situ* conservation

In situ conservation is the main method of conserving genetic resources of species existing in natural forests and secondary natural forests, especially those with long growing cycle and difficulties in artificial cultivation. Nature Reserve-based *in situ* FGR conservation was started early in China. In the past 10 years, it has been developed rapidly and has achieved significant progress. China already started to carry out FGR surveys and inventories which are expected to complete in 2015. China has conducted a national wildlife resources survey, making clear about the resources and distribution of over 160 rare or endangered species (Appendix table 10). The survey found that the number of threatened and endangered species reached 1 200, about 70% of forest species have endangered populations, requiring urgent and intensified protection.

2.1 Types of *in situ* conservation

There are three types of *in situ* conservation of FGR in China: area, population and individual, each of which has different roles, functions, conservation units and management measures (Table 2-1).

Table 2-1, Types of in situ FGR conservation in China

Type	Specific forms	Roles and functions	Protection units and management measures
Area	Nature reserves, protected plots, forest parks, scenic areas	Reserve of biological species and shelter for rescuing endangered species, conservation of species diversity, genetic diversity and ecosystem diversity, continual, systematic and long-term observation,	Area as conservation unit, independent institution for management and administration, e.g. Nature Reserve Administration, Forest Park Administration. Usually protection and tourism development combined

Type	Specific forms	Roles and functions	Protection units and management measures
		studies of reproduction and domestication of rare species.	together. Mainly evolutionary FGR conservation.
Population	*In situ* conservation forest, natural forest for seed collection	Conservation of populations of trees with superior traits, the largest contribution to propagation and afforestation from *in situ* conservation, for both dynamic monitoring and evaluation and utilization.	Stand as conservation unit, usually managed by Nature Reserves or seed production bases, Observation and dynamic monitoring based on conservation, germplasm collection for research or production.
Individual	Ancient trees, rare trees	conservation of individual trees with superior characteristics, ornamental, ecological and history educational functions.	Individual as conservation unit, Afforestation Committee and Forestry Bureau are usually the competent authorities, maintained and protected by the owners, collection is not allowed except for research and educational purposes.

2.2 System of *in situ* conservation

2.2.1 Nature reserve

Up to 2010, China has established 2,588 different types of nature reserves, with a total area of 149 million ha, accounting for about 14.9% of the land area, increased by 125.8% and 69.1%

respectively in number and area compared to 1999 (Figure 2-1). The number and the area of nature reserves tended to be gradually stabilized.

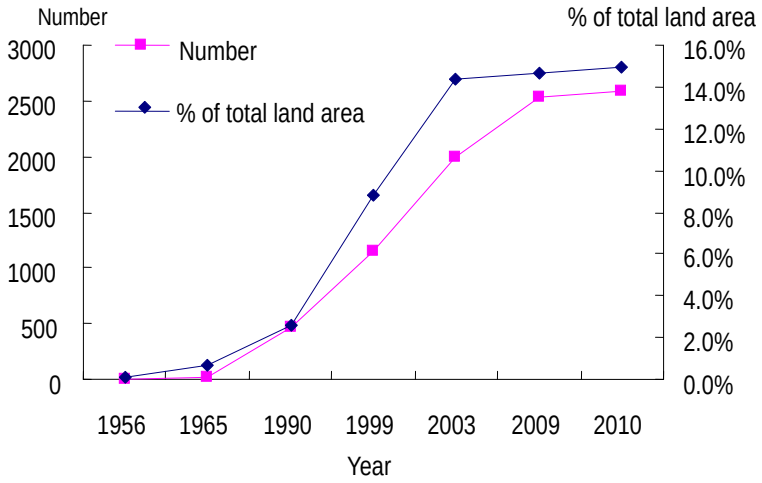

Figure 2-1, Development trends of nature reserves in China

There are 2,035 nature reserves in forestry sector, with a total area of 123.3 million ha, accounting for 78.6% and 82.8% respectively of the total number and the total area nature of reserves, covering about 90% of all types of Wild Fauna and Flora, 85% of terrestrial natural eco-system types and 65% of higher plant communities.

Up to 2010, more than 50,000 various types of protected plots were established of forests, wetlands, wildlife and their habitats, ancient and rare trees, cultural heritages and natural landscapes, with a total area of more than 150 million ha. The protected plots are mostly distributed in densely populated areas in southern China, mostly in small size but of great value for protection, and not suitable for the establishment of nature reserves. The protected plots are particularly suitable for protecting scattered rare and valuable endangered species.

Nature reserves of forestry sector accounted for 76.9% of the total area of *in situ* conservation, playing a main role (Figure 2-2). Compared to other forms of *in situ* conservation, nature reserve has intensity of protection, bigger size and more investments (Table 2-2).

The implementation of "Wildlife Conservation and Nature Reserve Development Program" and "Natural Forest Protection Program", brought the main habitats of more than 300 species of key wild woody plants into protection, stable artificial populations and communities have been established for over 1,000 species of wild plants, and breakthroughs have been made propagation of a number of endangered species. FGR conservation of precious, rare and endemic species in natural forests has been improved.

2.2.2 Forest park

Up to 2010, China has set up 2,583 Forest Parks at all levels with a total area of 16.78 million ha, accounting for 10.4% of the total area of *in situ* conservation (Figure 2-2). Among those, the total number of National Forest Parks has reached 747, and the total area reached 11.78 million ha. Forest Parks covered about 40% of wild plant types, 32% higher plant communities, about 10% of natural forest.

Table 2-2, Statistical comparison of in situ conservation types

Type	Number	Area (ha)	Conservation type	Protection intensity	Utilization intensity
All nature reserves	2588	149000000	Area	Higher	Low
of forestry sector	2035	123300000	Area	Higher	low
Protected plots	50000	1500000	Area	moderate	low
Forest parks	2583	16780000	Area	moderate	low
Scenery parks	885	18140000	Area	low	low
Seed production stands	>100	500000	population	moderate	high
In situ conservation forests	51	416	population	high	moderate
Ancient and rare trees	2850000	28500*	individual	high	low

*: The area of individual trees is calculated at about 100 m^2 of land.

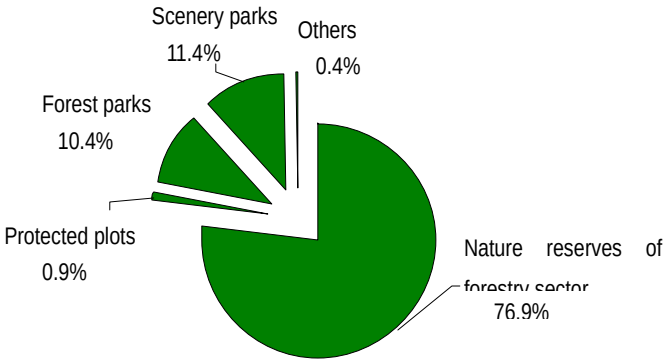

Figure 2-2, Different types of area percentage of in situ conservation

2.2.3 Scenery park

Up to 2009, China has established 885 scenery parks (excluding forest parks, nature reserves), consisting of 187 national-level scenery parks and 698 provincial-level scenery parks, with a total area of 18.14 million ha, accounting for about 1.89% of China's total land area, and 11.4% of the total area of *in situ* conservation (Figure 2-2). 21 national scenery parks including Taishan, Huangshan, Zhangjiajie, and Jiuzhaigou have been listed by the UNESCO as World Natural Heritage or the World Natural and Cultural Heritage.

In addition, China has built 199 National Wetland Parks, protecting about 0.92 million ha of wetland, part of the FGR in the National Wetland Parks are protected in appropriate ways.

2.2.4 *In situ* conservation forest

China has developed technical standards such as the "Technical codes of setting *in situ* FGR conservation sites", providing detailed specifications for selection of species and populations, size of conservation plots, characteristics of observation, collection of samples and subsequent protection measures of *in situ* conservation.

Endangered or threatened populations of a species are protected by *in situ* conservation, sample

populations of the species is taken as the conservation unit, in which target species should have more than 30 to 50 individuals normally blooming and fruit bearing. Since 2003, "The National FGR Platform" has set up 51 locations of *in situ* conservation for more than 40 species such as *Pinus bungeana*, *Thuja sutchuenensis* and *Tetraena mongolica* with populations as conservation unit in some provinces (autonomous regions), each location with an area of 3-10 ha. The conservation stands and sample individuals were measured, photographed, seed collected and labeled for protection, follow-up observations will be carried out every 10 years. *in situ* conservation stands can be set up either inside or outside Nature Reserves, for example, 6 *in situ* conservation stands of *Pinus bungeana* have been set up, and only one of them is located in nature reserve.

In addition, approximately 50 million ha of seed collection forests of more than 100 species have been established, of which some natural forests are basically *in situ* conservation stands. And information and actual materials of these *in situ* conservation forests have been made available for sharing as services provided by the National FGR Platform.

2.2.5 Ancient and rare trees

Up to 2009, China has 2.853 million ancient and rare trees across the country except nature reserves, forest parks, and the two major state-owned forest regions in the northeast and the southwest, displaying an increase of 7 times compared with 339,000 trees registered in the 1999 survey. The number of ancient trees was 2.847 million, accounting for 99.8% of the total; and the number of rare trees was 5,758, accounting for 0.2% of the total. According to the national standards of grading ancient trees, there were 51,000 level-1 national ancient trees (age ≥ 500 years), accounting for 1.8% of the total number; 1.043 million level-2 national ancient trees (200 years ≤ age <500 years), accounting for 36.6% of the total; 1.753 million level-3 national ancient trees (100 years ≤ age <200 years), accounting for 61.6% of the total (Table 2-3).

On the basis of the inventory of ancient and rare trees, a database and a digitalized photo library

of the ancient and rare trees have been established, together with a software package developed specifically for managing the information, and a national information network has been established for protection and management of ancient and rare trees.

Table 2-3, Statistics of ancient and rare trees

Level	Age (year)	Number (tree)	% of the total
Level-1 ancient tree	≥500	51000	1.80%
Level-2 ancient tree	200-499	1043000	36.60%
Level-3 ancient tree	100-199	1753000	61.60%
Sum		2847000	99.80%
Rare trees		5758	0.20%
total		2853000	100%

2.3 Techniques for *in situ* conservation

2.3.1 Setting of *in situ* conservation forest

1) Priority species for *in situ* conservation was determined by the existing quantity of the species, the socio-economic value and the depletion of FGR.
2) The number of populations or stands of target species, the size of area and effective number of trees for in situ conservation were determined according to the result of genetic diversity analysis, combined with data obtained from field surveys.
3) Use GPS and GIS technologies to determine the 3-D positions of *in situ* conservation plots and individual trees, and labels, reference posts and maps were used to ensure the accuracy of positioning and easy for repeated surveys and monitoring of the *in situ* conservation forests.

2.3.2 Monitoring and evaluation and maintenance of *in situ* conservation

1) Populations and individual trees were measured at the same time on species composition, age

structure, regeneration ability, succession direction, growth traits, diseases and pests, fruiting ability, photos were taken with information on the stands recorded, all information was put into databases.

2) Using non-destructive sampling methods to collect sample materials for observation, research, facility conservation and utilization.

3) For species difficult to propagate and with very limited number trees, studies on propagation techniques were carried out, such as breaking dormancy, removal of hard seed coat, promoting pollination and fruiting, improving micro environment for germination.

4) A co-management system was established with owners, e.g. nature reserves and forest farms. Relying on the owners to conduct patrol, observation, and disease and pest control, at the same time, the national FGR project and local responsible agencies jointly conduct regular observations, diagnosis and dynamic monitoring and analysis for long-term maintenance of the stability and integrity of the *in situ* conservation.

2.3.3 Utilization of conserved resources

1) Carry out propagation studies on the rare and endangered species within Nature Reserves in older to carry out *ex situ* conservation and artificial reproduction for utilization.

2) Collecting seeds, pollen or other vegetative organs from plus trees, superior provenances, ancient and rare trees, *in situ* conservation forests and other valuable wild trees, mainly for resource conservation and scientific researches.

2.4 Information systems

China has established a website of Chinese nature reserves (http://www.nre.cn), providing information on many wild forest resources. A website for the National FGR Platform was also established (http://www.nfgrp.cn), providing information on 1,200 accessions of *in situ* FGR conservation. The development of database on forest parks was officially launched in 2010.

Since 2003, trainings on *in situ* FGR conservation have been carried out regularly in order to enhance capacity building of institutions and professional teams.

2.5 Main problems, needs and future priorities

2.5.1 Main problems and needs

1) Lack of adequate financial support and relevant policies limited the establishment and in-depth studies of *in situ* conservation forests acting as FGR functional areas, and need sustained and steady capital investment and policy support.
2) A large number of *in situ* conserved FGR have not been studied systematically, the genetic resources have not been effectively utilized. Due to the lack of technical basis for determining *in situ* conservation unit, it needs to improve the technical system for *in situ* FGR conservation.

2.5.2 Future priorities

1) Carry out assessment and monitoring of *in situ* conserved FGR, establish a system of FGR inventory and sampling survey, evaluate genetic diversity of *in situ* conserved populations, monitoring the dynamic changes.
2) Carry out *in situ* conservation management for the purpose of maintaining genetic diversity of the target species. For those important FGR not ready to establish nature reserves or protected plots, protection sites can be set up within the original distribution in order to strengthen the management of *in situ* conservation with population as conservation unit, therefore to improve the efficiency of FGR management and utilization.
3) Strengthen technical studies of *in situ* FGR conservation; improve the technical system of protection. Focuses will be put on establishment and monitoring of *in situ* conservation forests, restoration and rehabilitation of endangered populations of *in situ* conservation, mechanism of threatening and propagation, evaluation and exploitation of FGR.

Chapter 3 The state of FGR *ex situ* conservation

Ex situ conservation is an important way of conserving FGR, includes *ex situ* conservation forest and facility storage conservation, the former is the main form of *ex situ* conservation and the later is a supplement to the former. In China, most tree species under cultivation are conserved in *ex situ* conservation forest. China has built a preliminary *ex situ* FGR conservation system including multi-species collection, single-species collection, local (regional) collection and low-temperature storage. A large amount of FGR has been conserved by the system, and activities of FGR characterization, evaluation, exploitation and utilization of these conserved FGR have been conducted.

3.1 Types of *ex situ* conservation

3.1.1 *Ex situ* conservation bank

Ex situ conservation bank refers to conservation forests or nurseries used to keep FGR as living trees, including those established for growing FGR collections, plantations as production bases of genetically improved seeds or propagation materials, experimental plantations for genetic improvement, botanic gardens and arboreta for display, dissemination of science and taxonomic studies.

Based on roles and functions, *ex situ* conservation banks are grouped into four types, i.e. multi-species collection, single-species collection, local (regional) collection, and display collection (Table 3-1). Institutions engaged in *ex situ* conservation mainly include research institutes, educational organizations, production and management agencies of seeds and propagation materials, botanical gardens and arboreta.

Table 3-1: Types of ex situ FGR conservation in China

Type	Establishment	Status of diversity
Multi-species collection	Established by the National FGR Platform	Samples of populations, families and individuals representing Intra-species genetic diversity.
Single-species collection	Established by specific FGR projects	Same as above
Local (regional) conservation	By local agencies engaged in seed and propagation material production	Selected or improved breeding and propagation materials.
Display collection	By botanical gardens, arboreta	Samples of species representing inter-species diversity, science dissemination and taxonomic studies

3.1.2 Facility storage conservation

Facilities storage conservation refers to the low-temperature storages which conserve seeds and other propagation materials. Compared to *ex situ* conservation bank which conserves living plants, facility storage conservation has advantages such as less space demanding, long-term conservation, high security due to central and intensive control, large storage capacity.

3.2 The system of *ex situ* conservation

As described earlier in this chapter, *ex situ* conservation consist of *ex situ* conservation banks and facility storages conservation. *Ex situ* conservation banks include multi-species collection, single-species collection, local (regional) collection, and display collection.

3.2.1 Multi-species collections

Multi-species collections are conservation banks established by the National FGR Platform, featured with early establishment, large quantity of conserved FGR, highly representative and typical, playing a fundamental and central role in FGR conservation. At present, 22 sites of

multi-species collections have been built respectively in middle temperate, warm temperate, subtropics and tropics of China, with a total area of 420.6 ha (Table 3-2) and a number of more than 2,000 species including over 120 major species (Appendix Table 11). In addition, studies in FGR collection, propagation and conservation have also been carried at different levels of species/population, population/family, population and individual.

Table 3-2: System of Ex situ FGR Conservation in China

Conservation Method	Collection Types	No.	Name and location	Area (ha)	Target species	No. of major species	No. of accessions
Ex Situ Conservation Banks	Multi-species collection	1	FGR conservation bank of the middle-temperate (Heilongjiang)	20.1	Major tree species in mid-temperate	22	4,420
		2	FGR conservation bank of northwestern warm temperate (Inner Mongolia)	12.3	Desert trees and shrubs species	10	1,680
		3	FGR conservation bank of warm temperate plains and mountain regions (Beijing)	9.3	Major timber and gardening ornamental tree species	25	984
		4	FGR conservation bank of middle warm temperate (Shanxi)	22.5	Major afforestation and economic tree species	15	2,534
		5	FGR conservation bank of eastern warm temperate (Shandong)	21.0	Afforestation species like Poplar and economic species	16	2,000
		6	FGR conservation bank of southern warm temperate (Henan)	17.0	Endemic species	25	2,211
		7	FGR conservation bank of western warm temperate (Shanxi)	14.1	Endemic species, rare and endangered species	12	620
		8	FGR conservation bank of unique economic trees in warm temperate desert (Xinjiang)	3.3	Endemic economic species	7	222
		9	FGR conservation bank of northern north-subtropics (Jingshan, Hubei)	56.7	Endemic species, rare and endangered species	24	10,023
		10	FGR conservation bank of eastern north-sub-tropics (Nanjing and Xuzhou of Jiangsu Province)	15.8	Afforestation species in Plains like *Populus, Salix, Ginkgo biloba* etc.	12	2,450
		11	FGR conservation bank of southern north-subtropics (Hunan)	8.3	Endemic, exotic, economic species,	15	858
		12	FGR conservation bank of eastern middle-subtropics (Zhejiang)	9.2	Economic and rare species	12	8,208
		13	FGR conservation bank of western middle-subtropics (Sichuan)	26.2	Major afforestation and rare species	26	8,000
		14	FGR conservation bank of south subtropics (Guangxi)	20.1	Major afforestation, rare and exotic species	18	1,089
		15	FGR conservation bank of subtropics (Jiangxi)	46.8	Endemic indigenous tree species, rare and endangered species	26	2,000
		16	FGR conservation bank of tropics (including south subtropics) (Guangxi)	23.9	Rare species	16	1,300
		17	FGR conservation bank of exotic trees (CAF, Beijing)		Exotic species	12	1,100
		18	FGR Conservation bank of flower plants (CAF, Beijing)		Landscape tree species, woody flowers	46	3,170
		19	FGR Conservation bank of evergreen broad-leaved tree species of middle subtropics (Zhejiang)	12.0	Endemic species	22	1,788
		20	FGR conservation bank of endemic tropical tree species (Guangdong, Hainan)	19.0	Tropical endemic species	30	2,444

		21	FGR conservation bank of economic tree species of southwest China (Yunnan)		23.0	Economic species	18	2,858
		22	FGR conservation bank of Bamboo and rattan (Anhui, Hainan)		40.0	Bamboo, rattan	15	582
			Total		420.6			60,145
	Single-species Collection	1	National FGR conservation bank of *Castanea mollissima*			*Castanea mollissima*		
		2	National FGR conservation bank of *Populus* (Jiangsu)			Populus		
		3	National FGR conservation bank of *Camellia japonica*			*Pinus sylvestris* L. var. *mongolica*		
		4	National FGR conservation bank of *Camellia japonica* g			*Camellia japonica*		
		5	National FGR conservation bank of Bamboo			Bamboo		
		6	National FGR conservation bank of *Cunninghamia lanceolata*			*Cunninghamia lanceolata*		
		7	National FGR conservation bank of *Pinus massoniana*			*Pinus massoniana*		
		8	National FGR conservation bank of *Camellia oleifera*			*Camellia oleifera*		
		9	National FGR conservation bank of Populus (Hunan)			Populus		
		10	National FGR conservation bank of *Alsophila spinulosa*			*Alsophila spinulosa*		
		11	National FGR conservation bank of *Picea asperata*			*Picea asperata*		
		12	National FGR conservation bank of *Lycium chinense*			*Lycium chinense*		
		13	National FGR conservation bank of *Pinus sylvestris* L. var. *mongolica*			*Pinus sylvestris* L. var. *mongolica*		
	Regional Conservation	Genetically improved species bases		Seed Orchards	19,600	Other 131 national key genetically improved species bases		
				Cutting Orchards	18,100			
				Experimental and demonstration Forests	222,100			
				Seed stands	146,100			
		Seed collection bases		Seed collection bases of all levels	630,000			
	Display collection			160 botanical gardens and arboreta				
Facility Storage	Low-temperature storage			Tree. bamboo and rattan		Indigenous tree species	20	4,107

A large quantity of FGR have been collected and conserved since the 1980s. The National FGR Platform alone has conserved 60,000 accessions of 2,116 species (Table 3-2). Among them, 7 species with the number of accessions exceeding 1,000 are *Cunninghamia lanceolata, Keteleeria fortunei, Pinus massoniana, Pinus sylvestris* L. var. *mongolica, Larix logensis, Larix kaempferi, Betula alnoides* which are all main afforestation species, and 82 species have a number of accessions between 100 and 999 (Table 3-3). Among the conserved species, 94% are indigenous and 6% are exotics. In addition, a large quantity of FGR has been conserved at various seeds and propagation materials production bases at different locations.

Table 3-3: Quantity of conservation by the National FGR Platform

No. of accessions	No. of species conserved		Quantity of FGR conserved	
	No. of species	%	No. of accessions	%
＞1,000	7	0.33%	17,408	35.14%
100～999	82	3.88%	23,282	47.00%
50～99	34	1.61%	2,299	4.64%
10～49	123	5.82%	2,551	5.15%
1～9	1,869	88.37%	3,996	8.07%
Total	2,116	100%	49,536	100%

3.2.2 Single-species collections

Single-species collections are conservation banks established by specific projects of the SFA. These conservation banks conserve FGR of a single tree species, and act as supplements of the multi-species collections, mainly used to construct base populations for tree breeding program of the species. China has already built national FGR conservation banks of 13 species, including *Cunninghamia lanceolata, Pinus massoniana, Populus, Picea asperata, Pinus sylvestris* L. var. *mongolica, Bamboo, Castanea mollissima, Lyeium chinense, Camellia japonica, Camellia oleifera, Alsophila spinulosa* and other species (see Table 3 - 2).

3.2.3 Local (regional) collections

Local (regional) collections refer to the production bases of tree seeds and propagation materials

including the genetically improved, where breeding materials or improved propagation materials are conserved and the FGR conservation is combed with breeding. Up to now, China has established a series of production bases, 630,000 ha for seed collections and 409,100 ha for improved materials, among which 131 locations (161 stands in total) are the national priority bases for improved materials. A total of 44 species such as *Cunninghamia lanceolata, Pinus massoniana, Pinus tabulaeformis,* genus *Larix* for timber and other species (genera) for non-timber uses (Figure 3-1). The Southwest Conservation Bank of Plant Germplasm Resources built in Kunming, Yunnan province, conserved a large number of FGR.

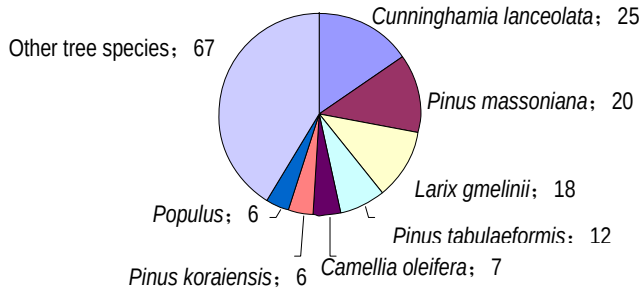

Figure 3-1: Species and total number of stands conserved in the national priority bases for improved reproduction materials

3.2.4 Display collections

Display collections include botanical gardens and arboreta used to display collection of species, to carry out relevant researches and dissemination of scientific knowledge, at the same time they also play the role of collecting and conserving FGR as the local (regional) collections. More than 160 botanical gardens and arboreta have been established mostly in the eastern and central regions of China. These display collections are conserving a large number of species, and about 20,000 species of higher plants have been introduced and conserved in Botanical Gardens of Chinese Academy of Sciences. Although the Botanical Gardens and Arboreta are conserving a large number of species, however, the number of individuals within species is small. The focus of

display collections is on inter-species diversity, and the function of conserving Intra-species diversity is limited.

3.2.5 Low-temperature storage facility

Although China currently has not yet established a national low-temperature storage facility for FGR conservation, but some of provinces (regions) have established small-scale low-temperature storage facilities, with relatively less advanced equipments. In 2001, the Forestry Research Institute of the CAF built a small-scale low-temperature storage with a storage capacity bank of 30 m^2 and temperature range of 0-5°C, conserving seeds of *Picea asperata, Pinus bungeana, Pinus massoniana, Pinus tabulaeformis, Gleditsia sinensis*，*Sophora japonica*，*Melia azedarach, Prunus mandshurica, Caragana korshinskii* and others. In 2011, a low-temperature storage facility for Bamboo genetic resources was built in Huangshan, Anhui Province by the Center for Bamboo and Rattan, with a storage capacity of 112 m^2 and temperatures of -20 °C and 4 °C respectively.

3.3 Techniques of *ex situ* conservation

Techniques of *ex situ* conservation mainly refer to technical measures related to the construction of conservation forest. As for the conservation techniques of the cryopreservation and ultra-dry conservation facilities, only few pilot studies have been carried out with no practical applications. Techniques in constructing *ex situ* conservation forest mainly include the evaluation and selection of target species for conservation, the determination of sample size, and the configuration of the conservation stands.

3.3.1 Priority setting for *ex situ* conservation

For the species conserved in the multi-species collections, the priority for conservation is determined by the level of threatening, the value of utilization, the richness of genetic diversity and representativeness of the target species. The priority of conservation for the species in the

single-species collections and the local (regional) collections is determined by the economic value, the scope of distribution and the scale of cultivation. The priority for those in the display collections is determined by the values of research, dissemination of scientific knowledge and landscaping.

3.3.2 Models of *ex situ* conservation

Ex situ conservation can be carried out in different models according to the principle of combining conservation, evaluation and utilization together: 1) Conservation of large population for species with wide distribution and results obtained from provenance trails; 2) Conservation of population combining conservation, evaluation and utilization purposes for species with a moderate range of distribution and no provenance trials; 3) Conservation of population with family configuration for seed orchard trees which were not the selected plus trees or have not been provenance tested; 4) Conservation of population of small samples (provenances) for species with no provenance trials and successfully introduced important exotic tree species; 5) For those tested superior families, breeding population with family configuration can be constructed as conservation population; 6) Conservation combining progeny test, conservation and utilization of selected families; 7) Conservation of families as reproduction population for those tested families to be used for establishing seedling seed orchards or seed stands; 8) Conservation of plus trees, clones for all types of genotype conservation; 9) Conservation of reconstructed populations for endangered species, scattered species or threatened populations; 10) Conservation of composite populations for shrub species with no studies in breeding.

3.3.3 Sampling strategies on *ex situ* conservation

Sample size was determined according to the range of distribution of the target species. 5-7 populations were conserved for species with less than 200,000 ha of distribution; 7-9 populations for species with 200,000 to 500,000 ha of distribution; 9~13 populations for species with 500,000 to 800,000 ha of distribution; 13~17 populations for species with more than 800,000 ha of distribution. 27-33 individual trees were conserved for families within populations; 23-30 individual

trees were conserved for individuals within families planted in family plots with multiple replications; 3-5 ramets per site were conserved for clones.

3.3.4 Utilization of conserved FGR

Sharing and utilization of FGR conserved *ex situ* were carried out in the following ways: collaborative researches, exchanges, distribution and allocation by administrative permit, and trading, for example, the propagation material produced by local (regional) collections were distributed or allocated to production institutions for propagation and utilization, and the National FGR Platform started to provide actual FGR to the public since 2008, including sharing for public welfare, sharing as exchanges, sharing through trading, sharing as administrative permit, sharing through collaborative research. These have changed the traditional way of sharing conserved FGR as internal sharing through inter-agency joint conservation and exchange of FGR. Up to 2010, more than 5,000 accessions of FGR have been provided to domestic research institutions, enterprises and individuals.

