Latest Progresses of Silviculture Research in China

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1 Forestry outlines in China

2 Research and demonstration for sustainable forest management in China

3 Tree breeding and improvement in China

4 Planted forest technology in China

5 Natural forest management in China

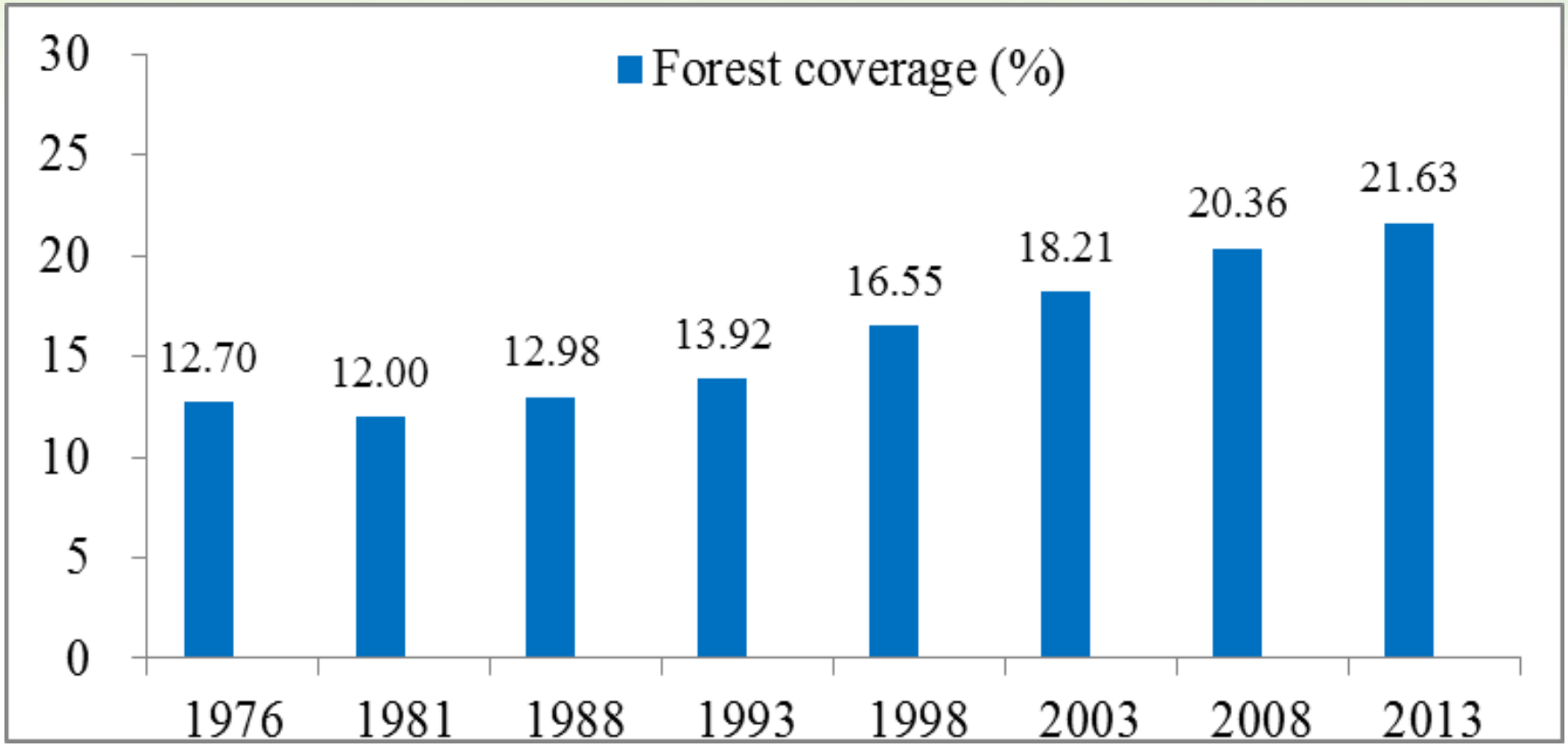
6 Forest conservation and forest health in China

7 Conclusions and suggestion

1 Forestry outlines in China