3.4 Collection and conservation approaches

1) Collection and conservation by genetic improvement research projects. Genetic improvement have been carried out for more than 100 tree species, including *Cunninghamia lanceolata, Pinus, Larix, Populus, Salix, Paulownia, Juglans regia, Castanea mollissima, Camellia oleifera, Phyllostachys pubescens* and many others. A large number of provenances, plus tree, families, clones and varieties have been conserved in the process of genetically improvement,

2) Collection and conservation by FGR research projects. Since the 1980s, China started researches on the collection and conservation of FGR and established the national cooperative network to carry out the construction of conservation banks. Up to now, 22 FGR conservation banks have been established in different climate zones of China, which conserves populations (provenances), families and individuals (clones) of indigenous species,

mainly including species (genera) such as *Cunninghamia lanceolata, Pinus massoniana, Pinus sylvestris* var. *mongolica, Pinus bungeana, Pinus tabulaeformis, Picea asperata, Larix, Populus, Salix, Juglans mandshurica, Liriodendron chinense, Alnus cremastogyne, Ginkgo biloba, Melia azedarach, Castanopsis hystrix, Gleditsia sinensis* etc.

3) Collection and conservation by seed and seedling production programs as well as for FGR conservation programs. In recent years, China has built a number of national priority production bases of genetically improved trees and national level FGR conservation banks. In 2009, the SFA approved 131 national priority production bases of genetically improved trees and 13 national FGR conservation banks. China also implemented a number of FGR conservation projects such as the "Tropical FGR Conservation Bank Project", the "Subtropical FGR Conservation Bank Project", which collected and conserved a large number of indigenous tree species such as *Bamboo, Schima superba, Camellia oleifera, Lycium chinensis, Castanea mollissima, Camellia japonica* and many others.

4) Collection and conservation by research projects in introduction of exotic tree species. China has introduced *Eucalyptus, Acacia, Pinus elliotii, Pinus taeda, Pinus caribaea, Populus, Tectona grandis, Casuarina equisetifolia* and other tree species. The research projects have collected and conserved FGR such as provenances, varieties, clones during the process of introduction and cultivation.

5) Collection and conservation by Botanical Gardens (Arboreta). Over 160 Botanical Gardens and Arboreta have been established throughout China, which systematically collected and conserved a large number of FGR with species as the conservation unit.

3.5 Documentation and information system

Since 2004, the "National FGR Platform" developed more than 20 FGR related technical standards, including description standards, codes and criteria. The standards constituted a unified

system of FGR classification, documentation and description. Some of the standards have already become the national standards or forestry sector standards. The contents of documentation and digitalized description mainly include passport information, and other information on basic characteristics, conservation institution, sharing approaches, characterization and descriptions. The National FGR Platform also provides information sharing and services through its web portal (www.nfgrp.cn).

3.6 Major problems, needs and priorities for future work

3.6.1 Major problems and needs

1) *Ex situ* conservation is a long-term basic and systematic work involving collection, conservation, research, information processing and other aspects of FGR, and there is an urgent need to strengthen capacity building by establishing a stable personnel team with improved overall abilities.

2) Techniques for long-term, safe and efficient conservation, and monitoring, evaluation and utilization of *ex situ* conservation and low-temperature storages still need to be improved. It is urgently needed to establish a national cooperative for FGR conservation, evaluation and utilization, to strengthen the coordinating and management, and to develop a complete system of technical standards. It is also needed to establish a stable and long-term mechanism of financial input, and to build national low-temperature storage and supporting facilities.

3) The technologies for *ex situ* conservation and low-temperature storage facilities are relatively legged behind. It is needed to carry out researches on related theories and technologies, to maintain genetic diversity of *ex situ* conservation forest, and to extend the viability and germination rate of seeds conserved in facility storages.

3.6.2 Priorities for future work

1) Improving the system of *ex situ* conservation. Through implementation of the "National FGR Platform", the development of production bases of seeds and seedlings and the special

investment projects to improve multi-species collections, single-species collections, local/regional collections and low temperature storages.

2) Carrying out in-depth studies in monitoring and evaluating of genetic diversity in *ex situ* conservation forests, monitoring and maintaining the seed vigor in low-temperature storages and applications of geographic information systems, developing and revising technical standards for *ex situ* FGR conservation and improving the efficiencies of management, decision-making, scientific research and safe conservation.

3) Improving the information system of the National FGR Platform; increasing information and actual FGR sharing; further strengthening documentation and integration of FGR; improving the efficiency of utilizing FGR conserved *ex situ* and promoting sharing of information and actual FGR.

Chapter 4 The state of utilization and sustainable management of FGR

FGR is renewable and an important part of biodiversity resources, and the basic material for the forest tree breeding researches. Science-based and rational management and utilization of FGR have significant implications in safeguarding sustainable development of agriculture and forestry production, promoting ecological stability, breeding new varieties, poverty alleviation and guaranteeing of food security.

4.1 Management and utilization of conserved FGR

4.1.1 Utilization

The ultimate goal of FGR conservation is to utilize these resources, and to bring economic, ecological and social benefits for the socio-economic development. Especially the research and development of vegetative propagation techniques, have led to the solution of the bottlenecks of propagation difficulties and small population sizes of some species. Research of propagation techniques and utilization of FGR have been carried out for more than 100 major rare and endangered species, including *Liriodendron chinense, Taxus chinensis, Davidia involacratu, Cercidiphyllum japonicum, Lindera flavinervia, Abies beshanzuensis, Cathaya argyrophylla* etc. Breakthroughs in propagation techniques have led to continual expansion of population size of endangered species, direct provision of plant materials needed for exploitation and utilization, therefore to relieve the pressures on natural resources and promote the protection and conservation of FGR of endangered tree species.

For FGR with important economic value and superior characteristics including certificated genetically improved trees, new varieties and local varieties, and superior propagation materials, production bases (seed stands, seed orchards, cutting orchards, experimental and demonstration forests) were established to produce improved seeds and propagation material, thus to achieve extended utilization of the resources. Up to 2010, China has established production bases of

improved trees of 409,100 ha in total, among which 19,600 ha were seed orchard, 18,100 ha were cutting orchard, 222,100 ha were various experimental and demonstration forests, 146,100 ha were seed stands; China has also establishment seed collection bases of 630,000 ha; and 336,000 nurseries with a total area of 688,000 ha (Table 4-1).

From 2001 to 2010, the average annual harvested tree seeds in China amounted to 23.51 million kg, annual number of cuttings produced from cutting orchards and clonal propagation nurseries averaged at 635 million and 1.2 billion respectively, and 13.5 billion of various vigorous plant stocks (Table 4-2). These resources are mainly used for growing short-rotation fast growing and high yielding industrial plantations, economic forests, pulpwood plantations, special purposed forests and other afforestation projects. The average growth gain of improved timber trees was more than 10%, and the average yield gain of improved economic trees was more than 15%.

Table 4-1, Exploitation and Utilization of Genetically Improved Trees

Utilization Methods		Number	Area (ha)	Materials of genetically improved trees
Total			2,133,000	
Production bases of improved trees	Seed orchards		19,600	Progeny tested superior families, selected plus trees and introduced superior families.
	Cutting orchards		18,100	Bred and introduced superior varieties and clones of *Juglans regia, Ziziphus jujuba, Populus tomentosa, Ginkgo biloba, Castanea mollissima*.
	Seed stands		146,100	Superior stands of *Pinus, Larix, Cunninghamia lanceolata, Quercus, Betula platyphylla*.
	Experimental & pilot forests		222,100	Experiments and demonstrations of timber, economic and precious tree species.
Total of above		751 (2007)	409,100	Superior provenances of *Larix, Pinus, Platycladus orientalis, Picea asperata, Juniperus rigida, Eucalyptus, Robinia pseudoacacia, Cunninghamia lanceolata*.
Seed collection bases		663 (2007)	630,000	Superior provenances of *Pinus, Cunninghamia lanceolata, Larix, Eucalyptus, Platycladus orientalis, Picea asperata, Pinus bungeana, Juniperus rigida, Robinia pseudoacacia*.
Various nurseries		336,000 (2010)	688,000	Superior provenances of *Pinus, Larix, Cunninghamia lanceolata, Eucalyptus, Platycladus orientalis, Picea asperata, Juniperus rigida, Robinia pseudoacacia*.

Data Sources: China's Forestry Statistical Yearbook

Table 4-2, Yield of improved seeds and propagation materials in recent 10 years

Year	Seeds by seed collection bases (million kg)	Production bases of improved varieties of forest tree				Yield of strong seedlings (billion plants)
		Seed by seed orchards (kg)	Seed by seed stands (million kg)	Cuttings by cutting orchards (billion)	Cuttings by clonal propagation nurseries (billion)	
2010	6,46	620,000	1,29	1.19	0.66	13,1
2009	5,91	790,000	1,78	0.77	0.55	12,5
2008	9,62	990,000	2,28	0.61	0.38	12,5
2007	12,12	360,000	1,66	0.25	0.83	13,3
2006	10,29	360,000	1,33	0.3	1.5	12,4
2005	11,86	530,000	2,05	0.2	1.8	13,9
2004	11,25	360,000	1,54	0.4	2.4	13,5
2003	9,48	1,560,000	1,99	1.4	0.3	16,8
2002	8,49	1,038,000	1,292	1.2	3.5	
2001	7,58	477,000	1,47	0.027	0.84	
Average	9,306	708,500	1,6682	0.635	1.2	13,5

Data Sources: China's Forestry Statistical Yearbook

4.1.2 Restraining factors

For the utilization of the conserved FGR, major restraining factors include:

1) Long production cycle and high cost. The cost of producing seeds or scions/cuttings of the conserved FGR (including genetically improved trees) was high, the high cost led to reduced demand.
2) Insufficient supply of superior FGR. Under developed propagation techniques and simple propagation facilities led to quality and quantity of superior trees insufficient to meet the need by large-scale extension and utilization. Huge benefits can be gained from exploitation and utilization of some rare tree species with high economic values, however, due to the very limited resources, poor propagation techniques or small production scale, the demand by exploitation and utilization thus cannot be met.
3) A benefit-sharing mechanism needs to be established and improved. The lack of policies and regulations for protection of intellectual properties related to genetic resources, and the lack of

effective mechanisms of sharing responsibilities, rights and interests between suppliers and users of the genetic resources, have led to that the suppliers cannot benefit from the exploitation and utilization of the genetic resources whereas the users cannot get use right of the genetic resources.

4.2 Breeding and genetic improvement

Since the 1980s, China carried out systematical genetic improvement researches on the main afforestation tree species, and provenance trials and genetic improvement studies have been conducted for over 100 species, including coniferous or broadleaved timber species of *Cunninghamia lanceolata, Pinus, Larix, Populus and Salix,* ornamental species of *Liriodendron chinense, Magnolia denudata*, woody food and oil-yielding species of *Juglans regia, Camellia oleifera*, protection species of *Hippophae rhamnoides, Caragana Korshinskii, Haloxylon ammodendron*, biomass energy species of *Vernicia fordii* and *Jatropha curcas*, and Bamboo and Rattan. (Appendix table 13). Also studies of introduction and domestication of important exotic trees species have been carried out, successful exotic tree species include *Eucalyptus*, exotic Pines and Acacias, largely enriched the number of timber and afforestation tree species in China.

4.2.1 Breeding techniques

Selection of provenances, families and plus trees: China has carried out plus tree selection, provenance trials, progeny tests or clonal tests for more than 70 important afforestation tree species, such as *Cunninghamia lanceolata, Pinus massoniana, Pinus tabulaeformis, Pinus koraiensis, Larix gmelinii, Pinus caribaea, Betula platyphylla, Liriodendron chinense*, a large number of improved provenances, families and individuals were selected, laying a solid foundation for genetic improvement of these species (Appendix table 14). For example, three times of large-scale provenance trails were carried out for *Cunninghamia lanceolata*, involving more than 200 provenances. The "Standards for nationwide zoning *Cunninghamia lanceolata*" based on results from the provenance trials; 9 provenance regions were identified for

Cunninghamia lanceolata, a number of superior provenances of high and stable yield were obtained with an average genetic gain of 16% for the volume. A range wide provenance trial was established *for Pinus massoniana* involving 28 trial sites and 142 provenances, provenance regions (3 zones and 6 regions) were identified based on results from the provenance trial, a number superior provenances were selected and used in afforestation nationwide, with a volume gain of more than 15%.

Cross-breeding: China launched a systematic, planned crossbreeding program, in which a large number of Inter-species or Intra-species hybridization experiments have been conducted for species of *Populus, Salix, Pinus, Larix, Liriodendron, Taxodium ascendens , Cryptomeria fortunei, Taxodium distichum* and other species (genus), a large number of superior hybrid progenies, including hybrid *Populus*, hybrid *Salix*, hybrid *Pinus* and hybrid *Liriodendron*, hybrid of *Taxodium mucronatum* × *Cryptomeria fortunei*, *Taxodium* 'zhongshansha 302' were developed; with obvious hybrid vigor. For example, the hybrid *Liriodendron* has a faster growth and a stronger resistance than the parents.

Clonal Selection: China has undertaken researches of techniques for clonal selection for important afforestation tree species, economic tree species and ornamental gardening tree species; and carried out large-scale researches of clonal development for trees of *Populus, Salix, Cunninghamia lanceolata, Eucalyptus, Robinia pseudoacacia, Ulmus pumila, Larix, Liriodendron chinense, Hippophae rhamnoides, Sophora japonica, Ginkgo biloba*. A number of superior clones, such as the Triploid series of *Populus tomentosa* and superior clonal series of *Cunninghamia lanceolata,* were developed with the average genetic gain of 20-50%. Cutting orchard of *Cunninghamia lanceolata, Pinus massoniana, Populus tomentosa* etc. have been established at multiple sites in order to promote the extended use of the superior clones. Clonal plantations have been established, making a great contribution to the development of industrial timber forest.

Biotechnology: Regarding researches in Cell Engineering, somatic embryogenesis, screening of mutants of salt-tolerant somatic cells have been carried out for trees of *Populus, Liriodendron chinense, Larix, Acacia mearnsii*, among which the somatic embryogenesis technology has

already applied in the large-scale production of *Liriodendron chinense*. Suspension cell lines of *Populus popularis* '39' were developed. Salt-tolerant somatic cell variant plants of *Populus popularis* '39' were obtained, and field trials and molecular detection were started. Regarding genetic engineering, regenerated plants of *Populus alba* × *P. glandulosa* was obtained with transformation of insect resistant gene (*Cry 3A*) into the genome through *Agrobacterium tumefaciens* mediation method. Transgenic plants of hybrid poplar of *Populus simonii* × *P. nigra* were obtained by transforming exogenous gene *Bet2A* through *Agrobacterium tumefaciens* mediation method using the sterilized leaf segments as transformation receptor material. Besides, researches were also carried out in lignin improvement, transformation of stress-resistant genes and nitrogen fixation genes, genetic mapping. Progress has been made in simultaneous transformation of multiple genes in poplar trees.

4.2.2 Seed orchard development

Up to 2010, China has established a variety of seed orchards with a total area of 19,600 ha, among which the seed orchards of *Pinus sylvestris* var. *mongolica*, *Larix gmelini* have larger areas than other species. Based on progeny tests, most primary seed orchards established earlier have gone through thinning or converted into a 1.5 generation seed orchards, and some 2nd generation seed orchards were constructed using selected progenies. In Fujian, third generation seed orchards of *Cunninghamia lanceolata* have been established or are going to be established. In Heilongjiang, greenhouse seed orchards of *Betula platyphylla* have been established (Appendix table 15).

4.3 Utilization, management and trade of propagation material

4.3.1 Management and extension of improved trees

The former Ministry of Forestry issued the "Management rules for the use of genetically improved forest trees" in 1997, and implemented the system of certification of improved forest trees. Up to

2009, a total of 2,776 genetically improved varieties were certificated in China. Based on the management rules, through expanded propagation, experiments, demonstrations, training, instruction and consultation services etc., the certified superior trees including superior provenances, families, clones and local varieties have been widely used in various afforestation projects and achieved remarkable effects. Improved trees and superior FGR have been actively applied in national afforestation projects, and until 2010, the extent of using improved planting materials has been significantly increased.

4.3.2 International trade of propagation materials

Institutions of tree seed and seedling operations, forestry research institutions, universities and colleges, urban construction and gardening agencies are involved in activities of international exchange of tree seeds and vegetative materials. China annually imports more than 150,000 kg of seeds and several 100,000 seedlings of over 50 tree species, mainly including *Cedrus deodara, Pinus caribaea, Liriodendron chinense, Eucalyptus, Acacia,* etc. (Appendix table 12). China has already established cooperative relations with over 100 enterprises of tree seeds and seedlings and non-profit organizations of more than 30 countries in Europe, America, Asia, China has an annual export of over 400 species with more than 300,000 kg of tree seeds, several hundreds of thousands of seedlings, including *Ginkgo biloba*, *Sophora japonica, Larix gmelinii*, *Pinus bungeana* (Appendix table 12).

4.3.3 Commercial applications of genetically improved trees

At present, various genetically improved forest tree species have been commercially used in different degrees. Superior varieties with relatively large-scale commercial applications include Hunan series of *Camellia oleifera*, triploid *Populus tomentosa*, *Taxodium* x *zhongshansha*, *Sophora japonica* 'Golden leaf', *Pinus massoniana* 'Tongmian' (Appendix table 16). China requires that the major national forestry programs must use the genetically improved plant materials for their afforestation activities to promote the commercial application of genetically improved trees.

But some of the genetically improved materials are restricted due to the high cost of utilization, or the narrow geographical areas suitable for application.

4.4 Major problems, needs and priorities for future work

4.4.1 Major problems and needs

1) The yield of existing seed orchards and seed stands cannot meet the demands by practical application. Most seed orchards and seed stands are still in the first generation, genetic quality of seeds is not very high, and the extent of practical uses of improved seeds was not high. There is a need to expand the scale of the production bases of genetically improved seeds, to improve the yield and quality of the seed orchards and seed stands, and to increase the uses of genetically improved seeds.
2) The lack of diversity in breeding objectives, the lack of continuity for research projects in breeding, and the lack of effective incentive mechanisms in transformation of research results resulted in difficulties in fully mobilizing the enthusiasms of breeders, seed producers and users. There is a need to create a long-term multi-objective breeding mechanism, to formulate incentive policies of encouraging tripartite participation in the utilization and management of the genetically improved seeds.
3) In China, the systems of breeding and extension, production and supply, law enforcement and socialized services in relation to improved tree seeds are imperfect, and improvements are needed to make the breeding and extension, production and supply, law enforcement and socialized services more effective.

4.4.2 Priorities for future development

1) To expand the size of production bases of genetically improved seeds; to improve the genetic quality of seeds; and take measures to increase the yield of seed orchards and seed stands. To strengthen the effective use of modern breeding technologies in conventional tree breeding;

to create new genetic materials and improve the quantity and quality of improved materials.

2) Strengthen sustainable management and utilization of FGR; improve the extent of using improved seeds, support the innovation and development of seed enterprises, and encourage the investment of individuals and enterprises in genetic improvement of trees, in order to promote the formation of an effective community with common interests among tree breeders, producers and users of the genetically improved seeds.

3) Develop relevant policies to establish and perfect the systems of breeding and extension, production and supply, law enforcement and socialized services of genetically improved forest tree seeds.

Chapter 5 The state of national plan, research, education, training and legislation

Since 2000, China has formulated a series of national plans concerning FGR conservation and management, and carried out activities relevant to research, education, training and legislation, which have promoted FGR protection and management.

5.1 Nation plans and programs

In the last decade, China has promulgated and implemented a series of planning and programming related to the protection of FGR, mainly "Plans for the natural forest protection program (2000-2010) (2011-2020)", "Plan for the National Wildlife Protection and Nature Reserve Development Program (2001-2050)", "Plan for the National Wetland Protection Program (2002-2030)", "Medium- and Long-term Plan for Forestry Science and Technology Development (2006-2020)". These plans have incorporated FGR protection into national action plans from the ban on logging of natural forest to the establishment and the protection of nature reserves of key species and typical ecosystems with national priority for protection. In 2004, China promulgated the "Outlines for 2004-2010 Development of National Science and Technology Infrastructure Platform". In 2007, "the Outlines for Protection and Utilization of National Biological Species Resources" was released and in 2010, published "China Biodiversity Conservation Strategy and action plan (2011 -2030)". All these national programs and plans have taken FGR conservation and utilization as priority area or theme, and set up special projects of FGR research in the national science and technology support program, the basic work plan for national science and technology, the SFA key science and technology program, the special public welfare program of forestry sector, and have made significant achievements.

The SFA has developed some technical standards and regulations like "Technical codes for FGR survey", the "Rules for FGR management", organized and implemented national FGR inventory. Up to 2010, more than 10 provinces or autonomous regions completed the work of FGR inventory. It was intended to complete the FGR inventory in all provinces by 2015. In the past 10 years, the

SFA carried out the national wildlife resources survey, identified over 160 rare and endangered species and their abundance and distribution (Appendix table 10), the survey found 1 200 threatened and endangered species, endangered populations were fond for about 70% of the tree species surveyed, revealing an urgent need to strengthen FGR protection.

5.2 Research

Under the leadership of the SFA, research institutes, universities, production and management institutions have carried out collaborative FGR research and conservation (Appendix table 17).

Currently, China has 240 forestry research institutions and technology development organizations, engaged in research and development of FGR. Forestry research institutions have been well developed from central to local level. CAF is the earliest research institution carrying out FGR researches; it has established a cooperative relationship with 66 institutions of research, education and management of 25 provinces or municipalities, to carry out studies on collection, evaluation, conservation and sustainable utilization of FGR.

China has set up a number of special research projects to conduct studies on survey, collection, conservation, evaluation and utilization of FGR. In the past 10 years, China has carried out several key cooperative research projects, such as "Standardization of FGR documentation, integration and sharing", "Surveys on FGR in China", "Exploitation and innovative use of gene resources of trees and flower plants", cataloging and documenting FGR, setting up and networking FGR conservation banks, assessing FGR genetic diversity, exploring and utilizing FGR and developing information platform, and providing sharing services of FGR information in relation with actual FGR. On the basis of these research projects, with financial support from the government, the National FGR Platform has been established, engaged in FGR collection, conservation, documentation, evaluation and sharing services.

5.3 Education and training

Currently, China has 5 forestry universities, i.e. Beijing Forestry University, Nanjing Forestry University, Northeast Forestry University, Central South Forestry University of Science and Technology, Southwest Forestry University, and 200 various types of universities, colleges and technical schools that have forestry-related disciplines, among which a number of disciplines are related to FGR. In addition, the CAF, Beijing Forestry University and other research institutions and universities carried out FGR related graduate education. At present, FGR has not been set as an independent discipline in higher and secondary education on forestry, only few universities have taken FGR as a thesis subject for their postgraduate students, course studies on FGR have been evidently insufficient.

Since 2000, the SFA, the provincial forestry authorities and the CAF have organized a number of FGR training workshops at different scales. The SFA has organized regular national and regional training courses across the country, providing training to a large number of people working on FGR. In order to standardize the FGR surveys to be carried out by different provinces, each province also conducted provincial training courses. In 2008, Inner Mongolia Autonomous Region has trained more than 100 technical staff on FGR survey. In 2010 the CAF launched a series of national training workshops on FGR, administrative and technical staffs from over 10 provinces participated in the training. By various types of training and dissemination of relevant laws, regulations and policies, the understanding of the FGR importance by relevant staffs have been improved, strongly promoting the protection and utilization of FGR.

5.4 Laws and regulations

The FGR related Laws, regulations and rules in China mainly include the "Forest Law of the People's Republic of China", the "Seed Law of the People's Republic of China", the "Regulations on Wildlife Plants", the "Regulations on Nature Reserves", the "Regulations on New Plant Varieties Protection", the "Patent Law of the People's Republic of China", the "Regulations on Management of Import and Export of Endangered Wildlife", the "Law of Animal and Plant

Quarantine for Entry to and Exit from China", the "Regulations on Forest Pests and Diseases Prevention and Control", these laws and regulations provided clearly specifications on activities of FGR collection, conservation, utilization, import and export.

The SFA also promulgated regulations related to production and management of forest tree seeds and plant stocks, including the "Rules for quality control of forest tree seeds", "Rules for extension and application of genetically improved tree seeds and other reproduction materials", and the "Rules for FGR management". These regulations and rules have standardized the collection, conservation, breeding and other aspects of FGR, and provided important basis for FGR management.

5.5 Administration

China's forestry sector has a complete administration system, the SFA was set in the central government, and the SFA is the competent authority FGR, involving a number of departments (bureaus) and units of the SFA (Appendix table 17). Each province (Region or municipality) has a forestry department (bureau), forestry administration is also set in prefecture (municipality or county) governments, township (village) government has a forestry station responsible for FGR management, therefore forming a well structured 4-level administrative network, from central, provincial (autonomous regions and municipalities), prefectural (county), and township (village) governments.

In order to strengthen the management of FGR, the SFA set up a Leading Group on Protecting Resources of Biological Species in forestry sector in 2003, and the Office of the leading group was set up in the Science and Technology Development Center of the SFA, responsible for the coordination of protection and management of the resources of biological species in forestry sector. The Science and Technology Development Center is responsible for the implementation of the forestry component of the ABS Protocol of CBD and the Bio-safety Protocol.

The General Service of State-owned Forest Farm and Forest Tree Seed and Seedling of the SFA is responsible for the management of FGR collection, documentation, assessment, registration, conservation, exchange, utilization, conservation bases and facilities construction, and certification of improved varieties and propagation materials. The Department of Wildlife Protection and Nature Reserve Management of the SFA is responsible for the management of wildlife protection and nature reserves and the approval of import and export of wildlife. The China Office of Import and Export Management of Endangered Species, is responsible for issuing import or export permit in accordance with CITES convention and the relevant laws and regulations.

5.6 Public awareness and information dissemination

In the past 10 years, with extensive development of various educations on forest ecology, public awareness on forest protection is increased continuously; the public awareness on FGR is gradually improving.

FGR data and information have been gathered and disseminated through several key websites of the SFA (www.forestry.gov.cn), the National FGR Platform (www.nfgrp.cn), the General Service of State-Owned Forest Farm and Tree Seed and Seedling (www.sinoseed.com), Chinese Nature Reserves(www.nre.com.cn), and other professional websites and portal of relevant government agencies, significantly improving the efficiency of dissemination of FGR information.

5.7 The main problems, needs and future priorities

5.7.1 The main problems and needs

1) Currently, there is no specific law on genetic resources, and FGR related policies are imperfect, management tools are lagging behind. A specific law on genetic resources is needed, and other FGR related regulations need to be improved.
2) China has a vast territory, with rich FGR and high genetic diversity, there is an urgent need for

specialized FGR research and development institution to coordinate nationwide FGR collection, conservation and utilization for research use, provide technical support to government departments to formulate relevant policies.

3) Lack of sustained and stable financial support to FGR researches, the weakness of staffing and capacity in FGR need to be strengthened through the FGR education, research and training.

5.7.2 Priorities for future work

1) Develop FGR protection and management regulations, fill up the regulatory gaps, and promote FGR management in accordance with the law.
2) Strengthen FGR research and discipline development, improve and enrich the theoretical and technical systems, and establish long-term stable funding support mechanisms.
3) Strengthen public education by using network, television, newspapers and other media to carry out public education on FGR, enhance public awareness of FGR protection.

Chapter 6 The state of regional and international cooperation

International forestry cooperation and exchange developed rapidly, China has established good relationships and cooperates with more than 40 countries and more than 20 international organizations around the world, the regional and international cooperation in FGR also developed rapidly. Participation in international networks, bilateral or multilateral cooperation, and implementation of international conventions is the main form of regional and international cooperation.

6.1 International institutions and networks

International institutions and networks refer to the participation by a number of countries, institutions and other global or regional cooperation and exchange network. China has participated in nearly 20 international institutions or networks such as FAO, IUFRO and UPOV that are related to FGR. Activities such as information exchange, database development, formulation of conservation strategy and seed exchange have promoted exchanges and sharing of FGR information, improvement of technical standards and upgrading international status (Appendix table 20, 21). International cooperation and exchanges have focused on more than 40 species, e.g. *Camellia oleifera*, *Tecona grandis*, *Betula alnoides* and *Melia azedarach* etc.

INBAR is the first intergovernmental organization which set its headquarters in China, it organizes and coordinates the development and utilization of genetic resources of bamboo and rattan, bring benefits to many countries, including various forms of benefits such as genetic resources and related information of bamboo and rattan, cultivation techniques and methods of application, technology transfer and exchange, personnel training.

6.2 International cooperation projects

In the past 10 years, about 100 international projects in forestry were supported, with a funding of

about $ 374 684 900, including post-disaster reconstruction, vegetation recovery, ecological forestation, sand control and afforestation, the number of projects and the funds in these fields accounted for 48% and 61% respectively of the total, and the number of projects and funding in fields of sustainable forest management and development accounted for 34% and 37%, the number of funding in FGR protection, conservation, collection, evaluation and utilization were relatively small, accounted for 17% and 2% (Figure 6-1, 6-2).

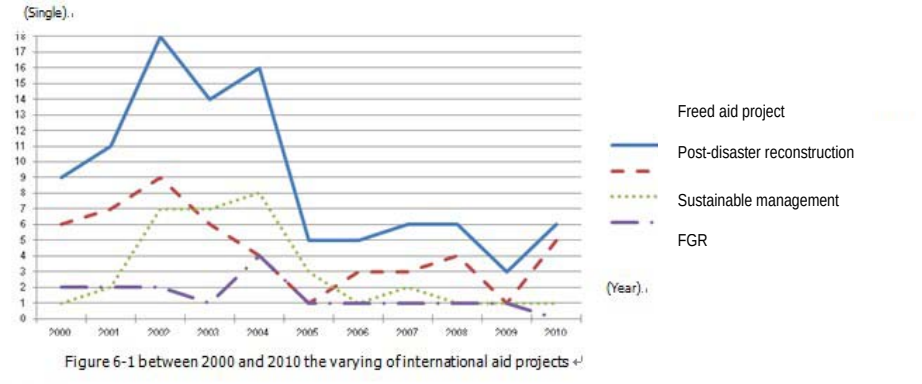

Figure 6-1 Changes of number of international aid projects between 2000 and 2010

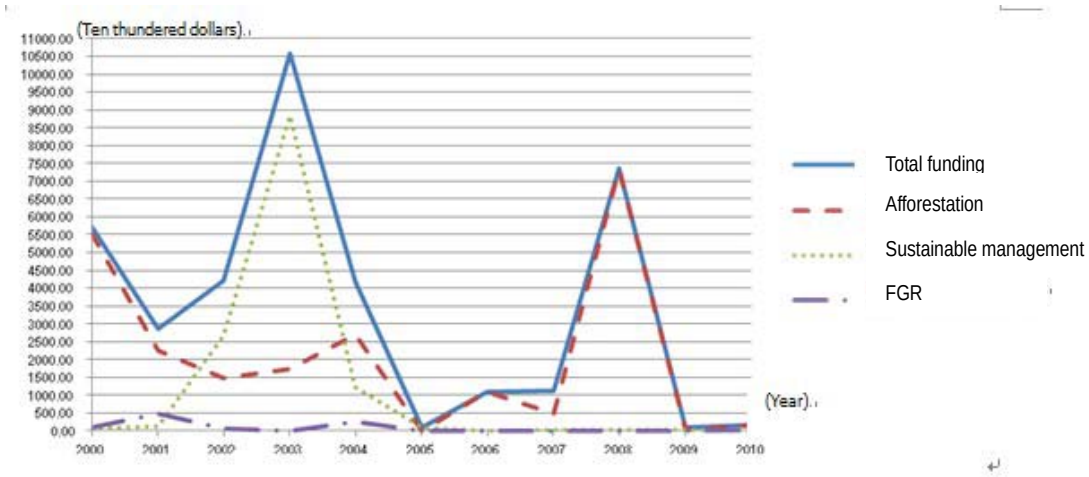

Figure 6-2 Changes of funding of international aid projects between 2000 and 2010

The international cooperation projects promoted FGR protection, conservation and utilization, mainly reflected in: 1) Strengthened sharing of actual material and information of FGR, and promoted the genetics and breeding of forest trees, development of new plant varieties and their

experiment, demonstration and extension in China, and enriched FGR diversity; 2) Promoted the protection of rare and endangered species and development and utilization of wild native tree species; 3) Introduced advanced foreign technologies, improved research and management capabilities and trained technical staff; 4) Accelerated regional economic development, alleviated poverty, improved public awareness of FGR conservation. For example, the *Taxus* conservation projects funded by the WWF in 2004 strengthened the protection of *Taxus* FGR, through compiling the Red Book for *Taxus* protection, making television dissemination video etc. (Table 6-1).

Table 6-1 Information on part of the international cooperation projects

DA	Project name	The main achievements	IA of China
ACIAR	China-Australia cooperative research on growth of *Eucalyptus*	174 species/provenances and 1666 families were introduced, enriching genetic diversity; Vegetative propagation techniques were studied, a rational model of fertilization for *Eucalyptus* plantations was proposed to promote tree growth, reduce soil degradation, increasing economic benefits.	CAF
ACIAR	Assessment of Ecological Restoration by growing *Pinus radiata* in Aba, Sichuan Province	Introduction and Assessment of *Pinus radiata* in Aba, Sichuan Province. Enrich the diversity of species in Aba arid valley, Sichuan.	CAF, SPAF, SPBF
WWF	*Camellia luteoflora* protection in Guizhou Chishui Alsophila protected areas	Mapping the distribution of *Camellia luteoflora*, establishment of a protection station for effective protection of *Camellia luteoflora* and their habitats. Through seminars and dissemination of booklets on protection of *Camellia luteoflora*, awareness of the local people was raised.	CICEPG, NNRTCG
WWF	Extension of the above project on *Camellia luteoflora* protection	Established *Camellia luteoflora* core protected areas, with a permanent signs for protection.	CICEPG, NNRTCG
WWF	Survey of the impacts of human activities on *Larix* forest in Taibai Mountain of Shaanxi	Survey on Taibai *Larix* forest Resources and anthropogenic interference with the types, causes, etc., drew specific recommendations for protective measures.	STNNR
WWF	Conservation of *Thespesia howii* and population restoration	The threats to *Thespesia howii* was investigated and *ex situ* conservation established. Public awareness of the species was raised through diverse forms of lectures and science dissemination.	HNU
WWF	The protection of *Parakmeria* in Emei	Studies on vegetative propagation of Emei *Parakmeria* have achieved preliminary results, artificial test community and	SAUD

DA	Project name	The main achievements	IA of China
		conservation base were established.	
WWF	Survey and evaluation of distribution of *Komagari catechu*	The threats to *Komagari catechu* and its artificial cultivation were studied. Public awareness was significantly improved through a variety of lectures, science dissemination and education activities.	WBG of CAS
WWF	Tourist disturbance and conservation strategies for *Cupressus gigantea*	The impacts of tourism activities on *Cupressus gigantean* was studied to know the effects on tree growth and damages to tree trunk, influences on understory vegetation and soil. Environmental education to visitors and local communities were conducted to raise public awareness.	CETDR of BJFU
WWF	Production of TV movie on rescuing Tertiary relict plants in West Ordos and Alashan	Tertiary relict plants and their habitats were surveyed. Various activities such as delivery of plant protection calendar to farmers, media presentations, and supervisory by relevant law enforcement agencies to strengthen the protection and slow down the destruction.	SUT
WWF	Rescue conservation and utilization of rare, endangered *Acer pentaphyllum*	Studied the endangered mechanism of five lobular maples. Conservation strategy was proposed. Small training courses were held to strengthen farmers and enterprises' environmental awareness.	CIB of CAS
WWF	Survey and detection of Wildlife trade – *Taxus* protection project	Through documenting the state of utilization and protection of wild *Taxus* resources utilization, and making television programs on knowledge of protection of *Taxus*, providing information to relevant agencies to strengthen the protection of Taxus resources.	CEPF
ITTO	Sustainable management and utilization of Chinese Southern bush Bamboo	400 suitable species were selected from more than 500 Bamboo species to create a Bamboo garden of 20 hm^2, for both scientific research and ornamental uses.	CAF
ITTO	Afforestation technology development and demonstration projects of tropical broad-leaved species in Yunnan Province, China	Completed studies in collection, conservation, utilization and pest control of *Epiphyllum*, mountain *Osmanthus*, Yunnan *Parakmeria* and 7 other native tree species in Yunnan. Carried out the afforestation technology with tropical broad-leaved species, built the center tree nurseries of tropical broad-leaved species and the base of the genetic improvement tropical broad-leaved species like the *Betula alnoides* and mountain *Osmanthus*.	YPAF and CAF
ITTO	Demonstration of cultivation and sustainable management of rattan in China	Studies were carried out on cultivation and sustainable utilization of rattan.	CIBR of SFA
EIB	Build bio-energy forest demonstration project in Jiangxi	Established 30 000 *ha* of biomass energy forest demonstration base in 19 counties like Ruijin, Shicheng, Guangchang, Suichuan, built *Camellia* bases of 22 700 ha, *Swida* bases of 6	JPBF

DA	Project name	The main achievements	IA of China
		700 ha.	
JICA	Chinese-Japanese technical cooperation project of forest Tree Breeding Center (Phase II)	3 Poplar varieties were developed for mountain areas, and a DNA technology for identification of Poplar varieties was developed. The range of growing Japanese Larch was moved southwards by 10 degrees of latitude, making it a main afforestation species at high altitudes in southwestern China. Non-destructive wood-strength testing technology was developed for Chinese Fir, Masson pine and Poplar. Assessment techniques for FGR of Masson pine were developed. Breeding for nematode resistance of Masson pine was carried out.	HPBF

Note: DA, Donor agency; IA, Implementation agency

6.3 International convention / agreement

China joined FGR related international conventions and played an active role in promoting FGR conservation. In 1981 China joined "Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)", Convention on "Biological Diversity" in 1993. In 1999 China became a member of the "International Convention on Protection of New Varieties of Plants" (1978 Act). In 2001, China joined the WTO, "Trade-Related Intellectual Property Rights Agreement", and "Cartagena Protocol on Bio-safety" (Table 6-2).

China signed more than 10 multilateral and bilateral agreements, for example, "Agreement the United States of America, the Department of the Interior and the People's Republic of China Ministry of Forestry on the nature conservation exchanges and cooperation Protocol"

Table 6-2 Major international Conventions/Protocols, and bilateral cooperation agreements related to FGR that China has signed

Name	Date of signature
International conventions and protocols	
CITES	1981
UNFCCC	1992
CBD	1993
UNCCD	1994

CIIW	1992
Kyoto Protocol	1998
UPOV Convention (1978 version）	1999
Cartagena Protocol on Bio-safety	2000
Non-legally binding instruments of all types of forests (International forest instrument)	2007
Bilateral cooperation agreements	
Exchanges and cooperation protocol of the United States of America, the Ministry of the Interior and the People's Republic of China Ministry of Forestry on the Conservation of Nature	1986
Memorandum of understanding on cooperation between the China SFA and the Italy Environment Ministry of Land and Resources on Rio conventions coordination and sustainable development	2004
Memorandum of understanding on forest resources and ecological environment protection field between National Forestry Administration of the People's Republic of China and the Republic of Argentina environment and sustainable development Secretariat of State	2009
Memorandum of Understanding of cooperation in the protection of forest biodiversity between National Forestry Administration of the People's Republic of China and Ministry of Environment of the Federative Republic of Brazil	2005

6.4 Major needs and future priorities

1) China is a rich country in FGR, and will strengthen international cooperation in FGR research, conservation and utilization, learning advanced technologies and experiences from foreign countries.
2) Carry out in-depth international cooperation. Developed countries are in a leading position in the field of biotechnology, it needs to narrow the gap through cooperation and exchange, to raise the quality level of domestic research in related areas, and promote the development and

utilization of FGR.

3) Play an active role in the regional networks. To those subjects with higher research capacity in China, such as the use of bamboo and rattan resources, China can provide assistance to the developing countries, including related technologies and training of human resources.

Chapter 7 The state of ABS

The fair and equitable sharing of benefits arising from the utilization of genetic resources is one of the three goals of the Convention on Biological Diversity. Access to genetic resources and the sharing of benefits arising from their utilization contribute to conservation and sustainable utilization of biodiversity, poverty alleviation and promoting environmental sustainability. China is formulating and revising the relevant domestic laws and regulations in order to promote the access to forest tree genetic resources and the sharing of benefits arising from their utilization.

7.1 Frameworks of law and policy

7.1.1 International conventions

At present, there are three major international systems involved in the implementation of the access to genetic resources and the fair and equitable sharing of benefits arising from their utilization between countries, they are: Convention on Biological Diversity (CBD), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) and the WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore. Among them, the regulations on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization in the CBD are the most central ones. China has long been actively participating in the international corporation and signed the CBD in 1992, so as to promote the access to genetic resources and the fair and equitable sharing of benefits arising from their utilization.

The Convention on Biological Diversity has three main goals: the conservation of biological diversity, the sustainable utilization of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources. The CBD recognized the sovereignty of States over their natural resources, and the access to genetic resources should be subject to the prior informed consent of the country in whose territory the resource is located, then defining the

conditions on how the benefits arising from the utilization should be shared with the country where the resource is geographically located. As the *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity* took effect, it further promoted worldwide conservation and utilization of genetic resources.

7.1.2 Domestic legislation and policies

At present, China has not yet established specialized legal system on access to plant genetic resources and the sharing of benefits arising from their utilization, but as for the access to plant genetic resources, rules have already been established in some laws and regulations.

1) Article 9 in the *Constitution of the People's Republic of China* provides that: the state ensures the rational use of natural resources and protects rare animals and plants. Appropriation or damaging natural resources by any organization or individual by whatever means is prohibited. In addition, "Crimes of Undermining Protection of Environmental Resources" added to the *Criminal Law of the People's Republic of China*.
2) Articles in the second chapter "The Protection of Genetic Resources" of the *Seed Law of the People's Republic of China* are regulations about the protection, prohibition, management and exchange of seed resources, also provides the official procedure of supplying seed resources to foreign countries. In 2008, the SFA announced the *"FGR Management Approach"*, which specifically standardized provisions on the collection, documentation, evaluation, recording, conservation, exchange and use of FGR.
3) The *Patent Law of the People's Republic of China (2008 Amendment)* took effect in October 1, 2009. This new amendment version clearly defined the principle of origin disclosure of genetic resources, i.e. the addition of "No patent will be granted for an invention based on genetic resources if the access or utilization of the said genetic resources is in violation of any law or administrative regulation", "For an invention based on genetic resources, the applicant shall state the direct origin and the initial origin of genetic resources in the application documents. If

the applicant is unable to state the origin, she or he shall state the reasons."

(4) China has already formulated a series of specific or related laws and regulations on the protection of biological genetic resources, including: the "Forest Law"; the "Wildlife Protection Law"; the "Environmental Protection Law"; the "Marine Environment Protection Law"; the "Grassland Law"; the "Fishery Law"; the "Water and Soil Conservation Law"; the "Regulations on Wild Plants Protection"; the "Regulations on the Administration of Import and Export of Endangered Wild Fauna and Flora"; the "Regulations on Nature Reserves"; the "Regulations on the Protection of New Varieties of Plants" etc.

(5) Besides, China has also developed relevant sectoral rules and local regulations, for example: the "List of Rare and Endangered Plant Species", the "List of Genetically Improved Forest Trees", the "Regulations for the Implementation of Protection of Terrestrial Wildlife Animals" etc.

All the laws and regulations mentioned above played an important role in promoting collection, conservation and utilization of genetic resources in China.

7.2 Stakeholders

Stakeholders involved in accessing and benefits sharing include the management departments of genetic resources, the providers of genetic resources and the users of genetic resources.

The SFA is in the competent authority of FGR in China, and its main responsibilities in FGR management include: issuances of logging permit and wild plants collection permit, approvals of import and export of China's wildlife with national priority for protection and study tours on China's wildlife by foreigners.

FGR Providers in China mainly include state-owned institutions, collective-owned institutions and individuals. The state-owned institutions are mainly nature reserves, world natural heritages, forest park and scenic areas, state-owned forest farms, experimental bases of research

institutions, botanical gardens, nurseries of FGR collections, propagation bases of improved forest trees etc. Collective-owned institution mainly refers to the owners of collectively-owned mountain forests in forest regions where the target FGR is located. Individuals mainly refer to the owners of improved forest trees.

Users of FGR mainly include scientific research institutions and universities and schools of higher education, enterprises and individuals involved in producing and managing FGR.

7.3 The state of Access to Genetic Resources

7.3.1 Access to genetic resources across countries

For a long time, China has been imposing a strict control over import and export of genetic resources. Any import and export of forest tree seeds by any institution or individual shall be approved by the SFA. China has already established cooperative relationships with various international (or regional) organizations and networks related to FGR (Table 7-1), playing an increasingly important role in the field of international cooperation in the field of FGR.

Table 7-1: Major International (or Regional) Organizations and Networks Cooperating with China

Organizations or networks	Abbreviation
United Nations Development Programme	UNDP
Food and Agriculture Organization of the United Nations	FAO
United Nations Forum on Forests	UNFF
Global Environment Facility	GEF
Asia Pacific Forest Genetic Resources Program	APFORGEN
Teak Network	TEAKNET
International Tropical Timber Organization	ITTO
International Network for Bamboo and Rattan	INBAR
International Sea-buckthorn Association	ISA
Biodiversity International	BI
International Union for the Protection of New Varieties of Plants	UPOV
Asia Pacific Association of Forestry Research Institutions	APAFRI
World Wide Fund for Nature	WWF

The Nature Conservancy	TNC
International Union for Conservation of Nature	IUCN
Wetlands International	WI
The Global Network for Forest Science Cooperation	IUFRO
Center for International Forestry Research	CIFOR
Conservation International	CI
East Asia Plant Variety Protection Forum	EAPVPF

Methods on access to genetic resources mainly include bilateral cooperation researches, species introduction experiments, exchanges, donations, and purchases etc. CAF has established a nationwide research network of tree introduction and domestication, and exchanged tree seeds with more than 60 foreign research institutions and botanical gardens.

As a country with abundant FGR, China has provided a large amount of FGR to other countries. China has more than 8,000 species of woody plants, many of which were introduced to foreign countries, e.g. Kiwi fruit, *Gingko*, *Metasequoia* (dawn redwood), Peony, *Rhododendron* and *Paulownia* etc. Many endemic tree species with significant economic values have been introduced into many other countries and made an important contribution to the whole world.

In recent years, governments heightened the conservation of FGR into a strategic level, and many countries established their own laws and regulations on conservation of plant genetic resources, and limit the export of genetic resources. The international access to genetic resources is becoming increasingly difficult and the quantity of access becomes less and less.

7.3.2 Access to domestic genetic resources

The SFA is in charge of the domestic access to FGR. Because of the process of accessing to FGR involves multiple stakeholders, there are diverse and easy ways of access to FGR, therefore, it is difficult for the government to monitor and supervise. Domestic access to FGR mainly includes cooperative researches, introduction experiments, exchanges, administrative allocation and donations, purchases etc.

From 2003, China started to develop the National FGR Platform, and the major goals are: to provide sharing services of information and FGR through the platform; to provide users with FGR and related information in different ways; and to study mechanisms of sharing of benefits arising from the utilization of genetic resources and models of operation, in order to lay a foundation for full access and utilization of genetic resources and benefit in future.

7.4 The state of benefit sharing

The sharing of benefits arising from the utilization of FGR was progressively developed with the negotiation and performance of the Convention on Biological Diversity. Major benefits arising from the utilization of FGR include that of forest products and improved germplasm of forest trees; and there are two ways to share these benefits: monetary benefit-sharing and non-monetary benefit-sharing. There are no special laws and regulations on the sharing of benefits arising from their utilization until now. And among all the existing laws and regulations, still no one involves the mechanism of the sharing of benefits arising from the utilization of genetic resources, because of this fact, most cases of the sharing of benefits arising from the utilization of genetic resources are spontaneous contractual agreements between providers and users, specifying respective responsibilities rights and benefits of both sides based on mutually agreed terms, such as joint development, technology share holdings, technology transfer, authorized utilization and many other forms. Although preliminary studies has been done on the benefit-sharing mechanisms, there are still many difficulties in actual operation, for example, most of the practices of sharing of benefits arising from the utilization of genetic resources were made in principle and with no requirements for legally binding. Apart from this, another fact is that it takes a long time to generate benefits from using genetic resources, it is difficult to track and share the benefits arise from the utilization of resources, the benefits for resources providers were hardly guaranteed.

7.5 Major problems, needs and priorities for future work

1) For the fact that there lack the specific laws, regulations and corresponding management systems on access to FGR and the sharing of benefits arising from their utilization, there is an urgent need to develop relevant laws and regulations.
2) Establishing mechanisms for access and benefit sharing, and developing models of ABS agreement, in order to promote the implementation of the system of ABS.
3) There is a need to strengthen advocacy, training and education on ABS system, and increase public awareness on FGR conservation and benefit sharing.

Chapter 8 Contributions to food security, poverty alleviation and sustainable development

FGR are basic resources for the development and survival of human society, and they provide guarantees for national ecological security and sustainable development, they also make great contributions to improve the comprehensive forestry productivity, the supply of edible products and oil and poverty alleviation.

8.1 Contributions to food security

China encourages the development of various economic forests. The components of economic forest are mainly tree species of extensive edible value, including nut trees (e.g. Chestnut, Walnut, Persimmon, Jujube etc.), fruit trees (e.g. Blueberry, Apple, Sea-buckthorn, Apricot etc.), woody vegetable trees (e.g. *Toona sinensis*, Chinese prickly ash, bamboo-shoot etc.) and woody oil-yielding trees (e.g. *Camellia oleifera*, olive, oil palm etc.) (Appendix table 6). The development of economic forests enriches the types of food and makes great contributions to food security.

8.1.1 Woody species for food

Development and utilization of food trees enriches the types of food, increases the supply of green and healthy food, and making contributions to food security. Currently, more than 100 species of woody plants for food are being cultivated and utilized in China, with an area of 2.667 million ha, an output of 1.7 billion kg. Walnut, Chestnut, Jujube and Persimmon are known as four major nut species in China, and Apricot, Pistachio, *Torreya grandis*, *Carya*, Pines (for edible seeds) are also widely grown (Appendix table 22). The yield and quality of all those species improved a lot through the selection, exploring and extension of the genetic resources of these species. For example, due to the large diversity Chinese chestnut genetic resources, many Chinese chestnut

varieties have been developed respectively suitable for the Yangtze River basin, northern, northwestern, southeastern, southwestern and northeastern China, with significantly improved yield and quality. Currently, the area of Chinese chestnut is more than 0.5 million ha with a yield of more than 0.6 billion kg, accounting for 60% of the total yield of chestnut in the world. Growing chestnut is one of the major sources of income generation for famers in many regions, especially mountain areas. Besides, genetic resources of Walnut, Jujube and many other fruit species are also abundant in China, making great contributions in maintaining China's food security.

8.1.2 Woody species for edible oil

China has more than 50 species of arbors and shrubs producing edible oil, among them, *Camellia oleifera*, Walnut, Apricot, Oil palm have concentrated distribution and can be grown in large-scale for commercial production (Appendix table 22). Woody plants for edible oil are resistant to stress conditions, easy to manage. In recent years, a number of high quality and high yield oil-tea varieties have been developed in some provinces in the subtropics of China, such as: the series of varieties of Xianglin oil-tea, Yalin oil-tea, Changlin oil-tea and Cenxi oil-tea with soft branches, which are widely grown in provinces of Hunan, Jiangxi, Zhejiang and Guangxi, greatly promoting large-scale development of oil-tea industry. Up to 2010, the area of oil-tea trees in China was 3.7 million ha and the annual yield was more than 0.2 billion kg.

8.1.3 Fruit tree species

China has a large number of fruit tree species, traditional species include Apple, Plum, Pear, Peach, Citrus, Pomegranate, Persimmon, Shaddock, Apricot, Grape, Loquat, Longan, Lychee, Coconut etc; while the newly explored and utilized species include Bueberry, *Vaccinium*, Raspberry, and Cherry etc.(Appendix table 22). Among the species, the yield and export volume of Apple ranked the first in the world. The yield of Apple in 2003 was 21.1 billion kg, and reached 27.86 billion kg in 2007. In 2010, the total area of fruit trees amounted to 11.77 million ha with a total fruit production of 127 billion kg and an annual output value of more than RMB 130 billion.

8.1.4 Woody vegetable species

China has a large number of woody vegetable species, such as: *Toona sinensis*, Chinese prickly ash, *Aralia elata*, Elm, Bamboo (or bamboo shoots), Rattan, *Vaccinum bracteatum*, *Slender acanthopanax*, *Cassia siamea*, *Lespedeza*, Black locust, Aspen, weeping Willow, *Kerria japonica*, Yunnan *Keteleeria* etc. In recent years, China also succeeded in introducing some good woody vegetable species from South America and India, e.g. Cauliflower tree, *Moringa*, woody tomato etc. Most of the woody vegetables are natural green food. However, the number varieties of these woody vegetables is still small, and only a few species such as *Toona sinensis*, Chinese prickly ash, Bamboo have been grown in large-scale (Appendix table 22). The total yield of dried bamboo shoots and all the other forest food products amounted to 26.3 trillion kg in 2009. A farmer who planted 1.3 ha of the varieties 'Dahongpao' of Chinese prickly ash in Yanggao village of Pingshun county in Shanxi province, with an annual yield of more than 1,250 kg, generating an income of over RMB 20,000. More than 20 villages are now specialized in growing Chinese prickly ash in Pingshun County and the industry in this county stepped into the fast track of large scale development. The total area of growing the species in Pingshun County amounted to 9,000 ha, with an annual yield of 1.85 million kg and a product value of RMB 37 million, leading to an increase of annual income per capita by RMB 240.

8.2 Contributions to poverty alleviation

FGR has made great contributions to the restructuring of rural production system, poverty alleviation, income increase etc. Utilization of FGR has also helped to maintain famers' livelihoods, provision of fire-wood and fodder, and supplement of food.

8.2.1 Managing FGR to promote restructuring of rural production system

Crop farming s is a labor-intensive activity, it needs continued cultivation, fertilization, weeding and

harvesting. In contrast, growing economic forest trees has long growth cycles, simple management and maintenance, leading to time-saving and greater benefits. Farmers were freed from heavy workload and have more time to engage in other industries. The application of improved varieties significantly increased the income of farmers, and enhanced farmer's enthusiasm in planting trees, further changed the traditional grain cropping system for some areas and households. For example, Yulin city in the northern part of Shanxi Province, by promoting the use of improved varieties of *Prunus armeniaca* and jujube etc, the annual income increased by more than RMB 1000 in more than 8% of the households, and even by several thousand RMB in some households. In 2009, a farmer household in Tianyuan Village of Yuhemao County in Yuyang district planted 1 ha *Prunus armeniaca*, which yielded more than 1,100 kg of almonds, generating a profit of more than RMB 8,300 excluding the cost, the annual income of the household exceeded 10,000 RMB coupled with an income of more than RMB 3,000 from other crops. Growing improved varieties convincingly promoted the implementation of land reclaim program and increased the proportion of economic forest trees. According to a survey in 2009, about 75.25% of households in Yulin were growing economic forest trees, which became an important source of income generation, and further driving the development of other industries such as processing, trading and services.

Cultivating *Carya* has become a leading industry of the rural economy in the main production areas of *Carya*. By growing improved *Carya* varieties in places such as Zhejiang and Anhui, the income of farmers was increased, at the same time the rural industrial structure was adjusted. The area of growing *Carya* in recent years was about 16,670 ha, with a total output of 6.3 million kg, and an annual output value of RMB 400 million, accounting for 85% of the total income of farmer household (Appendix table 22).

8.2.2 FGR utilization for poverty alleviation and income generation in rural areas

China has abundant genetic resources of economic tree species. Through propagation and management improved FGR, farmers' income was increased, achieving good impacts. The area

of growing reproduced forest trees increased from 0.59 million ha in 2005 to 0.688 million ha in 2010 (Table 8-1), and increased 200,000-300,000 jobs, the proportion of forestry income in the total farmers' income increased significantly. According to surveys, the income proportion of forestry in the total jumped from previous' less than 10% to 50% in Zanghuang county of Hebei province, Jiaonan city in Shandong province.

Table 8-1: Area, quantity and ownership proportions of reproduced tree stocks in China

Year	Area of reproduced tree stocks	Total number of trees	Number of improved varieties	Total no. of nurseries	Proportion of nurseries ownerships in number			Proportion of nurseries ownerships in area		
	Million ha	Billion plants	Billion plants	Million	State Owned	Collective Owned	Individual Owned	State Owned	Collective Owned	Individual Owned
2005	0.59	32.2	13.9	0.32	3.0%	4.0%	93.0%	17.8%	10.0%	72.2%
2006	0.60	41.7	12.4	0.31	3.5%	3.2%	93.3%	19.3%	8.2%	72.5%
2007	0.65	41.6	13.3	0.34	3.0%	3.0%	94.0%	20.6%	6.2%	73.2%
2008	0.661	46.4	12.5	0.29	3.0%	2.0%	95.0%	19.4%	5.5%	75.1%
2009	0.659	41.5	12.5	0.295	3.0%	3.0%	94.0%	14.7%	5.5%	79.8%
2010	0.688	42.3	13.1	0.336	2.6%	2.4%	95.0%	15.6%	5.8%	78.6%

Data Sources: China's Forestry Statistical Yearbook

8.3 Contributions to sustainable development

China's rich FGR play an important role in the sustainable development of forestry and agriculture, especially those improved species with high wood quality, fast growth, strong tress resistance and wide adaptability. Up to 2009, 2,776 varieties in China have been certified as genetically improved varieties at national and local levels, these varieties have significantly higher adaptability and some of them have significant disease and pest resistance, and the yield of timber averagely increased by 15-25%, the comprehensive benefit increased by 15-32%. Besides, there are still many superior provenances, families, clones, and local varieties have not been yet certified, but are also used in national afforestation projects and other tree planting practices.

China's area of plantation forest ranks the top in the world, among the plantations, FGR and especially the improved ones have been extensively used. For example, superior provenances,

families and clones of Poplar, Eucalypts, Chinese fir, Masson pine have been largely used in short-rotation industrial plantations for timber and pulpwood, among them the Poplar trees have gone through five generation-turnovers, and 2-3 generations have been upgraded for seed orchards of Chinese fir and Masson pine. Each generation possesses more superior characteristics on the basis of the previous generation. The yield and economic benefit per unit area have been significantly increased, and so did for disease and pest resistance, making great contribution to sustainable development of agriculture and forestry.

In the agroforestry system, the application of improved FGR such as *Paulownia elongata*, the variety 'Yutong 1', new Poplar varieties, Black walnut varieties, played a significant role in improving soil fertility, blocking sandstorms, thereby reducing natural disasters and increasing grain yield of the interplanted trees and crops. In Henan Province alone, grain output increased hundreds of millions of kilograms and natural disasters losses reduced about RMB 3-4 billion through appropriate selection of different FGR to establish farmland shelterbelts, forming a landscape of vigorous forests and high yielding crops. Song Village of Kaihua County in Zhejiang province once lacked more than 35,000 kg of grain in a year, by intercropping crops with trees, and now the village has a grain surplus of 30,000 kg. Meanwhile, the yield of *Camellia oleifera* seeds was doubled. Intercropping crops with trees can also increase the unit area productivity and farmers' income. Gaoyi County of Hebei province selected genetic resources of improved varieties of *Fraxinus* and *Gingko*, and made intercropping of trees and crops in different models, resulting in increased yield and income, as well as increased farmers' enthusiasm in planting trees and crops. According to statistics, Gaoyi County planted 550,000 intercropped trees, and achieved an annual income increased of RMB 1,200 per Mu. The networked farmland accounted for 80% of the total arable land of the county, and the forest coverage in the county jumped from 1.8% in 2004 to 12.8% in 2010, which play an important role in the sustainable development of agriculture and forestry.

Through the application of improved FGR, China established a lot of shelterbelt forests (such as coastal shelterbelt forests, the Yangtze River shelterbelt forests, the Three-North shelterbelt forests etc.), soil and water conservation forests, farmland shelterbelt forests, water source forests

etc., which played important roles in regulating climate, conserving water and soil, improving soil, windbreak and sand-fixation, windbreak and slope-fixation, and in reinforcing the comprehensive productivity of farmland and woodland. It helps to improve ecological environment in China and the world, and to promote long-term, stable and sustainable development of agriculture and forestry.

8.4 Contributions to realizing the "Millennium Goals"

In September 2000, at the Millennium Summit, world leaders adopted the "Millennium Declaration". The Declaration defined the eight Millennium Development goals (Box 1).

Social, economical, ecological and many other functions of FGR make direct or indirect contributions to the realization of the Millennium Goals. The direct contributions include poverty alleviation, guarantee food security, promotion of social economic development, and safeguarding agriculture and forestry productions and environmental sustainability. Indirect contributions include reduction of child mortality, improvement of women's health, promotion of gender equality through guaranteeing food security, providing natural medicines and improvement of economic conditions. The genetic diversity carried by FGR is the foundation for evolution and adaptations to environmental changes, and the fundamental guarantee of the direct and indirect benefits mentioned above.

As a country with abundant FGR, Science-based conservation and rational utilization of the FGR not only contribute greatly to domestic food security, poverty alleviation, sustainable development and realization of many other Millennium Goals, but also greatly contribute to realizing the Millennium Goals worldwide. Unique FGR of endemic trees such as *Gingko*, *Castanea mollissima*, *Metasequoia*, Chinese scholar tree, Walnut, Kiwi fruit, have already been planted in many regions in the world, and some of them become a very important component in developing local economy. Many gardening trees in Europe were from China.

Box 1：UN Millennium Development Goals

1. Eradicate extreme hunger and poverty
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

8.5 Major problems, needs and priorities for future work

8.5.1 Major problems and needs

1) The lack of technical support and market guidance in some areas resulted in a blind planting of monoculture plantations, and farmers are poor in resisting market volatility. There is an urgent need of improving the diversity of cultivating species and strengthening technical guidance and market guidance in order to reduce risks.
2) The number of new varieties of woody food- and oil-yielding trees, fruit trees and vegetable trees with high benefits and great demands is not large, so there is an urgent need to increase integrated exploitation and utilization of FGR, and to develop new varieties with high added values and market prospects, and help farmers get rid of poverty and become better off.
3) The extent of popularization of improved trees is not wide enough, and there is a need to establish a mechanism of participation by farmers in the process of collection, conservation, development and utilization of FGR, and to promote FGR conservation and utilization.

8.5.2 Priorities for future work

1) Strengthening technical training and guidance on market information; improving farmers' professional skills and ability of science-based plantings in order to increase farmers' income.
2) Intensifying development and utilization of FGR with high benefits and great demand.

Developing new varieties with high added values and market prospects, and help farmers get rid of poverty and become better off.

3) Strengthening survey, documentation and cataloguing, and dissemination and extension of improved varieties. And promoting farmers' participation in FGR conservation, management and utilization processes, and offering subsidies to farmers who conserve and use local varieties.

The State of China's
Forest Genetic Resources

Appendix tables

Beijing China

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Table of Contents

Table 1 Forest types and areas in China

Main forest characteristics	Area (1000 ha)
Natural forests	119692.5
Planted forests	61688.4

Data source：Report on the 7th national inventory of forest resources

Table 2 Forest ownership and area in China

Forest ownership	Area (1000 ha)
Public	71435.8
Group	51769.9
Private	58175.2

Data source：Report on the 7th national inventory of forest resources

Table 3 Major forest types and main tree species in China

Forest Types	Main species for each type	
	Trees	Shrub
Cold temperate coniferous forest	*Larix gmelinii, Pinus sylvestnis* var. *mongolica, Picea koraiensis, Picea jezoen, Pinus pumila, Sabina davurica, Quercus mongolica, Fraxinus mandshurica, Ulmus japonica, Betula platyphylla, Populus davidiana, Chosenia arbutifolia, Abies fabri, Picea asperata, Aceraceae, Carpinus cordata, Betula dahurica*	*Rhododendron dauricum, Betula fruticosa, Betula ovalifolia, Schisandra chinensis, Vitis amurensis, Actinidia kolomikta, Actinidia arguta, Akebia trifoliata*
Central temperate mixed coniferous and broad-leaved forest	*Pinus koraiensis, Picea jezoen, Abies nephrolepis, Larix gmelinii, Larix olgensis, Pinus syluestriformis, Picea koraiensis, Quercus mongolica, Populus davidiana, Populus ussuriensis, Betula ermanii, Fraxinus mandshurica, Juglans mandshurica, Cortex phellodendri, Ulmus pumila, Tilia, Pinus tabuliformis*	*Vitis amurensis, Schisandra chinensis, Akebia trifoliata*
Warm temperate deciduous broadleaved forest	*Pinus tabuliformis, Platycladus orientalis, Quercus variabilis, Quercus liaotungensis, Quercus mongolica, Quercus aliena, Quercus acutissima, Ulmus pumila, Ailanthus altissima, Koelreuteria paniculata, Fraxinus chinensis, Diospyros lotus, Ziziphus jujuba* var. *spinosa, Pterocarya stenoptera, Populus tomentosa, Populus simonii, Populus cathayana, Populus hopeiensis, Populus davidiana, Betula platyphylla, Tilia, Ulmus pumila, Juglans mandshurica, Salix matsudana, Sophora japonica, Catalpa bungei, Paulownia fortunei, Broussonetia papyrifera, Morus mongolica, Diospyros lotus, Toona sinensis, Pistacia chinensis, Celtis sinensis, Fraxinus chinensis, Melia azedarach, Pterocarya stenoptera, Platycarya strobilacea, Kalopanax septemlobus, Ulmus parvifolia, Pinus bungeana, Juniperus rigida, Sabina chinensis, Abies nephrolepis, Picea wilsonii, Picea meyeri, Larix principis-rupprechtii, Robinia pseudoacacia, Populus canadensis, Fraxinus velutina, Amorpha fruticosa*	*Vitex negundo var. heterophylla, Ziziphus jujuba var. spinosa, Cotinus coggygria, Ostryopsis davidiana, Corylus mandshurica, Abelia biflora, Caragana sinica, Lespedeza bicolor, Grewia biloba, Spiraea salicifolia, Padus racemosa, Malus baccata, Sorbaria sorbifolia, Rhododendron simsii, Alangium plataaifoliam, Vitis amurensis, Actinidia kolomikta, Actinidia arguta*
North subtropical	*Quercus acutissima, Quercus variabilis, Quercus aliena, Quercus chenii, Liquidambar formosana, Platycarya*	*Baeckea frutescens, Phyllanthus emblica,*

Forest Types	Main species for each type	
	Trees	Shrub
evergreen broad-leaved and deciduous broadleaved forest	*strobilacea, Albizia kalkora, Dalbergia hupeana, Cornus controversa, Pistacia chinensis, Kalopanax septemlobus, Sassafras tzumu, Phoebe zhennan, Acer L, Broussonetia kazinoki, Cunninghamia lanceolata, Abies fabri, Larix chinensis, Melia azedarach, Cryptomeria fortunei, Firmiana simplex*	*Phoenix hanceana, Citrus reticulata, Myrica rubra, Eriobotrya japonica, Melastoma candidum, Phyllostachys heterocycla, Pseudosasa amabilis*
Central, south subtropical evergreen broad-leaved forest	*Cyclobalanopsis glauca, Fagus longipetiolata, Castanopsis fargesii, Broussonetia kazinoki, Quercus, Cinnamomum camphora, Phoebe zhennan, Sassafras tzumu, Schima superba, Carpinus turczaninowii, Liquidambar formosana, Pinus kesiya var. langbianensis, Lithocarpus glabra, Chukrasia tabularis var. velutina, Gleditsia sinensis, Pistacia chinensis, Pteroceltis tatarinowii, Choerospondias axillaris, Pinus massoniana, Cunninghamia lanceolata, Cupressus funebris, pinus yunnanensis, Tsuga dumosa, Tilia, Ulmus pumila, Betula spp, Alnus japonica, Metasequoia glyptostroboides, Cathaya argyrophylla, Pseudolarix amabilis, Pseudotaxus chienii, Taiwania cryptomerioides, Keteleeria fortunei, Michelia figo, Glyptostrobus pensilis, Cryptomeria fortunei, Amentotaxus argotaenia, Platycladus orientalis, Eucommia ulmoides, Emmenopterys henryi, Davidia involucrata, Camptotheca acuminata, Tsoongiodendron odorum, Sinowilsonia henryi, Platycarya strobilacea, Cyclocarya paliurus, Dipteronia sinensis, Tetracentron sinensis, Liriodendron chinensis, Cercidiphyllum japonicum, Idesia polycarpa, Calycanthus chinensis, Camellia oleifera, Vernicia fordii, Sapium sebiferum, Cryptomeria fortunei, Bamboo, etc.*	*Calamus tetradactylus, Caryota ochlandra, Musa wilsonii, Alocasia macrorrhiza, Rhododendron simsii, Platycarya strobilacea, Woodfordia fruticosa, Garuga forrestii, Quercus fabri, Vaccinium bracteatum, Rhodomyrtus tomentosa, Baeckea frutescens*
Tropical monsoon forest, rainforest	*Castanopsis fargesii, Lithocarpus glabra, Cyclobalanopsis glauca, Cinnamomum camphora, Phoebe zhennan, Machilus pingii, Beilschmiedia intermedia, Cryptocarya chinensis, Alseodaphne hainanensis, Mytilaria laosensis, Manglietia fordiana, Michelia figo, Kmeria septentrionalis, Schima superba, Aphanamixis polystachya, Toona ciliata, Chukrasia*	*Daemonorops margaritae, Strychnos nuxvomica, Millettia dielsiana, Gnetum montanum, Ligustrum confusum, Mucuna sempervirens, Tetrastigma*

Forest Types	Main species for each type	
	Trees	Shrub
	tabularis, Litchi chinensis, Dimocarpus longan, Reevesia pubescens, Heritiera parvifolia, Pterospermum acerifolium, Calophyllum inophyllum, Mesua ferrea, Canarium album, Sapium sebiferum, Jatropha curcas, Adina pilulifera, Pouteria annamensis, Annamocarya sinensis, Rhoiptelea chiliantha, Gmelina chinensis, Vatica mangachapoi, Hopea hainanensis, Dipterocarpus, Parashorea chinensis, Hevea brasiliensis, Bamboo, etc.	*obtectum, Fissistigma oldhamii, Melocalamus, Rhapis humilis, Arenga engleri, Pinanga Bl., Phoenix sylvestris, Alocasia macrorrhiza, Alpinia japonica,*
Inner Mongolia, Xinjiang mountain coniferous forest	*Larix sibirica, Abies sibirica, Picea asperata, Platycladus orientalis, Juniperus formosana, Juniperus rigida, Betula L., Populus davidiana, Tilia mongolica, Morus mongolica, Cyclobalanopsis glauca, Salix pseudotangii, Salix alba, Betula albosinensis, Tamarix chinensis, Populus euphratica, Populus canescens*	*Alhagi sparsifolia, Elaeagnus oxycarpa, Nitraria tangutorum, Caragana sinica, Calligonum mongolicum, Ephedra intermedia, Spiraea salicifolia, Cotoneaster, Cotoneaster melanocarpus, Lonicera japonica*
Qinghai-Tibet alpine coniferous forest	*Picea wilsonii, Picea asperata, Picea likiangensis, Picea purpurea, Picea retroflexa, Picea smithiana, Picea spinulosa, Abies fargesii, Abies faxoniana, Abies fabri, Abies squamata, Abies ferreana, Abies forrestii, Abies delavayi, Abies spectabilis, Larix potaninii, Larix mastersiana, Larix himalaica, Larix griffithiana, Cupressus gigantea, Cupressus chengiana, Cupressus duclouxiana, Pinus armandi, Tsuga chinensis, Taxus chinensis, Cephalotaxus sinensis, Castanopsis fargesii, Cinnamomum camphora, Zelkova serrata, Betula L., Fraxinus chinensis, Populus spp., Salix L.*	*Rhododendron simsii, Lonicera japonica, Rosa L., Spiraea salicifolia, Rubus L., Cotoneaster B., Sorbus L., Sabina procumbens, Berberis Linn., Salix cupularis*

Data source：Peport on China's forestry resources

Table 4 The priority species and reasons for priority

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
1	*Cycas revoluta*	T	N	Gardening
2	*Ginkgo biloba*	T	N	Endemic, Threatened, Gardening, Economic
3	*Abies fabri*	T	N	Endemic, Timber
4	*Abies fargesii*	T	N	Endemic, Timber
5	*Abies ferreana*	T	N	Endemic, Timber
6	*Abies holophylla*	T	N	Endemic, Timber
7	*Abies squamata*	T	N	Endemic, Timber
8	*Cathaya argyrophylla*	T	N	Endemic, Threatened
9	*Cedrus deodara*	T	N	Gardening, Timber, Medicinal
10	*Keteleeria fortunei*	T	N	Endemic , Timber
11	*Keteleeria davidiana*	T	N	Endemic , Timber
12	*Larix chinensis*	T	N	Endemic, Threatened
13	*Larix gmelinii*	T	N	Timber
14	*Larix kaempferi*	T	E	Timber
15	*Larix mastersiana*	T	N	Endemic, Threatened
16	*Larix olgensis*	T	N	Timber
17	*Larix potaninii*	T	N	Endemic , Timber
18	*Larix griffithiana*	T	N	Timber
19	*Larix principis-rupprechtii*	T	N	Endemic, Timber
20	*Larix sibirica*	T	N	Timber
21	*Picea asperata*	T	N	Endemic, Timber, Gardening
22	*Picea brachytyla*	T	N	Endemic, Timber
23	*Picea crassifolia*	T	N	Endemic, Timber
24	*Picea koraiensis*	T	N	Timber
25	*Picea meyeri*	T	N	Endemic, Timber
26	*Picea likiangensis*	T	N	Endemic, Timber
27	*Picea purpurea*	T	N	Endemic, Timber
28	*Picea schrenkiana*	T	N	Timber
29	*Picea wilsonii*	T	N	Endemic, Timber, Gardening
30	*Pinus armandi*	T	N	Endemic, Timber, Gardening
31	*Pinus bungeana*	T	N	Endemic, Gardening
32	*Pinus caribaea*	T	E	Timber
33	*Pinus densata*	T	N	Endemic, Timber
34	*Pinus elliottii*	T	E	Timber
35	*Pinus henryi*	T	N	Endemic, Timber
36	*Pinus kesiya* var. *langbinnensis*	T	N	Timber
37	*Pinus koraiensis*	T	N	Timber

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
38	*Pinus latteri*	T	N	Timber
39	*Pinus massoniana*	T	N	Timber
40	*Pinus sylvestris* var. *mongolica*	T	N	Timber, Protection
41	*Pinus tabulaeformis*	T	N	Endemic, Timber
42	*Pinus taeda*	T	E	Timber
43	*Pinus taiwanensis*	T	N	Endemic , Gardening
44	*Pinus thunbergii*	T	E	Timber, Protection
45	*Pinus densiflora*	T	N	Endemic, Timber
46	*Pinus yunnanensis*	T	N	Timber
47	*Pseudolarix amabilis*	T	N	Endemic, Threatened, Gardening
48	*Pseudotsuga forrestii*	T	N	Endemic, Threatened
49	*Pseudotsuga gaussenii*	T	N	Endemic, Threatened
50	*Pseudotsuga sinensis*	T	N	Endemic, Threatened
51	*Pseudotsuga wilsoniana*	T	N	Endemic, Threatened
52	*Tsuga chinensis*	T	N	Endemic, Timber
53	*Tsuga chinensis* var. *oblongisquamata*	T	N	Endemic, Timber
54	*Tsuga chinensis* var. *tchekiangensis*	T	N	Endemic, Timber
55	*Tsuga chinensis* var. *forrestii*	T	N	Endemic , Timber
56	*Tsuga longibracteata*	T	N	Endemic, Timber
57	*Tsuga mertensiana*	T	N	Endemic, Timber
58	*Cryptomeria fortunei*	T	N	Endemic, Timber
59	*Cunninghamia lanceolata*	T	N	Endemic, Timber
60	*Glyptostrobus pensilis*	T	N	Endemic, Threatened, Gardening
61	*Metasequoia glyptostroboides*	T	N	Endemic, Threatened, Gardening
62	*Taiwania cryptomerioides*	T	N	Timber
63	*Taxodium ascendens*	T	E	Timber
64	*Taxodium distichum*	T	E	Timber, Gardening
65	*Chamaecyparis formosensis*	T	N	Endemic, Threatened
66	*Cupressus chengiana*	T	N	Endemic, Timber
67	*Cupressus funebris*	T	N	Endemic, Timber, Gardening, Protection
68	*Cupressus gigantea*	T	N	Endemic , Timber
69	*Fokienia hodginsii*	T	N	Timber, Threatened
70	*Platycladus orientalis*	T	N	Endemic, Timber, Protection, Gardening
71	*Sabina chinensis*	T	N	Timber, Protection, Gardening
72	*Sabina vulgaris*	O	N	Endemic, Gardening, Protection
73	*Sabina saltuaria*	T	N	Endemic, Timber
74	*Thuja occidentalis*	T	E	Timber, Gardening
75	*Podocarpus macrophyllus*	T	N	Gardening
76	*Nageia nagi*	T	N	Timber, Garden

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
77	*Cephalotaxus sinensis*	T	N	Endemic , Garden
78	*Pseudotaxus chienii*	T	N	Endemic, Threatened
79	*Taxus chinensis*	T	N	Endemic, Threatened, Medicinal, Gardening
80	*Taxus chinensis* var. *mairei*	T	N	Garden, Timber, Medicinal
81	*Taxus cuspidata*	T	N	Garden, Timber, Medicinal
82	*Taxus fuana*	T	N	Timber
83	*Taxus wallichiana*	T	N	Timber
84	*Torreya fargesii*	T	N	Endemic, Threatened
85	*Torreya grandis*	T	N	Timber
86	*Torreya grandis 'Merrillii'*	T	N	Economic
87	*Casuarina equisetifolia*	T	E	Protection, Timber
88	*Populus alba*	T	N	Protection, Timber
89	*Populus cathayana*	T	N	Protection, Timber, Endemic
90	*Populus davidiana*	T	N	Timber
91	*Populus deltoides*	T	E	Timber
92	*Populus euphratica*	T	N	Timber, Protection
93	*Populus nigra*	T	E	Timber
94	*Populus nigra* var. *thevestina*	T	N	Timber
95	*Populus simonii*	T	N	Timber, Protection
96	*Populus tomentosa*	T	N	Endemic, Timber
97	*Populus x canadensis*	T	E	Timber
98	*Salix babylonica*	T	N	Timber, Garden, Endemic
99	*Salix matsudana*	T	N	Timber, Protection
100	*Salix matsudana* f. *umbraculifera*	T	N	Garden
101	*Salix matsudana* f. *tortuosa*	T	N	Garden
102	*Salix psammophila*	O	N	Protection
103	*Salix integra*	O	N	Economic
104	*Myrica rubra*	T	N	Endemic, Economic
105	*Caraya illinoensis*	T	E	Economic
106	*Caraya cathaythsis*	T	N	Endemic, Economic
107	*Juglans mandshurica*	T	N	Timber, Threatened
108	*Juglans regia*	T	N	Economic
109	*Pterocarya stenoptera*	T	N	Timber
110	*Alnus cremastogyne*	T	N	Endemic, Timber, Protection
111	*Alnus nepalensis*	T	N	Timber
112	*Betula alnoides*	T	N	Timber
113	*Betula platyphylla*	T	N	Timber
114	*Betula luminifera*	T	N	Endemic, Timber
115	*Betula albo-sinensis*	T	N	Endemic, Timber

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
116	*Carpinus putoensis*	T	N	Endemic, Threatened
117	*Corylus heterophylla*	O	N	Economic
118	*Corylus mandshurica*	O	N	Endemic, Economic
119	*Grevillea robusta*	T	E	Garden, Timber
120	*Ostrya rehderiana*	T	N	Endemic, Threatened
121	*Ostryopsis davidiana*	O	N	Endemic, Protection
122	*Castanea henryi*	T	N	Economic, Endemic, Timber
123	*Castanea mollissima*	T	N	Economic, Timber
124	*Lithocapus glaber*	T	N	Endemic, Timber
125	*Castanopsis hystrix*	T	N	Timber
126	*Castanopsis kawakamii*	T	N	Endemic, Timber , Threatened
127	*Castanopsis fargesii*	T	N	Endemic, Timber
128	*Quercus aliena*	T	N	Endemic, Timber
129	*Quercus mongolica*	T	N	Timber
130	*Quercus variabilis*	T	N	Timber
131	*Quercus acutissima*	T	N	Timber
132	*Cyclobalanopsis glauca*	T	N	Timber
133	*Cyclobalanopsis myrisinaefolia*	T	N	Timber
134	*Celtis sinensis*	T	N	Timber, Garden
135	*Pteroceltis tatarinowii*	T	N	Endemic, Economic, Garden
136	*Ulmus laevis*	T	N	Endemic, Timber, Gardening
137	*Ulmus parvifolia*	T	N	Endemic, Garden
138	*Ulmus macrocarpa*	T	N	Endemic, Timber
139	*Ulmus pumila*	T	N	Endemic, Timber
140	*Zelkova schneideriana*	T	N	Endemic, Timber, Gardening
141	*Zelkova serrata*	T	N	Timber, Gardening
142	*Artocarpus heterophyllus*	T	N	Timber , Economic, Garden
143	*Broussonetia papyrifera*	T	N	Timber, Medicinal
144	*Cudrania tricuspidata*	T	N	Garden, Protection
145	*Ficus altissima*	T	N	Timber, Garden
146	*Ficus benjamina*	T	N	Timber, Garden
147	*Ficus tinctoria*	T	N	Timber
148	*Ficus microcarpa*	T	N	Garden, Timber
149	*Ficus microcarpa* var. *pusillifolia*	T	N	Garden, Timber
150	*Ficus virens*	T	N	Garden
151	*Morus alba*	T	N	Economic, Timber, Medicinal
152	*Haloxylon ammodendron*	T	N	Protection
153	*Haloxylon persicum*	T	N	Protection
154	*Paeonia lutea*	O	N	Endemic, Threatened

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
155	*Paeonia suffruticosa*	O	N	Endemic, Garden, Medicinal
156	*Berberis thunbergii*	T	N	Gardening
157	*Liriodendron chinense*	T	N	Endemic, Timber, Garden
158	*Magnolia denudata*	T	N	Endemic, Garden, Timber
159	*Magnolia liliflora*	T	N	Garden, Endemic
160	*Magnolia Medicinalis*	T	N	Economic, Medicinal
161	*Manglietia hainanensis*	T	N	Endemic , Gardening
162	*Manglietia fordiana*	T	N	Endemic, Timber, Garden
163	*Manglietia insignis*	T	N	Timber, Garden
164	*Manglietiastrum sinicum*	T	N	Endemic, Threatened
165	*Michelia chapensis*	T	N	Garden, Timber
166	*Michelia figo*	T	N	Endemic, Garden, Medicinal
167	*Michelia macclurei*	T	N	Timber, Gardening
168	*Tsoongiodendron odorum*	T	N	Endemic, Threatened, Gardening
169	*Illicium verum*	T	N	Endemic, Economic, Medicinal, Timber
170	*Polyalthia laui*	T	N	Endemic, Timber
171	*Cinnamomum camphora*	T	N	Timber, Garden
172	*Cinnamomum cassia*	T	N	Endemic, Economic, Medicinal
173	*Cinnamomum japonicum*	T	N	Endemic, Timber, Garden
174	*Phoebe bournei*	T	N	Timber, Gardening
175	*Phoebe zhennan*	T	N	Endemic, Threatened, Timber, Gardening
176	*Machilus thunbergii*	T	N	Timber, Garden
177	*Sassafras randaiense*	T	N	Endemic , Timber
178	*Sassafras tsumu*	T	N	Endemic, Timber, Garden
179	*Pittosporum tobira*	O	N	Garden
180	*Liquidambar formosana*	T	N	Garden, Timber
181	*Mytilaria laosensis*	T	N	Timber
182	*Semiliquidambar cathayensis*	T	N	Endemic, Threatened
183	*Eucommia ulmoides*	T	N	Endemic, Economic, Threatened, Medicinal
184	*Platanus acerifolia*	T	N	Garden, Timber
185	*Eriobotrya japonica*	T	N	Economic
186	*Malus pumila*	T	N	Economic
187	*Malus spectabilis*	T	N	Endemic, Garden
188	*Prunus triloba*	O	N	Garden
189	*Armeniana sibirica*	T	N	Endemic, Economic
190	*Prunus armeniaca*	T	N	Endemic, Economic
191	*Prunus salicim*	T	N	Endemic, Economic
192	*Prunus persica*	T	N	Endemic, Economic, Garden
193	*Prunus cerasifera* var. *atropurpurea*	T	N	Garden

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
194	*Prunus mume*	T	N	Endemic, Economic, Garden
195	*Prunus persica*	T	N	Economic
196	*Prunus yedoensis*	T	E	Garden
197	*Pyracantha fortuneana*	O	N	Endemic, Protection
198	*Sorbaria sorbifolia*	O	N	Garden
199	*Acacia auriculaeformis*	T	E	Timber
200	*Acacia confusa*	T	N	Timber, Protection
201	*Acacia crassicarpa*	T	E	Timber
202	*Acacia mangium*	T	E	Timber
203	*Acacia mearnsii*	T	E	Garden, Timber, Economic
204	*Acacia dealbata*	T	E	Garden, Timber
205	*Albizia julibrissin*	T	N	Garden, Timber, Protection
206	*Amorpha fruticosa*	O	E	Economic, Protection
207	*Cercis chinensis*	O	N	Gardening
208	*Cercis gigantea*	T	N	Endemic, Garden, Timber
209	*Bauhinia variegata*	T	E	Garden, Timber
210	*Bauhinia blakeana*	T	N	Gardening , Timber
211	*Caragana microphylla*	O	N	Protection
212	*Caragana rosea*	O	N	Endemic, Protection, Medicinal
213	*Caragana sinica*	O	N	Endemic, Protection, Garden, Medicinal
214	*Caragana korshinskii*	O	N	Protection, Medicinal
215	*Cassia siamea*	T	N	Timber
216	*Dalbergia odorifer*	T	N	Endemic, Threatened , Timber
217	*Dalbergia hupeana*	T	N	Endemic, Timber
218	*Erythrina variegata*	T	E	Garden, Timber, Medicinal
219	*Erythrina corallodendron*	T	E	Garden, Medicinal
220	*Erythropholeum fordii*	T	N	Endemic, Threatened, Timber
221	*Gleditsia sinensis*	T	N	Endemic, Garden, Timber
222	*Lespedeza bicolor*	O	N	Garden, Ecology
223	*Ormosia henryi*	T	N	Endemic, Timber, Threatened
224	*Ormosia hosiei*	T	N	Endemic, Timber
225	*Pterocarpus indicus*	T	E	Timber
226	*Robinia pseudoacacia*	T	E	Timber, Garden
227	*Sophora japonica*	T	N	Endemic, Timber , Garden
228	*Sophora japonica* var. *pendula*	T	N	Garden
229	*Zenia insignis*	O	N	Endemic, Timber, Protection, Economic
230	*Nitraria tangutorum*	O	N	Protection
231	*Clausena lansium*	T	N	Endemic, Economic, Medicinal

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
232	*Murraya paniculata*	O	N	Garden, Medicinal
233	*Phellodendron amurense*	T	N	Timber, Threatened , Medicinal
234	*Phellodendron chinense*	T	N	Endemic, Medicinal, Timber
235	*Citrus grandis*	T	N	Endemic, Economic
236	*Citrus limon*	T	N	Endemic, Economic
237	*Citrus sinensis*	T	N	Endemic, Economic
238	*Citrus tongerina*	T	N	Endemic, Economic
239	*Ailanthus altissima*	T	N	Endemic, Protection, Timber
240	*Canarium pimela*	T	N	Economic, Medicinal, Timber
241	*Canarium album*	T	N	Timber, Medicinal, Garden
242	*Aglaia odorata*	T	N	Endemic, Garden
243	*Chukrasia tabulaxis*	T	N	Timber, Garden
244	*Khaya senegalensis*	T	E	Timber
245	*Melia azedarach*	T	N	Endemic, Protection, Medicinal, Timber
246	*Melia toosendan*	T	N	Timber, Medicinal
247	*Swietenia macrophylla*	T	E	Timber
248	*Swietenia mahagoni*	T	E	Timber
249	*Toona ciliata* var. *pubescens*	T	N	Timber
250	*Toona sinensis*	T	N	Timber, Garden
251	*Toona sureni*	T	N	Timber
252	*Vernica montana*	T	N	Endemic, Economic
253	*Vernica fordii*	T	N	Endemic, Economic
254	*Hevea brasiliensis*	T	E	Economic
255	*Bischofia polycarpa*	T	N	Endemic, Garden
256	*Sapium sebiferum*	T	N	Endemic, Economic, Gardening
257	*Coriaria sinica*	T	N	Endemic, Protection
258	*Mangifera persiciformis*	T	N	Endemic, Garden, Timber
259	*Mangifera indica*	T	N	Economic, Timber, Garden
260	*Choerospondias axillaris*	T	N	Endemic, Timber, Medicinal, Garden
261	*Pistacia chinensis*	T	N	Endemic, Timber, Gardening
262	*Pistacia vera*	T	E	Economic
263	*Rhus typhina*	T	E	Garden
264	*Toxicodendron verniciflnum*	T	N	Economic
265	*Cotinus coggygria* var. *cinerea*	T	N	Endemic, Garden
266	*Ilex rotunda*	T	N	Endemic, Garden, Timber
267	*Euonymus japonicus*	T	N	Garden
268	*Tapiscia sinensis*	T	N	Endemic , Gardening
269	*Acer palmatum*	T	N	Garden
270	*Acer truncatum*	T	N	Endemic, Garden, Timber

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
271	*Acer mono*	T	N	Endemic, Garden, Timber
272	*Dipteronia sinensis*	T	N	Endemic
273	*Aesculus chinensis*	T	N	Endemic, Garden, Timber
274	*Dimocarpus longan*	T	N	Endemic, Economic
275	*Eurycorymbus cavaleriei*	T	N	Endemic
276	*Handeliodendron bodinieri*	T	N	Endemic, Threatened
277	*Koelreuteria bipinnata*	T	N	Endemic, Garden, Medicinal
278	*Koelreuteria paniculata*	T	N	Garden
279	*Koelreuteria bipinnata* var. *integriforia*	T	N	Endemic, Garden
280	*Litchi chinensis*	T	N	Endemic, Economic
281	*Sapindus mukorossi*	T	N	Timber, Garden
282	*Xanthoceras sorbifolia*	T	N	Endemic, Economic
283	*Zizyphus jujuba*	T	N	Endemic, Economic
284	*Burretiodendron hsienmu*	T	N	Timber, Threatened
285	*Tilia amurensis*	T	N	Timber
286	*Hibiscus syriacus*	O	N	Endemic, Garden
287	*Hibiscus tiliaceus*	O	N	Garden
288	*Ochroma lagopus*	T	E	Timber
289	*Bombax malabaricum*	T	N	Garden
290	*Firmiana simplex*	T	N	Endemic, Garden, Timber
291	*Camellia japonica*	T	N	Endemic, Garden
292	*Camellia oleifera*	T	N	Endemic, Economic
293	*Camellia sinensis*	T	N	Endemic, Economic
294	*Schima superba*	T	N	Endemic, Timber
295	*Schima wallichii*	T	N	Endemic, Timber
296	*Schima argentea*	T	N	Endemic, Timber
297	*Tamarix chinensis*	O	N	Endemic, Protection
298	*Tamarix ramosissima*	O	N	Endemic, Protection
299	*Tamarix austromongolica*	O	N	Endemic, Protection
300	*Hopea hainanensis*	T	N	Timber, Threatened
301	*Homalium hainanense*	T	N	Timber
302	*Aquilaria sinensis*	T	E	Economic
303	*Elaeagnus angustifolia*	T	N	Endemic, Protection, Economic
304	*Elaeagnus mollis*	T	N	Endemic, Economic, Threatened
305	*Hippophae rhamnoides spp.sinensis*	O	N	Economic, Protection
306	*Sonneratia caseolaris*	T	N	Protection, Timber
307	*Bruguiera gymnorrhiza*	T	N	Protection, Timber
308	*Rhizophora apiculata*	T	N	Protection, Timber
309	*Camptothecca acuminata*	T	N	Endemic, Timber , Garden

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
310	*Davidia involucrata*	T	N	Endemic, Threatened , Garden
311	*Terminalia catappa*	T	E	Timber, Garden, Protection
312	*Eucalyptus camaldulensis*	T	E	Timber
313	*Eucalyptus citriodora*	T	E	Timber
314	*Eucalyptus dunnii*	T	E	Timber
315	*Eucalyptus exserta*	T	E	Timber
316	*Eucalyptus globulus*	T	E	Timber
317	*Eucalyptus maideni*	T	E	Timber
318	*Eucalyptus robusta*	T	E	Timber
319	*Eucalyptus smithii*	T	E	Timber
320	*Eucalyptus urophylla*	T	E	Timber
321	*Eucalyptus viminalis*	T	E	Timber
322	*Eucalyptus grandis*	T	E	Timber
323	*Eucalyptus tereticornis*	T	E	Timber
324	*Syzygium jambos*	T	N	Protection, Timber
325	*Acanthopanax senticosus*	T	N	Medicinal
326	*Cornus alba*	T	N	Garden
327	*Cornus walteri*	T	N	Endemic, Economic, Garden
328	*Rhododendron fortunei*	T	N	Endemic, Garden
329	*Rhododendron simsii*	T	N	Garden
330	*Rhododendron dauricum*	O	N	Garden
331	*Forsythia suspensa*	O	N	Endemic, Garden
332	*Fraxinus rhynchophylla*	T	E	Timber, Protection
333	*Fraxinus bungeana*	T	N	Endemic, Protection
334	*Fraxinus chinensis*	T	N	Timber, Garden
335	*Fraxinus mandshurica*	T	N	Timber, Garden
336	*Jasminum nudiflorum*	T	N	Endemic, Garden
337	*Olea europaea*	T	E	Economic
338	*Osmanthus fragrans*	T	N	Endemic, Garden, Economic
339	*Syringa reticulata* var. *amurensis*	T	N	Endemic, Timber, Garden
340	*Syringa oblata*	T	N	Endemic, Garden
341	*Syringa pekinensis*	O	N	Endemic, Garden
342	*Ligustrum lucidum*	T	N	Garden, Endemic, Timber
343	*Gmelina hainanensis*	T	N	Timber
344	*Tectona grandis*	T	E	Timber
345	*Vitex negundo*	O	N	Endemic, Protection
346	*Lycium barbarum*	O	N	Economic, Medicinal
347	*Lycium chinense*	O	N	Endemic, Economic, Medicinal
348	*Paulownia catalpifolia*	T	N	Endemic, Timber

No.	Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
349	*Paulownia elongata*	T	N	Endemic, Timber
350	*Paulownia fargesii*	T	N	Endemic, Timber
351	*Paulownia fortunei*	T	N	Endemic, Timber
352	*Paulownia kawakamii*	T	N	Endemic, Timber
353	*Paulownia tomentosa*	T	N	Endemic, Timber
354	*Catalpa bungei*	T	N	Endemic, Timber, Garden
355	*Catalpa fargesii* f. *ducluouxii*	T	N	Endemic, Timber, Garden
356	*Dolichandrone cauda-felina*	T	N	Endemic, Timber, Garden
357	*Emmenopterys henryi*	T	N	Endemic, Threatened
358	*Kolkwitzia amabilis*	T	N	Endemic, Garden
359	*Lonicera Japonica*	O	N	Economic, Medicinal
360	*Lonicera maackii*	O	N	Endemic, Economic, Medicinal
361	*Viburnum macrocephalum*	O	N	Endemic, Garden
362	*Bambusa chungii*	O	N	Endemic, Timber , Garden
363	*Bambusa multiplex*	O	N	Garden, Timber
364	*Bambusa multiplex 'Fernleaf'*	O	N	Endemic, Garden, Timber
365	*Bambusa pervariabilis*	O	N	Endemic, Timber
366	*Bambusa textilis*	O	N	Endemic, Timber
367	*Bambusa ventricosa*	O	N	Endemic, Gardening
368	*Bambusa vulgaris 'Wamin'*	O	N	Endemic, Gardening
369	*Phyllostachys bambusoides*	T	N	Endemic, Timber
370	*Phyllostachys glauca*	T	N	Endemic, Timber
371	*Phyllostachys edulis*	T	N	Endemic, Timber
372	*Phyllostachys sulphurea* var. *viridis*	T	N	Endemic, Timber
373	*Phyllostachys violascens*	T	N	Endemic, Gardening
374	*Phyllostachys nigra*	T	N	Endemic, Garden, Timber
375	*Caryota ochlandra*	T	N	Endemic, Garden
376	*Cocos nucifera*	T	N	Garden, Protection, Economic
377	*Elaeis guineensis*	T	E	Economic
378	*Livistona chinensis*	T	N	Economic
379	*Rhapis excelsa*	T	N	Endemic, Garden, Medicinal
380	*Rhapis gracilis*	T	N	Endemic, Garden
381	*Trachycarpus fortunei*	T	N	Garden, Economic
382	*Areca catechu*	T	O	Garden, Medicinal

Data source: Afforestation technologies for major tree species in China (1978); An overview of cropping industry in China (Forest trees) (2001); The list of of wild plants with national priority for protection (1999).

Table 5 Forest species currently used in China

No.	Species (Scientific name)	Current uses (code)	Native (N) or Exotic (E)	Type of management system
1	*Ginkgo biloba*	1,3	N	Pl
2	*Abies fabri*	1,2	N	Na, Pl
3	*Cedrus deodara*	1,6	E	Na, Pl
4	*Larix gmelinii*	1,2	N	Na, Pl
5	*Larix kaempferi*	1,2	E	Na, Pl
6	*Larix olgensis*	1,2	N	Na, Pl
7	*Larix principis-rupprechtii*	1,2	N	Na, Pl
8	*Larix sibirica*	1,2	N	Na, Pl
9	*Picea asperata*	1,2	N	Na, Pl
10	*Picea koraiensis*	1,2	N	Na, Pl
11	*Picea crassifolia*	1,2	N	Na, Pl
12	*Picea schrenkiana*	1,2	N	Na, Pl
13	*Pinus armandi*	1,2	N	Na, Pl
14	*Pinus bungeana*	1,6	N	Na, Pl
15	*Pinus caribaea*	1,2	E	Na, Pl
16	*Pinus elliottii*	1,2	E	Na, Pl
17	*Pinus kesiya* var.*langbinnensis*	1,2	N	Na, Pl
18	*Pinus koraiensis*	1,2	N	Na, Pl
19	*Pinus massonoana*	1,2	N	Na, Pl
20	*Pinus sylvestris* var. *mongolica*	1,6	N	Na, Pl
21	*Pinus tabulaeformis*	1,2	N	Na, Pl
22	*Pinus taeda*	1,2	E	Na, Pl
23	*Pinus yunnanensis*	1,2	N	Na, Pl
24	*Pseudolarix amabilis*	1,6	N	Pl
25	*Cryptomeria fortunei*	1,6	N	Na, Pl
26	*Cunninghamia lanceolata*	1,6	N	Na, Pl
27	*Metasequoia glyptostroboides*	1,6	N	Pl
28	*Cupressus chengiana*	1	N	Pl
29	*Cupressus funebris*	1,6	N	Na, Pl
30	*Fokienia hodginsii*	1,6	N	Pl
31	*Platycladus orientalis*	1,6	N	Na, Pl
32	*Cinnamomum camphora*	1,4,6	N	Pl
33	*Taxus chinensis*	1,4,6	N	Na, Pl
34	*Taxus chinensis* var. *mairei*	1,4,6	N	Na, Pl
35	*Taxus cuspidata*	1,4,6	N	Na, Pl

No.	Species (Scientific name)	Current uses (code)	Native (N) or Exotic (E)	Type of management system
36	*Taxus fuana*	1,4,6	N	Na, Pl
37	*Taxus wallichiana*	1,4,6	N	Na, Pl
38	*Torreya grandis*	1,6	N	Pl
39	*Torreya grandis 'Merrillii'*	1,4,6	N	Na, Pl
40	*Casuarina equisetifolia*	1,6	N	Pl
41	*Populus euphratica*	1,6	N	Na.
42	*Populus alba*	1,6	N	Na, Pl
43	*Populus davidiana*	1,2	N	Na, Pl
44	*Populus cathayana*	1,2	N	Na, Pl
45	*Populus nigra*	1,2,3	E	Pl
46	*Populus deltoides*	1,2,3	E	Pl
47	*Populus nigra* var. *italica*	1,2,3	N	Na, Pl
48	*Populus simonii*	1,2,3	N	Na, Pl
49	*Populus tomentosa*	1,2	N	Na, Pl
50	*Myrica rubra*	4, 6	N	Pl
51	*Caraya illinoensis*	1,4	E	Na
52	*Juglans mandshurica*	1	N	Pl
53	*Juglans regia*	1,4,5	N	Pl
54	*Pterocarya stenoptera*	1,3,4,5	N	Na, Pl
55	*Alnus cremastogyne*	1,2,6	N	Na, Pl
56	*Castanea henryi*	1,4	N	Na, Pl
57	*Castanea mollissima*	1,4,5	N	Na, Pl
58	*Castanopsis hystrix*	1,2	N	Na, Pl
59	*Quercus variabilis*	1,4	N	Na, Pl
60	*Quercus mongolica*	1	N	Na, Pl
61	*Quercus acutissima*	1	N	Na, Pl
62	*Lithocarpus glaber*	1	N	Na, Pl
63	*Ulmus laevis*	1,6	N	Na, Pl
64	*Ulmus pumila*	1,6	N	Na, Pl
65	*Zelkova serrata*	1,6	N	Pl
66	*Haloxylon ammodendron*	4,5,6	N	Na, Pl
67	*Haloxylon persicum*	5,6	N	Na, Pl
68	*Liriodendron chinense*	1,6	N	Na, Pl
69	*Magnolia Medicinalis*	1,6	N	Pl
70	*Cocos nucifera*	1,4,5,6	N	Na, Pl
71	*Phoebe bournei*	1,6	N	Pl

No.	Species (Scientific name)	Current uses (code)	Native (N) or Exotic (E)	Type of management system
72	*Eucommia ulmoides*	1,4	N	PI
73	*Prunus persica*	1,4,5	N	Na, PI
74	*Eriobotrya japonica*	4,6	N	PI
75	*Acacia auriculaeformis*	1,4	E	PI
76	*Acacia confusa*	1,4	E	PI
77	*Acacia mangium*	1,4	E	PI
78	*Amorpha fruticosa*	6	N	Na, PI
79	*Robinia pseudoacacia*	1,4,5,6	E	PI
80	*Sophora japonica*	1,6	N	PI
81	*Zenia insignis*	1,6	N	PI
82	*Ailanthus altissima*	1,6	N	Na, PI
83	*Melia azedarach*	1,4,6	N	PI
84	*Swietenia macrophylla*	1	E	Na, PI
85	*Toona ciliata* var. *pubescens*	1	N	PI
86	*Toona sinensis*	1,4,6	N	Na, PI
87	*Toona sureni*	1,6	N	PI
88	*Hevea brasiliensis*	1,4	E	Na, PI
89	*Sapium sebiferum*	1,3,6	N	Na, PI
90	*Vernica fordii*	1,3,6	N	Na, PI
91	*Anacardium occidentale*	4	E	Na, PI
92	*Choerospondias axillaris*	1,3,6	N	Na, PI
93	*Phellodendron chinense*	4,6	N	PI
94	*Pistacia chinense*	1,3,6	N	Na, PI
95	*Pistacia vera*	4,5	E	Na, PI
96	*Acer truncatum*	1,4	N	Na, PI
97	*Xanthoceras sorbifolia*	3,4,6	N	PI
98	*Zizyphus jujuba*	4,5	N	Na, PI
99	*Tilia amurensis*	1,6	N	PI
100	*Camellia oleifera*	4,5	N	Na, PI
101	*Schima superba*	1,6	N	Na, PI
102	*Tamarix chinensis*	4,5	N	Na, PI
103	*Tamarix ramosissima*	4,5	N	Na, PI
104	*Tamarix austromongolica*	4,5	N	Na, PI
105	*Hopea hainanensis*	1	N	Na, PI
106	*Hippophae rhamnoides*	4,5,6	N	Na, PI
107	*Davidia involucrata*	6	N	Na, PI

No.	Species (Scientific name)	Current uses (code)	Native (N) or Exotic (E)	Type of management system
108	*Eucalyptus citriodora*	1,2,4	E	Pl
109	*Eucalyptus globulus*	1,2,4	E	Pl
110	*Eucalyptus camuldulensis*	1,2,4	E	Pl
111	*Eucalyptus grandis*	1,2,4	E	Pl
112	*Eucalyptus tereticornis*	1,2,4	E	Pl
113	*Eucalyptus urophylla*	1,2,4	E	Pl
114	*Eucalyptus robusta*	1,2,4	E	Pl
115	*Acanthopanax senticosus*	4	N	Pl
116	*Fraxinus chinensis*	1,4	N	Na, Pl
117	*Fraxinus mandshurica*	1,6	N	Pl
118	*Olea europaea*	4	E	Na, Pl
119	*Tectona grandis*	1,6	E	Pl
120	*Paulownia catalpifolia*	1,5	N	Pl
121	*Paulownia elongata*	1,5	N	Na, Pl
122	*Paulownia fargesii*	1,5	N	Na, Pl
123	*Paulownia fortunei*	1,5	N	Na, Pl
124	*Paulownia kawakamii*	1,5	N	Na, Pl
125	*Paulownia tomentosa*	1,5	N	Na.
126	*Catalpa bungei*	1,6	N	Na, Pl
127	*Catalpa fargesii* f. *ducluouxii*	1,6	N	Na, Pl
128	*Phyllostachys edulis*	1,4,6	N	Na, Pl
129	*Elaeis guineensis*	3,4	E	Na, Pl
130	*Jatropha curcas*	3	E	Pl
131	*Swida wilsoniana*	3	N	Pl

Current use:

1) Solid wood products
2) Pulp and paper
3) Energy (fuel)
4) Non wood forest products (food, fodder, medicine, etc.)
5) Used in agroforestry systems
6) Other (please specify) _____

Management Type: Na, natural forest; Pl, plantation

Data source: Afforestation technologies for major tree species in China (1978);

Table 6 Main tree species with environmental services or social values

No.	Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value (code)
1	*Cycas revoluta*	N	4,5,6
2	*Ginkgo biloba*	N	4,5,6
3	*Cedrus deodara*	N	4,5
4	*Picea meyeri*	N	4,5
5	*Pinus densata*	N	1,4,5
6	*Pinus henryi*	N	1,4,5
7	*Taxodium ascendens*	N	1,2
8	*Cupressus funebris*	N	1,2,3,5
9	*Sabina chinensis*	N	1,3,5
10	*Sabina vulgaris*	N	1,3,5
11	*Thuja occidentalis*	E	1,3,5
12	*Podocarpus macrophyllus*	N	4,5
13	*Populus davidiana*	N	1,2,3
14	*Populus euphratica*	N	1,2,3,5
15	*Populus x canadensis*	E	1,2
16	*Salix matsudana* f *umbraculifera*	N	1,3,5
17	*Salix matsudana* f. *tortuosa*	N	1,3,5
18	*Salix psammophila*	N	1,2,3
19	*Salix integra*	N	1,2,3
20	*Juglans mandshurica*	N	1,3,5
21	*Betula platyphylla*	N	1,2,3,5
22	*Corylus heterophylla*	N	1,3
23	*Corylus mandshurica*	N	1,3,5
24	*Ostryopsis davidiana*	N	1,3
25	*Quercus denlata*	N	1,2,3
26	*Quercus mongolica*	N	1,2,3
27	*Celtis sinensis*	N	1,3,5
28	*Pteroceltis tatarinowii*	N	1,3,5
29	*Ulmus pumila*	N	1,2,3,5
30	*Zelkova serrata*	N	3,4
31	*Broussonetia papyrifera*	N	1,5,7
32	*Cudrania tricuspidata*	N	1,3,5

No.	Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value (code)
33	*Ficus altissima*	N	1,3,5
34	*Ficus benjamina*	E	3,5
35	*Ficus tinctoria*	N	3,5
36	*Ficus microcarpa*	N	1,3,5
37	*Ficus microcarpa* var.*pusillifolia*	N	1,3,5
38	*Morus alba*	N	1,2,3
39	*Paeonia suffruticosa*	N	4,5
40	*Berberis thunbergii*	N	1,3,5
41	*Liriodendron chinense*	N	3,5,7
42	*Magnolia denudata*	N	5,6
43	*Magnolia liliflora*	N	4,5,6,7
44	*Manglietia hainanensis*	N	3,4,5
45	*Michelia chapensis*	N	3,5
46	*Michelia figo*	N	3,4,5
47	*Michelia macclurei*	N	1,2,3,5,7
48	*Polyalthia laui*	N	3,5
49	*Sassafras tsumu*	N	2,3,5
50	*Pittosporum tobira*	N	4,5,7
51	*Liquidambar formosana*	N	1,2,3,5
52	*Platanus acerifolia*	N	5,7
53	*Amygdalus triloba*	N	3,5
54	*Malus pumila*	N	3,7
55	*Malus spectabilis*	N	1,3,4,5
56	*Prunus armeniaca*	N	1,2,3,7
57	*Prunus cerasifera* var.*atropurpurea*	N	3,5
58	*Prunus mume*	N	3,4,5
59	*Prunus yedoensis*	E	1,3,5
60	*Pyracantha fortuneana*	N	3,4,5
61	*Sorbaria sorbifolia*	N	1,3,5
62	*Albizia julibrissin*	N	1,2,5
63	*Amorpha fruticosa*	E	1,2,3,5
64	*Bauhinia variegate*	N	3,5
65	*Bauhinia blakeana*	N	3,5

No.	Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value (code)
66	*Caragana microphylia*	N	1,2,3
67	*Caragana rosea*	N	1,2,3,5
68	*Cercis chinensis*	N	3,4,5
69	*Erythrina orientalis*	E	3,5
70	*Lespedeza bicolor*	N	1,2,3
71	*Robinia pseudoacacia*	E	1,2,4,5,7
72	*Sophora flavescens*	N	1,2,3
73	*Sophora japonica*	N	4,5,6,7
74	*Sophora japonica* var. *pendula*	N	5
75	*Sophora viciifolia*	N	1,2,3
76	*Wisteria sinensis*	N	3,5
77	*Nitraria tangutorum*	N	1,2,3
78	*Clausena lansium*	N	3,7
79	*Murraya paniculata*	N	1,3,5
80	*Ailanthus altissima*	N	1,2,3,5
81	*Aglaia odorata*	N	1,3,5
82	*Melia azedarach*	N	1,2,3,7
83	*Buxus sinica*	N	3,5
84	*Coriaria sinica*	N	1,2,3
85	*Rhus typhina*	E	3,5
86	*Ilex rotunda*	N	1,3,5
87	*Buxus megistophylla*	N	3,5
88	*Acer palmatum*	N	3,4,5
89	*Aesculus chinensis*	N	3,4,5,6
90	*Dimocarpus longan*	N	3,5,7
91	*Koelreuteria bipinnata*	N	1,3,5
92	*Koelreuteria paniculata*	N	1,3,5
93	*Litchi chinensis*	N	3,5,7
94	*Sapindus mukorossi*	N	1,3,5,7
95	*Zizyphus jujuba*	N	1,3,7
96	*Hibiscus syriacus*	E	3,5
97	*Hibiscus tiliaceus*	N	3,5
98	*Firmiana simplex*	N	1,3,5

No.	Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value (code)
99	*Camellia japonica*	N	3,4,5
100	*Tamarix chinensis*	N	1,2,3,5
101	*Elaeagnus angustifolia*	N	1,2,3,7
102	*Sonneratia caseolaris*	N	1,5
103	*Bruguiera gymnorrhiza*	N	1,5
104	*Davidia involucrata*	N	3,4,5
105	*Terminalia catappa*	N	3,5
106	*Syzygium hainanense*	E	3,5
107	*Cornus alba*	N	1,2,3,5
108	*Rhododendron decorum*	N	1,3,5
109	*Rhododendron simsii*	N	1,3,5
110	*Forsythia suspensa*	N	1,3,5
111	*Fraxinus americana*	E	1,2,3,5
113	*Fraxinus chinensis*	N	1,2,3,5
114	*Jasminum nudiflorum*	N	3,5
115	*Olea europaea*	N	3,7
116	*Osmanthus fragrans.*	N	3,4,5
117	*Syringa aromaticum*	N	3,4,5
118	*Syringa oblata*	N	3,4,5
119	*Syringa oblate var. affinis*	N	3,4,5
120	*Vitex negundo*	N	1,2,3
121	*Lycium chinense*	N	1,2,3,7
122	*Paulownia catalpifolia*	N	2,3,5
123	*Paulownia elongata*	N	2,3,5
124	*Dolichandrone cauda-felina*	N	3,7
125	*Kolkwitzia amabilis*	N	3,5
126	*Lonicera Japonica*	N	3,5,7
127	*Lonicera maackii*	N	3,5
128	*Viburnum odoratissimum*	N	3,5
129	*Bambusa vulgaris 'Wamin'*	N	3,5
130	*Bambusa chungii*	N	1,3,5
131	*Bambusa multiplex*	N	1,3,5
132	*Bambusa multiplex 'Fernleaf'*	N	1,3,5

No.	Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value (code)
133	*Bambusa pervariabilis*	N	1,3,5
134	*Bambusa textilis*	N	3,5
135	*Bambusa ventricosa*	N	3,5
136	*Artocarpus heterophyllus*	E	3,5
137	*Caryota ochlandra*	E	3,5
138	*Cocos nucifera*	N	3,5
139	*Rhapis excelsa*	N	3,5
140	*Rhapis gracilis*	N	3,5
141	*Trachycarpus fortunei*	N	5,7
142	*Dracaena cochinchinensis*	N	3,7

Services and values include:

1) Soil and water conservation including watershed management
2) Soil fertility
3) Biodiversity conservation
4) Cultural values
5) Aesthetic values
6) Religious values
7) Other (Specify) _____

Table 7 List of tree species considered to be threatened

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
1	*Alsophila spinulosa*			20	W	1,3	√		
2	*Reevesia rotundifolia*			100	R	3			√
3	*Cycas micholitzii*			80	W	1,3,7		√	
4	*Cycas panzhihuaensis*			100	W	1,3,12		√	
5	*Cycas pectinata*			25	L	1,3			√
6	*Cycas siamensis*			25	R	3			√
7	*Cycas taiwaniana*			100	L	1,3			√
8	*Ginkgo biloba*			100	W	1,3	√		
9	*Abies beshanzuensis*			100	R	1,3	√		
10	*Abies chensiensis*			100	W	1,3		√	
11	*Abies fanjingshanensis*			100	R	1,3	√		
12	*Abies georgei*			100	W	1,3			√
13	*Abies sibirica*			40	L	1			√
14	*Abies yuanbaoshanensis*			100	R	1	√		
15	*Abies ziyuanensis*			100	L	1	√		
16	*Cathaya argyrophylla*			100	W	1,3	√		
17	*Keleleeria fortunei*			100	W	1,3			√
18	*Keteleeria hainanensis*			100	L	1,3		√	
19	*Keteleeria calcarea*			100	W	1,3		√	
20	*Keteleeria formosana*			100	L	1,3		√	
21	*Keteleeria pubescens*			100	L	1,3		√	
22	*Keteleeria xerophila*			100	R	1,3			√
23	*Larix chinensis*			100	W	1,3		√	
24	*Larix mastersiana*			100	W	1,3		√	
25	*Picea aurantiaca*			100	R	1,3		√	
26	*Picea brachytyla*			100	L	1,3			√
27	*Picea montigena*			100	R	3		√	
28	*Picea neoveitchii*			100	W	1,3		√	
29	*Picea obovata*			30	L	1,3			√
30	*Picea smithiana*			30	R	1,3			√
31	*Pinus dabeshanensis*			100	L	11		√	
32	*Pinus koraiensis*			60	W	1,3		√	
33	*Pinus kwangtungensis*			100	W	1,3			√
34	*Pinus massoniana* var. *hainanensis*			100	R	3		√	
35	*Pinus roxburghii*			20	R	1			√
36	*Pinus sibirica*			30	L	1			√
37	*Pinus sylvestris* var. *mongolica*			50	W	3,12			√

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
38	*Pinus sylvestriformis*			100	R	1,2,3		√	
39	*Pinus takahasii*			50	L	1,3			√
40	*Pinus wangii*			100	R	1,2,3		√	
41	*Pseudolarix amabilis*			100	W	15		√	
42	*Pseudotsuga brevifolia*			100	W	1,3		√	
43	*Pseudotsuga forrestii*			100	W	1,3		√	
44	*Pseudotsuga gaussenii*			100	W	1,3		√	
45	*Pseudotsuga sinensis*			100	W	1,3		√	
46	*Pseudotsuga wilsoniana*			100	R	3			√
47	*Tsuga chinensis* var. *tchekiangensis*			100	W	1,3			√
48	*Tsuga forrestii*			100	W	3,7			√
49	*Tsuga longibracteata*			100	W	1,3			√
50	*Amentotaxus formosana*			100	R	3	√		
51	*Amentotaxus argotaenia*			100	W	1,3			√
52	*Amentotaxus yunanensis*			60	L	3	√		
53	*Cunninghamia unicanaliculata*			100	L	3			√
54	*Metasequoia glyptostroboides*			100	L	1,2	√		
55	*Taiwania cryptomeriioides*			70	L	1,3	√		
56	*Calocedrus macrolepis*			100	W	1,3,7			√
57	*Chamaecyparis formosensis*			100	W	1,3		√	
58	*Cupressus chengiana*			100	W	1,3		√	
59	*Cupressus gigantea*			100	R	1,3,7	√		
60	*Fokienia hodginisii*			80	W	1,3		√	
61	*Glyptostrobus pensilis*			100	L	3,6	√		
62	*Thuja koraiensis*			50	L	1,3		√	
63	*Thuja sutchuenensis*			50	L	1,3		√	
64	*Daerydium pierrei*			20	W	1,3			√
65	*Podocarpus annamiensis*			30	L	1,3			√
66	*Podocarpus fleuryi*			40	W	1,3			√
67	*Podocarpus imbricatus*			25	W	1,3			√
68	*Cephalotaxus hainanensis*			20	W	1,3	√		
69	*Cephalotaxus lanceolata*			70	W	3,7		√	
70	*Cephalotaxus oliveri*			70	W	1,3		√	
71	*Pseudotaxus chienii*			100	W	3,7		√	
72	*Taxus chinensis*			50	W	3	√		
73	*Taxus chinensis* var. *mairei*			50	W	3	√		
74	*Taxus cuspidate*			50	W	3	√		
75	*Taxus fuana*			50	W	3	√		
76	*Taxus wallichiana*			50	R	1,3	√		

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
77	*Torreya jackii*				W	3		√	
78	*Torreya yunnanensis*			100	L	1		√	
79	*Chosenia arbutifolia*			40	W	3,10		√	
80	*Populus euphratica*			30	W	1,3,5			√
81	*Populus pruinosa*			60	W	1,3,5,7			√
82	*Salix magnifica*			100	R	1,2,3			√
83	*Salix polyadenia* var. *tschangbaischanica*			60	L	3,6,7			√
84	*Annanmocarya sinensis*			50	W	3		√	
85	*Juglans mandshurica*			30	W	1,3		√	
86	*Juglans regia*			100	L	1,5,7		√	
87	*Betula halophila*				R	1		√	
88	*Carpinus putoensis*			100	R	1,7	√		
89	*Carylus chinensis*			100	W	1,3			√
90	*Ostrya rehderiana*			100	R	1,7	√		
91	*Castanopsis concinna*			100	L	1,3		√	
92	*Castanopsis kawakamii*			100	W	15			√
93	*Cyclobalanopsis rex*			30	L	1,3			√
94	*Fagus hayatae*			100	L	3,12			√
95	*Trigonobalanus doichangensis*			80	L	1,3		√	
96	*Celtis wightii*			30	L	1,3,5			√
97	*Ptoroceltis tatarinowii*			100	W	1,3			√
98	*Ulmus chenmoui*			100	L	1,3			√
99	*Ulmus elongata*				W	3		√	
100	*Ulmus gaussenii*			100	R	3			√
101	*Zelkova serrata*			70	W	1,3		√	
102	*Rhoiptelea chiliantha*			70	W			√	
103	*Antiaris toxicaria*			20	W	3			√
104	*Artocaarpus hypargyreus*			100	W	3,5			√
105	*Artocarpus lakoocha*			20	W	1,3			√
106	*Heliciopsis henryi*			20	W	3			√
107	*Helioia shweliensis*			100	L	3			√
108	*Calligonum mongolicum*			80	W	3,5		√	
109	*Haloxylon ammodendron*			50	W	1,3,5,7			√
110	*Haloxylon persicum*			20	L	1,3,5			√
111	*Gymnocarpos przewalskii*			80	W	1,3,5	√		
112	*Euptelea pleiosporma*			50	W	1,3			√
113	*Trochodendron aralioides*			50	W	1,3		√	
114	*Cercidiphyllum japonicum*			50	W	1,3		√	

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
115	*Paeonia lutea*			100	W	3			√
116	*Paeonia rockii*			100	W	3, 7			√
117	*Paeonia suffruticosa* var. *spontanea*			100	R	3			√
118	*Paeonia decomposita*			100	L	3		√	
119	*Alcimandra cathcartti*			30	W	1,3	√		
120	*Kmeria septentrionalis*			100	L	1,3	√		
121	*Liriodendron chinensis*			60	W	3		√	
122	*Magnclia zenii*			100	R	3			√
123	*Magnolia odoratissima*			100	L	1,3		√	
124	*Magnolia amoena*			100	W	1,2,3			√
125	*Magnolia cylindrica*			100	W	1,2,3			√
126	*Magnolia henryi*			20	W	1,2,3			√
127	*Magnolia Medicinalis*			100	W	1,3		√	
128	*Magnolia Medicinalis* sp. *biloba*			100	W	1,3			√
129	*Magnolia rostrata*			50	L	3			√
130	*Mag*nolia *sieboldii*			30	W	1,3,7			√
131	*Magnolia sinensis*			100	L	1,3			√
132	*Magnolia wilsonii*			100	W	1,3,7			√
133	*Manglietia aromatica*			100	L	3		√	
134	*Manglietia decidua*			100	L	1,3	√		
135	*Manglietia grandis*			100	L	3			√
137	*Manglietia insignis*			20	W	1,3			√
138	*Manglietia megaphylla*			100	R	3,7			√
139	*Manglietia pachyphylla*			100	L	1,3		√	
140	*Manglietia patungensis*			100	L	3		√	
141	*Manglietiastrum sinicum*			100	R	3	√		
142	*Michelia chapensis*			100	L	3		√	
143	*Michelia hedyosperma*			100	W	3,7		√	
144	*Michelia longistaminafa*			100	L	1,2,3		√	
145	*Michelia wilsonii*			100	W	3		√	
146	*Parakmeria lotungensis*			100	W	3			√
147	*Parakmeria omeiensis*			100	L	3	√		
148	*Parakmeria yunnanensis*			100	W	3			√
149	*Paramichelia baillonii*			50	W	3		√	
150	*Tsoongiodendron odorum*			70	W	3		√	
151	*Tetracentron sinense*			100	L	1,3		√	
152	*Calycanthus chinensis*			20	L	1,3,7		√	
153	*Oncodostigma hainanensis*			100	L	1,3,5		√	
154	*Saccopetalum prolificum*			100	L	1,3,7		√	

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
155	*Horsfieldia hainanensis*			100	L	1,3		√	
156	*Horsfieldia pandurifolia*			100	L	1,3			√
157	*Horsfieldia tetratepala*			100	L	1,3		√	
158	*Myristica yunnanensis*			100	R	3,7			√
159	*Alseodaphne hainanensis*			70	W	3			√
160	*Cinnamomum camphora*			40	W	1,3		√	
161	*Cinnamomum japonicum*			30	W	1,3		√	
162	*Cinnamomum longepaniculatum*			100	L	1,3		√	
163	*Cinnamomum mairei*			100	L	1,3,7			√
164	*Cinnamomum micranthum*			70	W	1,3			√
165	*Cinnamomum rigidissimum*			100	L	1,3		√	
166	*Litsea auriculata*			100	W	3,7			√
167	*Litsea dilleniifolia*			100	L	3,7			√
168	*Litsea pierrei* var.*lobata*			100	L	3			√
169	*Neolitsea sericea*			40	R	3		√	
170	*Phoebe bournei*				W	3,5		√	
171	*Phoebe chekiangensis*			100	W	1,3		√	
172	*Phoebe nanmu*			100	L	3		√	
173	*Phoebe zhennan*			100	W	1,3		√	
174	*Bretschneidera sinensis*			100	W	3	√		
175	*Chunia bucklandiodes*			100	L	1,3		√	
176	*Disanthus cercidifolius* var. *longipes*			100	L	1,12		√	
177	*Semiliquidambar cathayensis*			100	W	1,3		√	
178	*Shaniodendron subaequale*			100	L	1,3	√		
179	*Sinowilsonia henryi*			100	W	1,3		√	
180	*Eucommia ulmoides*			100	W	3		√	
181	*Malus komarovii*			80	L	3, 5		√	
182	*Malus sieversii*			60	L	3,5		√	
183	*Malus sikkimensis*			30	W	3,7		√	
184	*Prunus mongolica*			50	W	3,7			√
185	*Rosa odorata*			100	W	1,3			√
186	*Rosa rugosa*			25	W	1,3			√
187	*Sorbus amabilis*			100	W	1			√
188	*Acrocarpus fraxinifolius*			30	L	1,3			√
189	*Ammopiptanthus mongolicus*			50	W	1,3			√
190	*Amoopiptanthus nanus*			50	L	1,3		√	
191	*Dalbergia fusca*			100	L	3,5		√	
192	*Dalbergia odorifera*			100	L	3		√	
193	*Gleditsia vestita*			100	R	1,5		√	

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
194	*Ormosia henryi*			70	W	1,3		√	
195	*Ormosia hosiei*			100	W	1,3		√	
196	*Ormosia howii*			100	R	1,7		√	
197	*Pterocarpus indicus*			50	W	1,3		√	
198	*Zenia insignis*			100	W	3		√	
199	*Tetraena mongolica*			100	L	3,7	√		
200	*Phellodendron amurense*			30	W	3		√	
203	*Toona sureni*			50	W	3		√	
204	*Cephalomappa sinensis*			100	W	1,3			√
205	*Cleidiocarpon cavaleriei*			100	W	1,3			√
206	*Croton laui*			100	L	1,3			√
207	*Deutzisanthus tonkinensis*			30	L			√	
208	*Mangifor sylvatica*			20	W	1,3			√
209	*Bhesa robusta*				R	3	√		
210	*Tapiscia sinensis*			100	W	3			√
211	*Acer catalpifolium*			100	L	1,3,5		√	
212	*Acer miaotaiense*			100	W	3		√	
213	*Acer yangjuechi*			60	R	3		√	
214	*Dipteronia dyerana*				L	3		√	
215	*Dipteronia sinensis*			100	W	1,3			√
216	*Aesculus wangii*			100	L	1,3,7			√
217	*Dimocarpus longan*			100	W	1,3		√	
218	*Eurycorymbus cavaleriei*			100	W	1, 3		√	
219	*Handeliodendron bodinieri*			100	W	3	√		
220	*Paranephelium hainanensis*			100	L	3, 5		√	
221	*Pometia tomentosa*			20	W	3			√
222	*Xerospermum bonii*			30	W	1,3,7			√
223	*Berchemiella wilsonii*			100	R	1,2		√	
224	*Burretiodendron esquirolii*			100	W	1,3		√	
225	*Excentrodendron hsienmu*			70	W	1,3		√	
226	*Craigia kwangsiensis*			70	R	3			√
227	*Craigia yunnanensis*			80	W	3		√	
228	*Tilia amurensis*			80	W	1,3		√	
229	*Firmiana danxiaensis*			100	L	1,3		√	
230	*Firmiana hainanensis*			100	L	1,3		√	
231	*Firmiana major*			100	L	3		√	
232	*Heritiera parvifolia*			100	L	3		√	
233	*Pterospermum kingtungense*			100	L	1,3		√	
234	*Apterosperma oblata*			100	L	3		√	

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
235	*Camellia grijsii*			100	W	1,3		√	
236	*Camellia chrysantha*			50	L	1,3,7	√		
237	*Camellia crapnelliana*			100	W	3		√	
238	*Camellia ranthamiana*			100	R	3		√	
239	*Camellia reticulata*			100	W	3		√	
240	*Camellia sinensis* var. *assamica*			25	W	3,6		√	
241	*Erythrophleum fordii*			70	W	3		√	
242	*Euryodendron excelsum*			100	R	3	√		
243	*Stewartia sinensis*			100	W	3			√
244	*Madhuca hainanensis*			100	L	3		√	
245	*Garcinia paucinervis*			60	L	3	√		
246	*Tamarix taklamakanensis*			100	R	13			√
247	*Dipterocarpus retusus*			30	W	1,3	√		
248	*Dipterocarpus gracilis*			50	R	1,7			√
249	*Hopea chinensis*			100	R	1,3	√		
250	*Hopea exalata*			100	R	3		√	
251	*Hopea hainanensis*			100	L	1,3	√		
252	*Hopea mollissima*			100	L	3,7		√	
253	*Parashorea chinensis*			100	L	15	√		
254	*Shorea assamica*			30	R	1,3	√		
255	*Vatica guangxiensis*			100	R	15		√	
256	*Vatica xishuangbannaensis*			100	R	1,3		√	
257	*Homalium laeticum* var. *glabratum*			100	L	3,12			√
258	*Taraktogenos annamensis*			25	L	3,5		√	
259	*Tetrameles nudiflora*			50	L	1,3		√	
260	*Aquilaria sinensis*			100	W	3			√
261	*Elaeagnus mollis*			100	L	1,3		√	
262	*Lagerstroemia intermedia*			70	L	1, 3			√
263	*Crypteronia paniculata*			20	L	1,3			√
264	*Pellacalyx yunnanensis*			100	R	3			√
265	*Camptotheca acuminata*			100	W	1,3		√	
266	*Davidia involucrata*			100	W	1,3,7	√		
267	*Davidia involucrata* var. *vilmoiniana*			100	L	1,3		√	
268	*Nyssa yunnanensis*			100	L	3	√		
269	*Anogeissus acuminata* var. *lanceolata*			20	L	1,3,7			√
270	*Lumnitzera littorea*			30	R	3		√	
271	*Terminalia myriocarpa*			20	W	1,2,3		√	
272	*Acanthopanax senticosus*			100	W	1,3		√	

No.	Species (scientific name)	Area (ha) of natural distribution	Average number of trees per hectare	Proportion of distribution	Distribution: widespread (W), rare (R), or local (L)	Type of threat (Code)	Threat category		
							High	Medium	Low
273	*Empetrum sibiricum*			20	L	3		√	
274	*Phyllodoce caerulea*			20	L	1			√
275	*Rhododendron aureum*			100	L	1,3		√	
276	*Rhododendron cyanocarpum*			100	L	1,3		√	
277	*Rhododendron fictolacteum*			100	L	1,7		√	
278	*Rhododendron haematodes*			100	L	3		√	
279	*Rhododendron jucundum*			100	R	1,3		√	
280	*Rhododendron protistum* var. *giganteum*			100	R	15	√		
281	*Rhododendron rex*			100	L	3,12		√	
282	*Rhododendron sulphureum*			100	R	15		√	
283	*Madhuca pasquieri*			100	W	1, 3		√	
284	*Halesia macgregorii*			100	W	3,7			√
285	*Pterostyrax psilophylla*			100	W	1,3			√
286	*Rehderodendron macrocarpum*			100	W	1,3		√	
287	*Sinojackia dolichocarpa*			100	R	3		√	
288	*Sinojackia xylocarpa*			100	L	3		√	
289	*Fraxinus mandshurica*			25	W	1,3		√	
290	*Syringa pinnatifolia*			100	W	3,7			√
291	*Syringa pinnatifolia* var. *alashanica*			100	R	3			√
292	*Gmelina arborea*			20	L	1,3,5		√	
293	*Gmelina hainanensis*			70	W	3			√
294	*Premna szemaoensis*			100	L	1,3			√
295	*Dunnia sinensis*			100	L	1,3			√
296	*Emmenopterys henryi*			100	W	1,3,7		√	
297	*Heptacodium miconioides*			100	L	3		√	
298	*Kolkwitzia amabilis*			100	W	1,3,5			√
299	*Leucomeris decora*			30	W	3			√
300	*Nouelia insignis*			100	W	3		√	
301	*Qiongzhuea tumidinosa*			100	L	1,3			√
302	*Caryota obtusa*			25	W	3,7		√	
303	*Chuniophoenix hainanensis*			100	L	1,3		√	
304	*Chuniophoenix nana*			100	R	3		√	
305	*Nypa fruticans*			30	W	3			√
306	*Trachycarpus nana*			100	L	1,3		√	
307	*Laportea urentissima*			60	L	1,3			√

Type of threat:

1) Forest cover reduction and degradation
2) Forest ecosystem diversity reduction and degradation
3) Unsustainable logging
4) Management intensification
5) Competition for land use
6) Urbanization
7) Habitat fragmentation
8) Uncontrolled introduction of alien species
9) Acidification of soil and water
10) Pollutant emissions
11) Pests and diseases
12) Forest fires
13) Drought and desertification
14) Rising sea level
15) Other (Specify)_____

Data source： The list of rare and endangered species in China (1987); The list of wild plants wth national priority for protection (1999); The inventory list of wild plants with protection priority given by the SFA (2004).

Threat categories:

Level 1: High – threatened throughout species range within the country;

Level 2: Medium – threatened in at least 50% of range within country;

Level 3: Low – threatened in less than 50% of range within country.

Table 8a Annual quantity of seed produced in China

Species		Total quantity of seed used (Kg)	Quantity of seed from documented sources (provenance/ seed zones delimited)	Quantity of seed from tested provenances (provenance trials established and evaluated)	Quantity that is genetically improved (from seed orchards)
Scientific name	Native (N) or Exotic (E)				

Note: No data available for this table.

Table 8b Annual number of seedlings (or vegetative propagules) planted in China

Species		Total quantity of seedlings planted	Quantity of seedlings from documented sources (provenance/ seed zones delimited)	Quantity of seedlings from tested provenances (provenance trials established and evaluated)	Quantity of vegetative reproductive material used.	Quantity of seedlings that are genetically improved
Scientific name	Native (N) or Exotic (E)					

Note: No data available for this table.

Table 9 List of forest species for which genetic variability has been evaluated in China

No.	Species	Native (N) or exotic(E)	Morphological traits	Adaptive and production	Molecular characterization
1	*Ginkgo biloba*	N	√		√
2	*Abies beshanzuensis*	N			√
3	*Abies ziyuanensis*	N			√
4	*Larix gmelinii*	N	√	√	√
5	*Larix kaempferi*	E		√	
6	*Larix olgensis*	N	√	√	√
7	*Larix principis-rupprechtii*	N	√	√	√
8	*Larix sibirica*	N		√	
9	*Picea crassifolia*	N	√		√
10	*Picea glauca*	N		√	
11	*Picea koraiensis*	N	√	√	√
12	*Picea likiangensis*	N	√		
13	*Picea meyeri*	N	√	√	√
14	*Pinus armandii*	N	√	√	√
15	*Pinus bungeana*	N	√	√	√
16	*Pinus caribaea*	E		√	
17	*Pinus densiflora* var. *ussuriensis*	N		√	
18	*Pinus elliottii*	E		√	
19	*Pinus koraiensis*	N	√	√	√
20	*Pinus massoniana*	N	√	√	√
21	*Pinus pumila*	N		√	
22	*Pinus sylvestris*	E		√	
23	*Pinus sylvestris* var. *mongolica*	N	√	√	
24	*Pinus tabulaeformis*	N	√	√	√
25	*Pinus taeda*	E		√	
26	*Pinus taiwanensis*	N	√	√	√
27	*Cryptomeria fortunei*	N		√	
28	*Cunninghamia lanceolata*	N	√	√	√
29	*Taiwania cryptomerioides*	N	√	√	√
30	*Fokienia hodginsii*	N		√	
31	*Plctycladus orientalis*	N	√	√	√
32	*Sabina vulgaris*	N			√
33	*Nageia nagi*	N		√	
34	*Taxus chinensis*	N			√
35	*Torreya grandis*	N	√		√

No.	Species	Native (N) or exotic(E)	Morphological traits	Adaptive and production	Molecular characterization
36	*Torreya grandis* 'Merrillii'	N	√		
37	*Casuarina equisetifolia*	E		√	√
38	*Populus davidiana*	N			√
39	*Populus simonii*	N	√		√
40	*Populus tomentosa*	N	√		√
41	*Carya cathayensis*	N	√		
42	*Cyclocarya paliurus*	N	√		
43	*Juglans mandshurica*	N	√	√	√
44	*Juglans regia*	N	√	√	√
45	*Alnus cremastogyne*	N	√	√	√
46	*Betula alnoides*	N		√	
47	*Betula luminifera*	N	√		√
48	*Castanea henryi*	N			√
49	*Castanea mollissima*	N	√		√
50	*Castanopsis sclerophylla*	N	√		
51	*Quercus acutissima*	N	√		
52	*Quercus liaotungensis*	N	√		
53	*Quercus mongolica*	N	√	√	√
54	*Quercus variabilis*	N	√		√
55	*Ulmus pumila*	N	√	√	√
56	*Liriodendron chinensis*	N	√	√	√
57	*Michelia chapensis*	N			√
58	*Lindera aggregata*	N	√		
59	*Prunus amygdalus*	N	√		
60	*Acacia auriculaeformis*	E		√	
61	*Acacia mangium*	E		√	
62	*Caragana Korshinskii*	N	√		
63	*Caragana microphylia*	N	√		
64	*Ormosia hosiei*	N			√
65	*Robinia pseudoacacia*	E		√	
66	*Idesia polycarpa*	N	√		
67	*Jatropha curcas*	N/E			√
68	*Pistacia chinensis*	N	√		
69	*Dipteronia sinensis*	N			√
70	*Tilia amurensis*	N			√
71	*Camellia oleilata*	N			√

No.	Species	Native (N) or exotic(E)	Morphological traits	Adaptive and production	Molecular characterization
72	*Schima superba*	N			√
73	*Tamarix chinensis*	N			√
74	*Hippophae rhamnoides* spp. *sinensis*	N			√
75	*Lagerstroemia indica*	N	√		
76	*Davidia involucrata*	N			√
77	*Eucalyptus camaldulensis*	E		√	
78	*Eucalyptus grandis*	E		√	
79	*Eucalyptus smithii*	E		√	
80	*Syringa oblata*	N	√		

Data source: Fulltext Database of Chinese Journals; Full-text database of China's Ph.D. Theses; Full-text database of outstanding theses of master degree.

Table 10 Target forest species included within *in situ* conservation programmes/units

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
1	*Ginkgo biloba*	Threatened	242 trees, all protected	Zhejiang	35
2	*Abies beshanzuensis*	Critically endangered	Only 3trees, all protected	Zhejiang	
3	*Abies chinsiensis*	Threatened	233554 trees, about 10% protected	Henan, Hubei, Chongqing, Shangxi, Gansu	1096
4	*Abies fanjingshanensis*	Threatened	17680 trees, majority protected	Guizhou	80
5	*Abies yuanbaoshanensis*	Critically endangered	589 trees, all protected	Guangxi	4
6	*Abies ziyuanensis*	Threatened	1979 trees, about 30% protected	Jiangxi, Hunan, Guangxi	100
7	*Cathaya argyrophylla*	Threatened	4484 trees, most protected	Hunan, Guangxi, Chongqing, Guizhou	6024
8	*Keteleeria hainanensis*	Threatened	11455 trees, partly protected	Henan	2290
9	*Keteleeria pubescens*	Threatened	8242 trees, partly protected	Guangxi, Guizhou	94
10	*Larix chinensis*	Threatened	4631538 trees, majority protected	Shangxi	6350
11	*Larix mastersiana*	Threatened	78539 trees, partly protected	Sichuan	296
12	*Picea brachytyla* var. *complanata*	Precious timber	1918758 trees, A small amount protected	Sichuan, Yunnan, Tibet	155455
13	*Picea neoveotchii*	Threatened	96343 trees, partly protected	Henan, Hubei, Chongqing, Shangxi, Gansu	529
14	*Pinus dabeshanensis*	Threatened	353 trees, mostly protected	Anhui, Henan, Hubei	107
15	*Pinus densiflora* var. *ussuriensis*	Threatened	1182832 trees, majority protected	Heilongjiang	2484
16	*Pinus koraiensis*	Precious timber	229401855 trees, A small amount protected	Liaoning, Jilin, Heilongjiang	3E+06
17	*Pinus kwangtungensis*	Threatened	748790 trees, A small amount protected	Jiangxi, Hunan, Guangdong, Guangxi, Henan, Guizhou	5527
18	*Pinus squamaia*	Critically endangered	29 trees, all protected	Yunnan	0.5
19	*Pinus sylvestriformis*	Threatened	109726 trees, majority protected	Jilin	593
20	*Pinus wangii*	Critically endangered	87 trees, all protected	Yunnan	8
21	*Pseudolarix amabilis*	Threatened	412715 trees, partly protected	Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Henan, Hubei, Hunan, Chongqing	39217
22	*Pseudotsuga brevifolia*	Threatened	205307 trees, partly protected	Guangxi, Guizhou	427
23	*Pseudotsuga forrestii*	Gradually dangerous	4300004 trees, partly protected	Yunnan, Tibet	119646
24	*Pseudotsuga sinensis*	Threatened	208859 trees, partly protected	Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Hunan, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi	5283
25	*Amentotaxus yunnanensis*	Threatened	26090 trees, mostly protected	Guizhou, Yunnan	489
26	*Glyptostrobus pensilis*	Threatened	285 trees, mostly protected	Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Yunnan	1

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
27	*Metasequoia glyptostroboides*	Threatened	5681 trees, all protected	Hubei, Hunan, Chongqing	6000
28	*Taiwania cryptomerioides*	Threatened	55275 trees, majority protected	Fujian, Hubei, Guizhou, Yunnan	2110
29	*Calocedrus macrolepis*	Gradually dangerous	196632 trees, Less than 10% protected	Guangxi, Henan, Guizhou, Yunnan	166284
30	*Cupressus chengiana*	Gradually dangerous	2374962 trees, partly protected	Sichuan, Gansu	14317
31	*Cupressus gigantea*	Threatened	44020 trees, mostly protected	Tibet	18650
32	*Fokienia hodginsii*	Threatened	654789 trees, partly protected	Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan	11585
33	*Thuja koraiensis*	Threatened	2582 trees, mostly protected	Jilin, Heilongjiang	
34	*Cephalotaxus lanceolata*	Threatened	6754 trees, mostly protected	Yunnan	439
35	*Cephalotaxus hainanensis*	Threatened	141985 trees, partly protected	Guangdong, Guangxi, Henan, Yunnan, Tibet	14316
36	*Cephalotaxus oliveri*	Threatened	3312207 trees, About 10% protected	Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan	1362
37	*Pseudotaxus chienii*	Threatened	245114 trees, partly protected	Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, Guangxi	436
38	*Taxus cuspidata*	Threatened	42675 trees, majority protected	Liaoning, Jilin, Heilongjiang	7003
39	*Taxus fuana*	Threatened	33975 trees, mostly protected	Tibet	4350
40	*Taxus wallichiana*	Threatened	4302170 trees, mostly protected	Sichuan, Yunnan, Tibet	236872
41	*Taxus chinensis* var. *mairei*	Threatened	1258778 trees, mostly protected	Shanxi, Zhejiang, Anhui, Fujian, Jiangxi, Guangdong, Guangxi, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi	39639
42	*Taxus chinensis*	Threatened	806903 trees, majority protected	Zhejiang, Anhui, Henan, Hubei, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi, Gansu	6787
43	*Torreya fargesii*	Threatened	53454 trees, majority protected	Hubei, Hunan, Chongqing, Sichuan, Guizhou, Shangxi, Gansu	1114
44	*Torreya grandis*	Threatened	764990 trees, A small amount protected	Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Hunan, Guizhou	94037
45	*Torreya jackii*	Threatened	703874 trees, partly protected	Zhejiang, Fujian, Jiangxi	2526
46	*Torreya yunnanensis*	Threatened	8938950 trees, A small amount protected	Yunnan	19133
47	*Chosenia arbutifolia*	Gradually dangerous	4287312 trees, Less than 10% protected	Inner Mongolia, Liaoning, Jilin, Heilongjiang	73121

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
48	*Annamocarya sinensis*	Threatened	472 trees, mostly protected	Hunan, Guangxi, Guizhou, Yunnan	18
49	*Juglans mandshurica*	Precious timber	39490648 trees, A small amount protected	Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia Liaoning, Jilin, Heilongjiang, Shandong, Henan, Shangxi	3E+06
50	*Juglans regia*	Threatened	35165 trees, majority protected	Inner Mongolia, Tibet, Xinjiang	262
51	*Betula hailophila*	Critically endangered	282 trees, all protected	Xinjiang	0.5
52	*Carpinus putoensis*	Threatened	Only 1 trees, protected	Zhejiang	
53	*Carpinus tiantaiensis*	Threatened	Only 21 trees, all protected	Zhejiang	
54	*Ostrya rehderiana*	Threatened	5 trees, all protected	Zhejiang	
55	*Castanopsis concinna*	Threatened	109434 trees, partly protected	Guangdong, Guangxi	313
56	*Trigonobalanus doichangensis*	Threatened	330544 trees, A small amount protected	Yunnan	1324
57	*Zlkova serrata*	Precious hardwood	623105 trees, A small amount protected	Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Guizhou, Yunnan, Tibet	167792
58	*Ulmus elongate*	Threatened	1429 trees, partly protected	Zhejiang, Anhui, Fujian, Jiangxi	118
59	*Gymnocarpos przewalkii*	Gradually dangerous	175072019 trees, A small amount protected	Inner Mongolia, Gansu, Ningxia, Xinjiang	1E+06
60	*Cercidiphyllum japonicum*	Threatened	174908 trees, Less than one third were protected	Shanxi, Zhejiang, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi, Gansu	3342
61	*Alcimandra cathcardii*	Gradually dangerous	133078 trees, The majority of them were protected	Yunnan, Tibet	56852
62	*Kmerria septentrionalis*	Threatened	4288 trees, partly protected	Guangxi, Guizhou	120
63	*Magnolia Medicinalis*	Precious medicinal materials	849556 trees, The majority of them were protected	Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Guizhou, Yunnan, Shangxi	116568
64	*Magnolia rostrata*	Threatened	220685 trees, The majority of them were protected	Yunnan	38140
65	*Manglietia deciduas*	Threatened	251 trees, partly protected	Jiangxi	
66	*Manglietiastrum sinicum*	Threatened	6 trees, All protected	Yunnan	1
67	*Parakmeria omeiensis*	Critically endangered	20 trees, All protected	Sichuan	
68	*Paramichelia baillonii*	Gradually dangerous	347384 trees, The majority of them were protected	Yunnan	36156
69	*Tsoongiodendron odorum*	Threatened	6548 trees,	Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Henan, Guizhou, Yunnan	490
70	*Illicium difengpi*	Threatened	517919 trees, A small amount protected	Guangxi	87745
71	*Teracentron sinense*	Threatened	727563 trees, A small amount protected	Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shangxi, Gansu	74468
72	*Calycanthus chinensis*	Threatened	1732214 trees, partly	Jiangsu, Zhejiang	2443

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
			protected		
73	*Oncodostigma hainanense*	Threatened	1500 trees, mostly protected	Henan	299
74	*Horsfieldia hainanensis*	Threatened	1481 trees, mostly protected	Guangxi, Henan	109
75	*Horsfieldia tetratepala*	Threatened	4101 trees, partly protected	Yunnan	2981
76	*Alseodaphne hainanensis*	Threatened	199520 trees, The majority of them were protected	Henan	11675
77	*Cinnamomum camphora*	Threatened	10460205 trees, A small amount protected	Shanghai, Zhejiang, Anhui, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Henan	23645
78	*Cinnamomum japonicum*	Threatened	30876 trees, partly protected	Shanghai, Zhejiang	83
79	*Cinnamomum longepaniculatum*	Threatened	16971 trees, partly protected	Sichuan, Shangxi, Gansu	389
80	*Cinnamomum rigidissimum*	Threatened	111264 trees, A small amount protected	Guangxi, Henan	10109
81	*Neolitsea sericea*	Threatened	47494 trees, A small amount protected	Shanghai, Zhejiang	74
82	*Phoebe bournei*	Threatened	178750 trees, A small amount protected	Zhejiang, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Guizhou	27488
83	*Phoebe chekiangensis*	Threatened	36664 trees, partly protected	Jiangxi, Zhejiang, Fujian	75
84	*Phoebe nanmu*	Threatened	57500 trees, The majority of them were protected	Yunnan, Tibet	2847
85	*Phoebe zhennan*	Threatened	45477 trees, partly protected	Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou	646
86	*Bretschneidera sinensis*	Threatened	22356 trees, The majority of them were protected	Zhejiang, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan	1500
87	*Chunia bucklandioides*	Threatened	515471 trees, partly protected	Henan	5795
88	*Semiliquidambar cathayensis*	Threatened	123745 trees, partly protected	Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Henan, Guizhou	9757
89	*Shaniodendron subaequale*	Threatened	8245 trees, The majority of them were protected	Jiangsu, Zhejiang, Anhui	57
90	*Eucommia ulmoides*	Threatened	10352 trees, A small amount protected	Zhejiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Sichuan	166
91	*Dalbergia fusca*	Threatened	205450 trees, partly protected	Yunnan	6312
92	*Dalbergia odorifera*	Threatened	1463399 trees, mostly protected	Henan	103619
93	*Gleditsia vestita*	Critically endangered	2 trees, All protected	Hunan	
94	*Ormosia henryi*	Threatened	564246 trees, A small amount protected	Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Guizhou, Yunnan	606

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
95	*Ormosia hosiei*	Threatened	70797 trees, mostly protected	Zhejiang, Fujian, Jiangxi, Henan, Hubei, Guangxi, Chongqing, Sichuan, Guizhou, Shangxi, Gansu	372
96	*Ormosia howii*	Threatened	120765 trees, mostly protected	Guangdong, Henan	2636
97	*Pterocarpus indicus*	Critically endangered	50, All protected	Yunnan	27
98	*Sindora glabra*	Threatened	184117 trees, partly protected	Henan	16906
99	*Zenia insignis*	Threatened	1904956 trees, partly protected	Hunan, Guangdong, Guangxi, Guizhou, Yunnan	22284
100	*Tetraena mongolica*	Threatened	49046747 trees, The majority of them were protected	Inner Mongolia, Ningxia	143969
101	*Phellodendron amurense*	Precious hardwood	128638291 trees, A small amount protected	Beijing, Tianjin, Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang	3E+06
102	*Phellodendron chinense*	Threatened	28380 trees, A small amount protected	Hubei, Hunan, Sichuan, Shangxi	182
103	*Amoora dasyclada*	Threatened	299217 trees, The majority of them were protected	Henan, Yunnan	21437
104	*Toona ciliata* var. *pubescens*	Threatened	203639 trees, partly protected	Zhejiang, Anhui, Fujian, Jiangxi, Hubei, Guangdong, Guangxi, Henan, Sichuan, Guizhou, Yunnan	4841
105	*Toona sureni*	Threatened	608136 trees, A small amount protected	Fujian, Hubei, Hunan, Guangdong, Guangxi, Henan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet	167690
106	*Deutzianthus tonkinensis*	Threatened	40844 trees, The majority of them were protected	Guangxi, Yunnan	3155
107	*Ilex kaushue*	Threatened	227 trees, All protected	Guangdong, Guangxi, Henan	7
108	*Bhesa robusta*	Critically endangered	10 trees, All protected	Guangxi	8
109	*Acer catalpifolium*	Critically endangered	53 trees, mostly protected	Sichuan	
110	*Acer yangjuechi*	Critically endangered	Only 4 trees, All protected	Zhejiang	
111	*Dipteronia dyerana*	Threatened	1807 trees, mostly protected	Guizhou, Yunnan	21
112	*Dimcarpus longan*	Threatened	1260645 trees, A small amount protected	Guangdong, Henan	16933
113	*Handeliodendron bodinieri*	Threatened	18854 trees, A small amount protected	Guangxi, Guizhou	979
114	*Litchi chinensis* var. *euspontanea*	Threatened	444800 trees, partly protected	Guangdong, Guangxi, Henan	23957
115	*Nephelium topengii*	Gradually dangerous	2421880 trees, A small amount protected	Guangxi, Henan	92500
116	*Paranephelium hainanensis*	Threatened	83 trees, All protected	Henan	2
117	*Burretiodendron esquirolii*	Threatened	50751 trees, majority protected	Guangxi, Guizhou, Yunnan	547
118	*Excentrodendron*	Threatened	124882 trees, About 30%	Guangxi, Yunnan	3427

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
	hsienmua		protected		
119	*Craigia yunanensis*	Threatened	Only 6 trees, All protected	Guangxi, Guizhou, Yunnan	3
120	*Hainania trichosperma*	Threatened	31660 trees, A small amount protected	Guangxi, Henan	446
121	*Tilia amurensis*	Gradually dangerous	510126250 trees, A small amount protected	Beijing, Tianjin, Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Shandong	7E+06
122	*Sinia rhodoleuca*	Threatened	21777 trees, majority protected	Guangdong, Guangxi	18
123	*Erythropsis kwangsiensis*	Threatened	3 trees, All protected	Guangxi	
124	*Firmiana danxiaensis*	Threatened	8 trees, All protected	Guangdong	
125	*Firmiana hainanensis*	Threatened	310140 trees, partly protected	Henan	19171
126	*Heritiera parvifolia*	Threatened	928532 trees, A small amount protected	Henan	30879
127	*Paradombeya sinensis*	Threatened	74189 trees, mostly protected	Yunnan	322
128	*Pterospermum kingtungense*	Critically endangered	25 trees, All protected	Yunnan	2
129	*Pterospermum menglunense*	Threatened	134093 trees, mostly protected	Yunnan	5240
130	*Camellia euphlebia*	Threatened	151020 trees, majority protected	Guangxi	1219
131	*Camellia impressinervis*	Threatened	360 trees, All protected	Guangxi	1
132	*Camellia nitidissima*	Threatened	169984 trees, majority protected	Guangxi	1366
133	*Camellia pinggaoensis* var. *terminalis*	Critically endangered	600 trees, All protected	Guangxi	1
134	*Camellia pubipetala*	Critically endangered	278 trees, All protected	Guangxi	1
135	*Erythrophleum fordii*	Threatened	33243 trees, About 1/3 protected	Fujian, Guangdong, Guangxi, Guizhou	372
136	*Euryodendron excelsum*	Threatened	13 trees, All protected	Guangdong, Guangxi	
137	*Garcinia paucinervis*	Threatened	37863 trees, partly protected	Guangxi, Yunnan	953
138	*Dipterocarpus retusus*	Threatened	24641 trees, partly protected	Yunnan	142
139	*Hopea chinensis*	Threatened	5162 trees, mostly protected	Guangxi	84
140	*Hopea exalata*	Threatened	2395592 trees, partly protected	Yunnan, Henan	305
141	*Hopea hainanensis*	Threatened	89344 trees, partly protected	Henan	8820
142	*Parashorea chinensis*	Threatened	75297 trees, mostly protected	Guangxi, Yunnan	611
143	*Vatica guangxiensis*	Critically endangered	65 trees, All protected	Guangxi	
144	*Vatica astrotricha*	Threatened	6548043 trees, A small amount protected	Henan	116581

No.	Species (scientific name)	Purpose for conservation	Number of populations (stands) or trees comserved	Location (Province)	Total Area (ha)
145	*Tetrameles nudiflora*	Threatened	20723 trees, majority protected	Yunnan	2140
146	*Aquilaria sinensis*	Threatened	531092 trees, majority protected	Guangdong, Guangxi, Henan, Yunnan	25264
147	*Sonneratia hainanensis*	Threatened	20 trees, mostly protected	Henan	
148	*Davidia involucrata*	Threatened	1716437 trees, mostly protected	Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi, Gansu	35406
149	*Nyssa yunnanensis*	Threatened	4 trees, All protected	Yunnan	
150	*Calycopteris floribunda*	Threatened	1403 trees, mostly protected	Yunnan	5
151	*Terminalia myriocarpa*	Threatened	164041 trees, A small amount protected	Guangxi, Yunnan, Tibet	31358
152	*Acanthopanax senticosus*	Gradually dangerous	5899000 trees, A small amount protected	Beijing, Shanxi, Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Henan, Shangxi	6E+06
153	*Rhododendron protistum* var. *giganteum*	Threatened	2996 trees, majority protected	Yunnan	240
154	*Lumnitzera littorea*	Threatened	962 trees, mostly protected	Henan	98
155	*Madhuca hainanensis*	Threatened	537880 trees, partly protected	Henan	25000
156	*Madhuca subquincuncialis*	Threatened	6429 trees, majority protected	Guangdong, Guangxi, Yunnan	195
157	*Styrax dolichocarpa*	Threatened	475 trees, mostly protected	Hunan	7
158	*Fraxinus mandschurica*	珍贵, Gradually dangerous	244176713 trees, A small amount protected	Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Henan, Shangxi, Gansu, Ningxia	4487726
159	*Gmelina hainanensis*	Threatened	339333 trees, A small amount protected	Guangdong, Guangxi, Henan	18159
160	*Emmenopterys henryi*	Gradually dangerous	810031 trees, About 1/10 protected	Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Henan, Hubei, Hunan, Guangdong, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shangxi, Gansu	170850
161	*Antirhea chinensis*	Threatened	61207 trees, partly protected	Guangdong, Henan	175
162	*Morinda Medicinalis*	Threatened	329533 trees, partly protected	Fujian, Jiangxi, Guangdong, Guangxi, Henan, Guizhou	39132
163	*Mussaenda anomala*	Critically endangered	59 trees, All protected	Guangdong, Guangxi, Guizhou	220
164	*Dracaena cochinchinensis*	Threatened	9215567 trees, majority protected	Guangxi, Henan, Yunnan	19790

Table 11 List of tree species with *ex situ* conservation

Species	Native (N) or exotic (E)	Field collections				Germplasm bank		
		Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks,		In vitro (including cryo conservation)	Seed banks	
Scientific name		No. stands	No. acc.	No. banks	No. clones	No. acc.	No. Banks	No. acc.
1. *Ginkgo biloba*	N	4	272					
2. *Larix chinensis*	N	1	54				1	30
3. *Larix gmelinii*	N	2	226					
4. *Larix gmelini x Larix*	N			1	64			
5. *Larix kaempferi*	E	2	990		422			
6. *Larix olgensis*	N	2	1215		576		1	49
7. *Larix principis-rupprechtii*	N	3	147	3	316			
8. *Picea koraiensis*	N	2	327	2	77			
9. *Pinus armandi*	N	2	230	2	177			
10. *Pinus bungeana*	N	5	592				1	344
11. *Pinus caribaea*	E	3	220					
12. *Pinus elliottii*	E	3	313	2	75			
13. *Pinus kesiya* var. *langbianensis*	N	1	192	1	237			
14. *Pinus koraiensis*	N	2	389				1	45
15. *Pinus massoniana*	N	5	2891		364		1	565
16. *Pinus strobus*	E	1	67					
17. *Pinus sylvestris* var. *mongolica*	N	3	1707		599		1	217
18. *Pinus tabulaeformis*	N	4	2748		978		1	371
19. *Pinus taeda*	E	3	274					
20. *Pinus taiwanensis*	N	3	204				1	45
21. *Pinus yunnanensis*	N	1	245	1	38		1	33
22. *Cryptomeria fortunei*	N	2	75					
23. *Cryptomeria japonica*	E	3	437					
24. *Cunninghamia lanceolata*	N	5	3795		257			
25. *Cupressus lusianica*	E	3	221					
26. *Cupressus duclouxiana*	N	1	194					
27. *Cupressus funebris*	N	2	63					
28. *Fokienia hodginsii*	N	3	105					
29. *Juniperus formosana*	N	1	61					
30. *Plctycladus orientalis*	N	5	314					
31. *Pseudotaxus chienii*	N	1	70					
32. *Casuarina cunninghamiana*	N	3	74					
33. *Casuarina equisetifolia*	N	2	74					
34. *Casuarina junghuhniana*	N	2	54					
35. *Populus alba*	N	3	249					

Species	Native (N) or exotic (E)	Field collections				Germplasm bank		
		Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks,		In vitro (including cryo conservation)	Seed banks	
Scientific name		No. stands	No. acc.	No. banks	No. clones	No. acc.	No. Banks	No. acc.
36. *Populus davidiana*	N	1	54					
37. *Populus deltoides*	E	5	226					
38. *Populus lasiocarpa*	N	3	123					
39. *Populus tomentosa*	N	5	244	3	512			
40. *Populus yunnanensis*	N	3	180					
41. *Populus x euramericana*	E			4	150			
42. *Salix integra*	N	2	71					
43. *Salix* spp.	N/E	2	149	2	612			
44. *Juglans regia*	N			4	118			
45. *Juglans mandshurica*	N	1	59					
46. *Alnus cremastogyne*	N	3	57					
47. *Alnus nepalensis*	N	3	84					
48. *Betula alnoides*	N	2	1123					
49. *Betula platyphylla*	N	1	86					
50. *Castanea mollissima*	N	4	591					
51. *Castanopsis hystrix*	N	3	139					
52. *Castanopsis sclerophylla*	N	3	152					
53. *Quercus aliena var.acuteserrata*	N	1	52					
54. *Pseudoceltis tatarinowii*	N	2	298					
55. *Ulmus pumila*	N	4	642					
56. *Ficus racemosa*	N	1	80					
57. *Cercidiphyllum japonicum*	N	1	61					
58. *Paeonia delavayi*	N			1	250			
59. *Paeonia suffruticosa*	N			1	979			
60. *Liriodendron chinensis*	N	3	51				1	50
61. *Paramichelia baillonii*	N	1	110					
62. *Chimonanthus praecox*	N			1	133			
63. *Cinnamomum camphora*	N	4	185					
64. *Eucommia ulmoides*	N	3	168	3	250			
65. *Amygdalus persica*	N	2	65					
66. *Armeniaca sibirica*	N	4	148				1	60
67. *Prunus humilis*	N			1	610			
68. *Prunus pedunculata*	N	3	144					
69. *Rosa chinensis*	N/E			1	212			
70. *Acacia mearnsii*	E	3	190					
71. *Albizia kalkora*	N	1	65					

Species	Native (N) or exotic (E)	Field collections				Germplasm bank		
		Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks,		In vitro (including cryo conservation)	Seed banks	
Scientific name		No. stands	No. acc.	No. banks	No. clones	No. acc.	No. Banks	No. acc.
72. Caesalpinia spinosa	E	1	74					
73. Caragana Korshinskii	N	2	78				1	78
74. Dalbergia obtusifolia	N	2	247					
75. Dalbergia odorifera	N	3	206					
76. Hedysarum scoparium	N	2	250				1	25
77. Robinia pseudoacacia	E	4	496	2	446			
78. Sophora japonica	N	4	192				1	160
79. Phellodendron amurense	N	3	146					
80. Ailanthus altissima	N	3	140					
81. Melia azedarach	N	3	87				1	981
82. Toona ciliata	N	2	53					
83. Toona ciliata var. *pubescens*	N	3	221					
84. Toona sinensis	N	2	321					
85. Aleurites fordii	N	3	122					
86. Aleurites fordii	N	2	56					
87. Jatropha curcas	N/E	3	553					
88. Phyllanthus emblica	N			1	91			
89. Sapindus mukorossi	N	2	71					
90. Zizyphus jujuba	N			4	112			
91. Camellia reticulata	N	3	161	3	53			
92. Camellia oleifera	N			5	307			
93. Camellia sinensis	N	3	142					
94. Schima superba	N	3	131					
95. Eucalyptus camaldulensis	E	3	104					
96. Eucalyptus cloeziana	E	3	62					
97. Eucalyptus dunnii	E	3	154					
98. Eucalyptus globulus	E	3	360					
99. Eucalyptus grandis	E	3	468					
100. Eucalyptus pellita	E	3	233					
101. Eucalyptus smithii	E	3	102					
102. Eucalyptus tereticornis	E	3	104					
103. Eucalyptus urophylla	E	3	646					
104. Diospyros glaucifolia	N			3	84			
105. Diospyros Kaki	N			3	94			
106. Fraxinus mandshurica	N	2	772		82			
107. Luculia pinciana	N			2	137			

Species	Native (N) or exotic (E)	Field collections				Germplasm bank		
		Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks,		In vitro (including cryo conservation)	Seed banks	
Scientific name		No. stands	No. acc.	No. banks	No. clones	No. acc.	No. Banks	No. acc.
108. Calophyllum inophyllum	N	1	200					
109. Tectona grandis	N/E	3	127					
110. Catalpa bungei	N	3	193					
111. Artemisia deserrorum	N	1	122					
112. Dendrocalamus latiflorus	N			1	115			
113. Phyllostachys bambusoides	N			3	192			
114. Phyllostachys edulis	N			3	74	1	1	321
115. Phyllostachys vioascens	N			3	123			

Table 12 Seed and vegetative propagules transferred internationally per year (Partial)

No.	Species (Scientific name)	Native (N) or Exotic (E)	Quantity of seed (Kg)		Number of vegetative propagules		Number of seedlings		Purpose
			Import	Export	Import	Export	Import	Export	
1	*Araucaria cunninghamii*	E	>10						Commercial
2	*Ginkgo biloba*	N		>10					Commercial
3	*Abies fargesii*	N		>10					Production
4	*Abies forrestii*	N		>10					Production
5	*Cedrus deodara*	E	>1000						Commercial
6	*Pinus banksiana*	E	>10						Commercial
7	*Pinus caribaea*	E	>10						Commercial
8	*Pinus elliottii*	E	>10						Commercial
9	*Pinus taeda*	E	>10						Production
10	*Pinus yunnanensis*	N		>10					Commercial
11	*Tsuga chinensis*	N		>10					Commercial
12	*Taiwania cryptomerioides*	N		>10					Commercial
13	*Cupressus lusitanica*	E	>10						Commercial
14	*Cupressus macrocarpa*	E	>10						Commercial
15	*Juniperus formosana*	N		>10					Commercial
16	*Juniperus rigida*	N		>10					Commercial
17	*Platycladus orientalis*	N		>10					Production
18	*Nageia nagi*	N		>10					Gardening
19	*Sabina chinensis*	N		>10					Commercial
20	*Taxus chinensis*	N		>10					Production
21	*Taxus chinensis* var. *mairei*	N		>10					Commercial
22	*Taxus cuspidata*	N		>10					Commercial
23	*Casuarina equisetifolia*	E	>10						Commercial
24	*Myrica rubra*	N		>10					Commercial
25	*Juglans regia*	N		>10					Production
26	*Platycarya strobilacea*	N		>10					Production
27	*Alnus cremastogyne*	N		>10					Production
28	*Betula tiansshanica*	N		>10					Commercial
29	*Carpinus cordata*	N		>10					Production
30	*Castanea henryi*	N		>10					Commercial

No.	Species (Scientific name)	Native (N) or Exotic (E)	Quantity of seed (Kg)		Number of vegetative propagules		Number of seedlings		Purpose
			Import	Export	Import	Export	Import	Export	
31	*Castanea mollissima*	N		>10					Commercial
32	*Fagus longipetiolata*	N		>10					Commercial
33	*Quercus acutissima*	N		>10					Commercial
34	*Quercus mongolica*	N		>10					Commercial
35	*Quercus variabilis*	N		>10					Commercial
36	*Celtis sinensis*	N		>10					Commercial
37	*Ulmus davidiana*	N		>10					Commercial
38	*Ulmus parvifolia*	N		>10					Commercial
39	*Ulmus pumila*	N		>10					Commercial
40	*Zelkova schneideriana*	N		>10					Commercial
41	*Zelkova serrata*	N		>10					Commercial
42	*Zelkova sinica*	N		>10					Commercial
43	*Morus alba*	N		>10					Commercial
44	*Berberis thunbergii*	N		>10					Production
45	*Liriodendron tulipifera*	E	>100						Production
46	*Prunus japonica*	N		>10					Commercial
47	*Prunus mume*	N		>10					Commercial
48	*Acacia spp.*	E	>10						Commercial
49	*Amorpha fruticosa*	N		>10					Commercial
50	*Cercis Canadensis*	E	>10						Commercial
51	*Cercis chinensis*	N		>10					Production
52	*Gleditsia japonica* var. *delavayi*	N		>10					Production
53	*Gleditsia sinensis*	N		>10					Production
54	*Laburnum alpinum*	E	>10						Production
55	*Sophora japonica*	N		>10					Commercial
56	*Wisteria sinensis*	N		>10					Commercial
57	*Toona sinensis*	N		>10					Commercial
58	*Buxus sinica*	N		>10					Commercial
59	*Cotinus coggygria* var. *cinerea*	N		>10					Commercial
60	*Cotinus coggygria* var. *atropurpureus*	E	>10						Commercial

No.	Species (Scientific name)	Native (N) or Exotic (E)	Quantity of seed (Kg)		Number of vegetative propagules		Number of seedlings		Purpose
			Import	Export	Import	Export	Import	Export	
61	*Toxicodendron succedanea*	N		>10					Commercial
62	*Ilex cornuta*	N		>10					Commercial
63	*Ilex latifolia*	N		>10					Commercial
64	*Ilex purpurea*	N		>10					Commercial
65	*Euscaphis japonica*	N		>10					Commercial
66	*Acer rubrum*	E	>10						Commercial
67	*Acer sinense*	N		>10					Commercial
68	*Acer triflorum*	N		>10					Commercial
69	*Ziziphus jujuba*	N		>10					Commercial
70	*Tilia amurensis*	N		>10					Commercial
71	*Tilia mandshurica*	N		>10					Commercial
72	*Camellia japonica*	N		>10					Commercial
73	*Elaeagnus umbellata*	N		>10					Commercial
74	*Nyssa sinensis*	N		>10					Commercial
75	*Eucalyptus spp.*	E	>10						Commercial
76	*Cornus alba*	N		>10					Commercial
77	*Cornus walteri*	N		>10					Commercial
78	*Fraxinus bungeana*	N		>10					Commercial
79	*Fraxinus chinensis*	N		>10					Commercial
80	*Fraxinus mandshurica*	N		>10					Commercial
81	*Osmanthus fragrans*	N		>10					Commercial
82	*Syringa microphylla*	N		>10					Commercial
83	*Syringa pekinensis*	N		>10					Commercial
84	*Syringa reticulate* var.*amurensis*	N		>10					Commercial
85	*Syringa velutina*	N		>10					Commercial
86	*Lonicera maackii*	N		>10					Commercial

Data sources：China National Tree Seed Coporation, http://www.chinaseeds.com/

Table 13 List of tree species with genetic improvement programmes

No.	Scientific name	Native (N) or exotic (E)	Improvement programme objective					
			Timber	Pulpwood	Energy	MP*	NWFP**	Other
1	*Ginkgo biloba*	N				√	√	
2	*Keteleeria fortunei*	N	√			√		
3	*Larix gmelinii*	N	√	√		√		
4	*Larix kaempferi*	E	√	√		√		
5	*Larix olgensis*	N	√	√		√		
6	*Larix principis-rupprechtii*	N	√	√		√		
7	*Picea koraiensis*	N	√			√		
8	*Picea meyeri*	N		√		√		
9	*Pinus armandii*	N	√	√		√		
10	*Pinus bungeana*	N				√		
11	*Pinus caribaea*	E		√				
12	*Pinus densata*	N	√	√		√		
13	*Pinus densiflora*	N	√			√		
14	*pinus elliottii*	E	√	√		√		
15	*Pinus koraiensis*	N	√	√		√		
16	*Pinus massoniana*	N	√	√		√	√	
17	*Pinus rigida* var.*serotina*	E				√		√
18	*Pinus sylvestnis* var. *mongolica*	N	√	√		√		
19	*Pinus tabuliformis*	N	√	√		√		
20	*Pinus taeda*	E	√	√		√		
21	*Pinus taiwanensis*	N	√			√		
22	*Pinus thunbergii*	N	√			√		
23	*Pinus yunnanensis*	N	√	√		√		
24	*Cryptomeria fortunei*	N				√		√
25	*Cunninghamia lanceolata*	N	√			√		√
26	*Metasequoia glyptostroboides*	N				√		√
27	*Taiwania cryptomerioides*	N	√			√		
28	*Taxodium ascendens*	E				√		√
29	*Taxodium distichum*	E				√		√
30	*Cupressus funebris*	N	√			√		
31	*Juniperus rigida*	N				√		√
32	*Platycladus orientalis*	N	√	√		√		
33	*Casuarina equisetifolia*	E				√		√
34	*Populus cathayana*	N	√	√		√		
35	*Populus canadensis*	E	√	√		√		
36	*Populus davidiana*	N		√		√		
37	*Populus euphratica*	N	√	√		√		
38	*Populus nigra*	E	√	√		√		
39	*Populus simonii*	N	√			√		

No.	Scientific name	Native (N) or exotic (E)	Improvement programme objective					
			Timber	Pulpwood	Energy	MP*	NWFP**	Other
40	*Populus tomentosa*	N	√	√		√		
41	*Salix babylonica*	N	√			√		
42	*Salix matsudana*	N	√			√		
43	*Juglans regia*	N				√	√	
44	*Alnus cremastogyne*	N	√	√		√		
45	*Betula alnoides*	N	√	√		√		
46	*Betula platyphylla*	N	√	√		√		√
47	*Corylus chinensis*	N						
48	*Castanea henryi*	N	√			√		
49	*Castanea mollissima*	N				√	√	
50	*Castanopsis eyrei*	N	√		√	√		
51	*Castanopsis hystrix*	N	√			√		
52	*Castanopsis sclerophylla*	N	√		√	√		
53	*Fagus longipetiolata*	N	√			√		
54	*Quercus mongolica*	N	√		√	√		
55	*Ulmus pumila*	N	√	√		√		√
56	*Zelkova serrata*	N	√			√		
57	*Ficus microcarpa*	N				√		
58	*Calligonum mongolicum*	N				√	√	
59	*Haloxylon ammodendron*	N			√	√		
60	*Paeonia suffruticosa*	N				√		√
61	*Liriodendron chinensis*	N	√	√		√		
62	*Liriodendron tulipifera*	E	√	√		√		
63	*Magnolia denudata*	N				√	√	
64	*Magnolia liliiflora*	N				√	√	
65	*Magnolia Medicinalis*	N				√	√	
66	*Manglietia yuyuanensis*	N				√		√
67	*Michelia chapensis*	N				√	√	
68	*Michelia macclurei*	N	√			√		
69	*Chimonanthus praecox*	N				√		√
70	*Cinnamomum camphora*	N	√			√		
71	*Phoebe zhennan*	N	√			√		√
72	*Sassafras tsumu*	N	√	√		√		
73	*Liquidambar formosana*	N	√	√		√		
74	*Eucommia ulmoides*	N				√	√	
75	Crataegus pinnatifida	N				√	√	
76	*Armeniaca vulgaris*	N				√	√	
77	*Sorbus pohuashanensis*	N				√		√
78	*Acacia auriculiformis*	E		√		√		
79	*Acacia crassicarpa*	E		√		√		

No.	Scientific name	Native (N) or exotic (E)	Improvement programme objective					
			Timber	Pulpwood	Energy	MP*	NWFP**	Other
80	*Acacia mangium*	E		√		√		
81	*Gleditsia sinensis*	N	√	√		√		
82	*Robinia pseudoacacia*	N	√	√	√	√		
83	*Sophora japonica*	N				√		√
84	*Zanthoxylum bungeanum*	N				√	√	
85	*Ailanthus altissima*	N	√			√		
86	*Melia azedarach*	N				√	√	
87	*Toona sinensis*	N	√			√	√	
88	*Jatropha curcas*	E			√	√		
89	*Sapium sebiferum*	N			√	√	√	
90	*Vernicia fordii*	N				√	√	
91	*Choerospondias axillaris*	N	√			√		
92	*Cotinus coggygria*	E				√		√
93	*Toxicodendron vernicifluum*	N				√	√	
94	*Dimocarpus longgana*	N				√	√	
95	*Zizyphus jujuba*	N				√	√	
96	*Elaeocarpus sylvestris*	N				√		√
97	*Camellia oleifera*	N				√	√	
98	*Elaeagnus angustifolia*	N				√	√	
99	*Hippophae rhamnoides*	N						
100	*Lagerstroemia indica*	N				√		√
101	*Davidia involucrata*	N	√			√		√
102	*Eucalyptus exserta*	E	√	√		√		
103	*Eucalyptus smithii*	E	√	√		√		
104	*Eucalyptus tereticornis*	E	√	√		√		
105	*Eucalyptus urophylla*	E	√	√		√		
106	*Cornus officinalis*	N				√		√
107	*Rhododendron simsii*	N				√		√
108	*Diospyros kaki*	N				√	√	
109	*Osmanthus fragrans*	N				√	√	
110	*Tectona grandis*	E	√			√		
111	*Lycium chinense*	N				√	√	
112	*Catalpa bungei*	N	√	√		√		
113	*Calamus tetradactylus*	N				√	√	
114	*Daemonorops margaritae*	N				√	√	
115	*Phyllostachys edulis*	N				√	√	

*MP: Multipurpose tree improvement program; **NWFP: Non-wood forest product

Data sources: Full-text database of Chinese journals

Table 14 Tree improvement trials (Partial)

No.	Scientific name	Native (N) or exotic (E)	Plus trees	Provenance trials		Progenies trials		Clonal testing and development			
			Number	No. of trials	No. of prov.	No. of trials	No. of families	No. of tests	No. of clones tested	No. Clones selected	No. Clones used
1	*Larix gmelinii*	N			17	1					
2	*Larix kaempferi*	E			10	2				8	
3	*Larix olgensis*	N			19	2					
4	*Larix principis-rupprechtii*	N			9	1					
5	*Larix sibirica*	N			15	2					
6	*Picea asperata*	N			17	1					
7	*Pinus armandi*	N			26	3	120	1	32	11	
8	*Pinus banksiana*	E			13	1					
9	*Pinus bungeana*	N			10	1	112	1			
10	*Pinus caribaea*	E			15	2					
11	*Pinus contorta*	E			5	1					
12	*pinus elliottii*	E			47	1					
13	*Pinus koraiensis*	N	557	1	16	2	360	1			
14	*Pinus massoniana*	N			142	4	268	8		53	
15	*Pinus sylvestris* var. *mongolica*	N		3	19	2	237	2			
16	*Pinus tabulaeformis*	N	1000	5	42	5	82	2			
17	*Pinus taeda*	E			27	2				5	
18	*Pinus yunnanensis*	N			4	1	81	1			
19	*Cunninghamia lanceolata*	N			209	15	570	20		12	
20	*Taiwania cryptomerioides*	N			13	1	24	1			
21	*Fokienia hodginsii*	N		2	17	1	48	1	15	5	5
22	*Platycladus orientalis*	N			66	4					
23	*Casuarina equisetifolia*	E			66	3	12	1	12	1	1
24	*Alnus cremastogyne*	N									
25	*Betula luminifera*	N			12	1					
26	*Betula platyphylla*	N			14	2	34	1			
27	*Castanopsis hystrix*	N			10	1					
28	*Liriodendron chinensis*	N			15	6					
29	*Liriodendron tulipifera*	E			9	3					
30	*Magnolia Medicinalis*	N			18	1					
31	*Cinnamomum camphora*	N			17	4	78	2			
32	*Phoebe bournei*	N			21	1					
33	*Prunus tomentosa*	N			4	1					
34	*Prunus armeniana*	N			4	1					
35	*Acacia spp.*	E			24	3					
36	*Robinia pseudoacacia*	E			19	3					
37	*Phellodendron amurense*	N			14	2					
38	*Melia azedarach*	N			5	1					

No.	Scientific name	Native (N) or exotic (E)	Plus trees	Provenance trials		Progenies trials		Clonal testing and development			
			Number	No. of trials	No. of prov.	No. of trials	No. of families	No. of tests	No. of clones tested	No. Clones selected	No. Clones used
39	*Toona sinensis*	N			9	1					
40	*Acer davidii*	N			12	1					
41	*Camellia oleifera*	N			26	2	175	1			
42	*Hippophae rhamnoides*	N/E			6+	1	10+		15+		
43	*Eucalyptus spp.*	E			33	3				24	
44	*Eucalyptus tereticornis*	E			4	2					
45	*Eucalyptus urophylla*	E			4	2					
46	*Phyllostachys edulis*	N			16	2					

Data sources: Full-text database of Chinese journals

Table 15 Seed orchards established (Partial)

Species (Scientific name)	Seed orchards		
	Number	Generation	Area (ha)
Alnus cremastogyne	149	1	3
Betula Platyphylla	34	Greenhouse indoor seed orchard	750m^2
Cryptomeria fortunei	16	1	1.5
Cunninghamia lanceolata		1.5	80
		2	60
		3	20
Cupressus funebris	45	1	3.8
Eucalyptus smithii	22	1	4
Haloxylon ammodendron		1	6.63
Larix gmelinii	192	1	112
Larix kaempferi	142	1	15
Larix principis-rupprechtii	108	1	74.4
Pinus elliottii		1.5	80
		2	25
Pinus kesiya var. *langbianensis*	35	1	12
Pinus koraiensis	108	1.5	30
Pinus massoniana		1.5	80
		2	24
Pinus sylvestnis var. *mongolica*	678	1	670.5
Pinus tabulaeformis	31	2	3.5
Pinus taeda		1.5	30

Data sources: Full-text database of Chinese journals

Table 16 Type of reproductive material available (Partial)

Species (scientific name)	Type of material	Available for national requests only		Available for international requests only	
		Commercial	Research	Commercial	Research
Alnus cremastogyne 'A-P1'	Seed, plant stock	√			
Camellia oleifera 'Xianglin'	Scion, plant stock	√			
Castanea mollissima 'Shuangji'	Scion, plant stock	√			
Cinnamomum camphora 'Z01'	Scion, plant stock	√			
Corylus chinensis 'Yuzhui	Scion, plant stock	√			
Cunninghamia lanceolata 'Rongshui'	Seed, plant stock	√			
Ginkgo biloba 'Dafushou'	plant stock	√			
Hippophae rhamnoides	Seed, plant stock	√			
Juglans regia 'Sichuan'	Scion, plant stock	√			
Liriodendron chinensis × *L. tulipifera*	Scion, plant stock	√			
Liriodendron chinensis 'L-P1'	Seed, plant stock	√			
Pinus bungeana	Seed, plant stock	√			
Pinus massoniana 'Tongmian'	Seed, plant stock	√			
Populus sp.	Scion, plant stock	√			
Populus alba '84K'	Scion, plant stock	√			
Populus bolleana	Scion, plant stock	√			
Populus canadensis '107', '108'	Scion, plant stock	√			
Populus x canadensis 'Sacrou 79'	Scion, plant stock	√			
Populus tomentosa. 'Sanmaoyang'	Scion, plant stock	√			
Amygdalus communis 'Zhipi'	Scion, plant stock	√			
Salix babylonica 'Jinsi'	Scion, plant stock	√			
Sophora japonica 'Jinye'	plant stock	√			
Sophora japonica 'Wuse'	plant stock	√			
Taxodium ascendens × *Taxodium mucronatum*	Scion, plant stock	√			
Taxus cuspidata × *T. bauata* 'Mandia'	Scion, plant stock	√			
Ulmus pumila 'Jinye'	Scion, plant stock	√			
Ulmus pumila var. *pendula*	Scion, plant stock	√			
Zanthoxylum bungeanum 'Jiuyeqin'	Scion, plant stock	√			
Zizyphus jujuba 'Youzao'	Scion, plant stock	√			
Zizyphus jujuba 'Hami'	Scion, plant stock	√			

Data source: Handbook of improved forest tree seed

Table 17 Institutions involved in conservation and use of FGR (Partial)

No.	Name of institution	Type of institution	Activities or programs
1	Department of wildlife protection and nature reserve management, SFA	Government	Management of wildlife animals and nature reserve
2	Administration of State-owned Forest Farms and Forest Seed and service, SFA	Government	Management of tree seed and plant stocks, forest farms and forest parks
3	Science and technology development center, SFA	Government	Management and coordination of the forestry biological genetic resources
4	Management center for import and export of endangered species, SFA	Government	Management of import and export of endangered plants and animals
5	Chinese Academy of Forestry	Research	FGR research and development, and FGR services
6	The state forestry administration International bamboo rattan network center, SFA	Research	Bamboo genetic resources research & development and services
7	Beijing Forestry University	University	FGR education and research
8	Northeast Forestry University	University	FGR education and research
9	Nanjing Forestry University	University	FGR education and research
10	Centralsouth Forestry Technology University	University	FGR education and research
11	Southwest Forestry University	University	FGR education and research
12	Provincial administrations of tree seeds and plant stocks	Government	Management to tree seeds and Seedlings and FGR
13	Provincial forestry academies	Research	FGR research
14	Multi-species FGR conservation banks (22 locations)	Research	FGR conservation and management
15	Single-species FGR conservation banks (13 locations)	Research	FGR conversation and propagation
16	Local (regional) FGR conservation banks (1300 locations)	Research	FGR conversation and Production of propagation materials
17	FGR conservation and display arboreta /Botanic gardens (160 locations)	Research	FGR collection, conservation, display and public traaining
18	All levels of nature reserves of forestry system of	Government	FGR protection

Table 18 Needs for developing FGR legislation and priority level

Needs	Priority level			
	Not applicable	Low	Moderate	High
Improve FGR legislation				√
Improve reporting requirements			√	
Consider sanction for non-compliance				√
Create forest genetic resources targeted regulations				√
Improve effectiveness of forest genetic resources regulations				√
Enhance cooperation between forest genetic resources national authorities			√	
Create a permanent national commission for conservation and management of forest genetic resources				√
Other				

Table 19 Needs for awareness raising and priority level

Needs	Priority level			
	Not applicable	Low	Moderate	High
Prepare targeted forest genetic resources information			√	
Prepare targeted forest genetic resources communication strategy			√	
Improve access to forest genetic resources information			√	
Enhance forest genetic resources training and education			√	
Improve understanding of benefits and values of forest genetic resources				√
Other				

Table 20 Overview of the main activities carried out through networks and species involved

Network Name	Activities	Genus/species Involved
International network and organization		
FAO	1, 6	*Olea europaea*, *Casuarina equisetifolia*
UNDP	1, 4, 6	*Populus* spp., *Pinus elliottii*, *Pinus taeda*, *Paulownia* spp.
Bioversity International	1	*Cunninghamia lanceolata*, *Erythrophleum fordii*, *Pterocarpus indicus*, *Toona sinensis*, *Acacia* spp.), *Eucalyptus* spp., *Tectona grandis*, *Artocarpus heterophyllus*, *Aquilaria* spp., *Azadirachta indica*, Bamboo, *Chukrasia tabularis*, *Fokienia hodginsii*, *Gmelina arborea*, *Pinus wallichiana*, *Casuarina equisetifolia*, *Juglans regia*, *Pistacia vera*, *Prunus amygdalus*, *Ziziphus jujube*
ITTO	4, 6	*Hevea brasiliensis*, Bamboo, *Anthocephalus chinensis*, *Bennettiodendron leprosipe*, *Parakmeria yunnanensis*, *Betula alnoides*, *Altingia excels*, *Schima wallichii*, *Choerospondias axillaris*
INBAR	1, 3	Bamboo, Rattan
GEF	4, 6	*Camellia oleifera*
WWF	1, 6, 4	*Larix chinensis*, *Camellia luteoflora*, *Thespesia populneoides*, *Cupressus gigantean*, *Acer pentaphyllum*, *Berchemiella wilsonii*
Teaknet	1, 3	*Tectona grandis*
Neem net	1, 3	*Melia azedarach*

Activities:

1- Information exchanges

2- Development of technical guidelines

3- Development of shared databases

4- Establishment of genetic conservation strategies

5- Germplasm exchange

6- Elaboration, submission and execution of joint research projects.

7- Other. (Please specify) _____

Table 21 Awareness raising needs. Needs for international collaboration and networking

Needs	Level of priority			
	Not applicable	Low	Medium	High
Understanding the state of diversity				√
Enhancing in situ management and conservation				√
Enhancing ex situ management and conservation				√
Enhancing use of forest genetic resources			√	
Enhancing research				√
Enhancing education and training				√
Enhancing legislation			√	
Enhancing information management and early warning systems for forest genetic resources			√	
Any other priorities for international programmes				√

Table 22 List of woody plant species important for food security or livelihoods

No.	Species	Contribution to food security	Roles in poverty allevation
1	*Actinidia chinensis*	Fresh fruit, rich nutrition, many superior varieties	Large planting area, high yield, good economic return, one of income sources for farmers.
2	*Amygdalus communis*	Rich nutrition, diverse nutrients and wide range of varieities	High economic value, play an important role in poverty alleviation in the northwest.
3	*Amygdalus persica*	Rich nutrition, rich content of pectic substances, fresh uses or processed for dry fruit and canned fruit, wide range of varieities, kernel may be edible	Widely planted, high yield, good economic return, one of the major income sources of farmers
4	*Aralia mandshrica*	Shoots for edible uses, processed for preserved vegetable	Widespread in northeast forest region, growing in open areas in forest, for food and medicinal uses, high economic value
5	*Artocarpus heterophyllus*	Served in fresh or cooked, or as vegetables. hihg contents of sugar, protein, vitamins B, C, minerals, fattyoil	Grown in Hainan, Guangdong, Guangxi, Yunnan, Taiwan. Used for shading, ornamental and edible uses. High economic value
6	*Calamus tetradactylus*		Used for making chairs, baskets and mats, also for medicines. Grown for poverty alleviation of farmers
7	*Camellia oleifera*	Over 30% oil content in seed, used to produce high qulity edible oil	Widely grown in subtropics, effective in poverty alleviation for farmers
8	*Carya cathayensis*	Crunchy and tasty, for edible uses or oil extractioin. Also ingredient for candy and dessert.	Dominant industry in Tianmu Mountain region, main income source for famers
9	*Carya illinoensis*	Nice taste, rich nutrition, for edible uses or oil extractioin. High-grade nutritional and health care products.	Grown as raw material for food production in many areas. High-grade dry fruit in the world, high economic benefit
10	*Castanea henryi*	Famous nut, highly nutrional and natural green food. Used to produce chestnut powder or canned food	Iimportant species for both timber and food, timber sed for rail road and construction, good economic benefit
11	*Castanea mollissima*	Direct use or decorational food	Widely grown, large yield top of the world, multiple uses for timber production and

No.	Species	Contribution to food security	Roles in poverty allevation
			landscaping, high economic benefit, good species for poverty alleviation in mountain areas
12	*Cerasus pseudocerasus*	Fresh food, preserved food or decorational food	TMultiple uses for food and and landscaping, widely planted, an important resource for the poverty alleviation of farmers
13	*Citrus maxima*	Highly nutritional, 4 major most famous varieties are cultivated in China	Highly demanded in markets, helping farmers and enterprises to become rich
14	*Citrus reticulata*	Highly nutritional, high contents of vitamin C and citric acid	Widely grown south from Hainan, north to Shan'xi, Ggansu and Henan; east from Taiwan, west to Tibet. Important fruit trees of income generaton for farmers
15	*Citrus sinensis*	High content of sugar, vitamin C and a certain amount of citric acid, high nutritional value. Fruit also contains vitamin P	Widely grown in southern provinces and centralize Sichuan, Guangdong and Taiwan, high medicinal value, significant contribution to local economic development
16	*Cornus walteri*	31.8-41.3% oil content in fruit, used as normal cooking oil	Widely grown in areas from Liaoning to southwesernt provinces, also used for industrial oil. Wood is hard with fine grains, suitable for high quality furniture or woodcarving, high economic value.
17	*Corylus chinensis*	Served in fresh or cooked, good raw material for Chocolate, candy and Dessert, also for extraction of edible and industrial oil	Widely grown and highly demanded, highly profitable, good species for poverty alleviation
18	*Crataegus pinnatifida*	Endemic species for both edible and medicinal uses, diverse varieties, used as fresh fruit or processed for drinks	Lovely flowers and fruits, good ornamental species for 4-side plantings. Rich wild resources suitable for poverty alleviation for farmers
19	*Dimocarpus longgana*	Fresh use and for canned food, wine, cream, sauce, also processed into dried fruit	Valuable fruit in south subtropics, for both timber and medicinal uses, an important income source for local farmers
20	*Elaeagnus*	Sugar ceontent 43-59% (20% of	Multiple ecological and economic uses

No.	Species	Contribution to food security	Roles in poverty allevation
	angustifolia	which is fructose). Used to produce powder, wine, vinegar, soy sauce, jam	such as fodder, wine, vinegar, saurce, medicne, essential oil and gum, highly profitable
21	*Elaeagnus spp.*	Highly nutritional, containing sugar, fat, tannins, organic acidd and vitamin B and C	Roots, leaves and fruits for medicinal use, a potential ecological economic tree species, root can fix nitrogen, beautiful green leaves and red fruits are of high ornamental value, good economic return
22	Elaeis guineensis	High oil content, palm oil is highly nutrional and good for edible use	Widely grown in the tropics, high oil yield, residues from oil extraction used as feed and fertilizer, nut shell used to make activated carbon, important economic source for poverty alleviation for farmers
23	*Eriobotrya japonica*	Delicious taste, highly nutritional, multiple medicainal functions of cough relief amd lung moisturing	Uses of edible, medicinal and landscaping, widely grown, important income source for poverty alleviation for farmers
24	*Ginkgo biloba*	Kernel edible, diverse varieties.	With high economic value, multiple uses for medicinal, timber and ornamental. Highly profitable.
25	*Grossularia spp.*	Rich in nutrition, suitable for fresh eating and processed products, Unique taste of its jams, wine, and canned fruit.	Cold resistance, tolerant to storage and transportation, high economic value
26	*Hippophae rhamnoides*	Highly nutritious, processed for food, beverage and health care products.	Fruit containing bioactive substances, edible and medicinal uses, Growing, harvesting and processing provide opportunities for local farmers to alleviate poverty
27	*Juglans regia*	Used in fresh or cooked, oil extraction, or processed walnut powder, high nutritional value.	Medicinal use. Obvious economic benefit, a very important economic tree species for poverty alleviation in mountain areas
28	*Litchi chinensis*	Rich nutrition, used in fresh or processed, wide range of improved varieties	Widely grown in tropical area, main source of revenue doe local farmers
29	*Malus baccata*	Used to produce wine and green	Potential ornamental species for gardening

No.	Species	Contribution to food security	Roles in poverty allevation
		processed as dried fruit and candied fruit	and landscaping, bark used as dye, commonly used as root stocks for grafting fruit trees, helping farmers to alleviate poverty
30	*Malus pumila*	Used in fresh, processed to produce wines and beverages, a wide range of varieties available	Widely grown, large yield, a major species for poverty alleviation for farmers
31	*Malus spectabilis*	Except fresh use, mostly processed into jams, vinegar and wine	Wwidely grown in north China, health care edibls, popular species for flower and fruits. high economic value
32	*Myrica rubra*	Highly nutritious, high contents of calcium, phosphorus, and iron, used in fresh	Health care function, easy cultivatation, long-lasting economic value, low production cost and acceptable economic benefit, popular in the international marke.
33	*Olea europaea*	Used to produce high quality edible oil, known as the Queen of "vegetable oil"	Suitable for the low valleys of the upstream of the Yangtze river, evident economic benefit
34	*Osmanthus fragrans*	Used for extracting aromatic oils and for edibles, also for making cakes and candy, brew wine. Many Osmanthus food available	WIith wide cultivation range, both medicinal and ornamental value, as a important way for local people to become rich.
35	*Phyllostachys heterocycla*	Bamboo shoots are excellent vegetables for fresh fry, dried and canned food	The most valuable bamboo in China, widely planted in south central maintain areas , high.economic benefit
36	*Pinus armandii*	Edible pine nuts, pollen can be used to make health care and nitritritonal food	Grown in the maintain areas in north China and northwest China, high economic benefit
37	*Pinus bungeana*	Edible pine nuts, pollen can be used to make health care and nitritritonal food	Mainly used for landscaping, important for local people to generate income and alleviate poverty.
38	*Pinus koraiensis*	Large pine nuts, delicious taste and highly nutritional	Precious wood, beautiful tree form, used for landscaping. High potential in the northeast for income generation and poverty alleviation
39	*Pinus*	Pollen has been widely used for	Multiple uses of medicinal, timber and

No.	Species	Contribution to food security	Roles in poverty allevation
	massoniana	nutritional health food.	ornamental. Rosin production makes significant contribution to poverty alleviation in maintain areas
40	*Pinus tabulaeformis*	Edible pine nuts, pollen can be used to make health care and nitritritonal food	Multiple uses of edibles, medicinal, timber and ornamental. Widely grown in the maintain areas in north China and northwest China, high economic benefit
41	*Pinus yunnanensis*	Edible pine nuts, pollen can be used to make health care and nitritritonal food	Multiple uses of edibles, medicinal, timber and ornamental. Widely grown in Yunnan, Guizhou, Sichuan and Guangxi provinces, high economic benefit
42	*Pistacia vera*	Highly nutrional kernel, delicious taste, used in fresh or fried, also widely used in sugar-making, cakes, chocolate, toast, ice cream, candied fruit, dried fruit, canned food and high-quality edible oi.	Mainly cultivated in Kashi, Hetian and Akesu in Xinjiang, one of the major income sources for local farmers.
43	*Prunus spp.*	One of the favorite traditional fruit, used in fresh, or processed to make canned or dried fruit prodcucts	Wide adaptability and easy cultivation, mainly grown is south of Yangtze River, high yield, high economic benefit
44	*Prunus armeniaca*	Nutritious kernel, diverse types of uses of flesh, nut and both	Widely grown in most provinces, huge economic benefit. China is a major producer of fresh apricot and the largest almond juice provider in the world
45	*Prunus dulcis*	Used in fresh or cooked, or for oil extraction, high nutritioncontent, diverse varieties	Multiple uses of medicinal, wood or ornamental, one of the major species in southern Xinjiang for poverty alleviation
46	*Punica granatum*	Rich in nutrition and full range of nutrients, mainly used in fresh, diverse varieties	Widely cultivated, high economic profit
47	*Rubus corchorifolius*	Fresh food or processed products, high nutritional value	Artificial cultivation mainly concentrated in north and east China, high economic value
48	*Semen Trigonellae*	Used in fresh, or making wines and drinks. High nutritional value	Widely cultivated, certain extent of contribution to poverty alleviation for farmers

No.	Species	Contribution to food security	Roles in poverty allevation
49	*Toona sinensis*	Unique fragrance of shoot, highly nutritional, good food for health and beauty	Wood is used as raw materials for high-quality furniture. Shoots are valuable, highly profitable, one of the ways to help farmers to get rid of poverty
50	*Torreya grandis* 'Merrill ii'	The best nut among dried fruits, with edible and medicinal values	Edible, medicinal and ornamental uses, grown in south of the Yangtze River, high economic value
51	*Ulmus pumila*	Fruit used as a edible vegetable, green food	Timber, young fruit and leaves all used for income generatin, help farmers in poverty alleviation
52	*Vitis vinifera*	Rich in nutrition, used in fresh or for making wines, many varieties available	Widely cultivated, significant economic benefit
53	*Xanthoceras sorbifolia*	Seed for extraction of edible oil, 50-70% oil content and 25.75% protein content in kernel, content of unsaturated fatty acid as high as 94%	Important multi-purpose economic species, particularly as an energy sp[eceis, great potential for future development and economic value
54	*Zanthoxylum bungeanum*	Well-known ingredient for cooking, young leaves and buds used as edible vegetable	Widely grown, playing important roles in poverty alleviation and income generation
55	*Zizyphus jujuba*	Rich in vitamin C, high sugar content, used in fresh or for processed food products	Widely planted, high economic benefit, suitable for poverty alleviation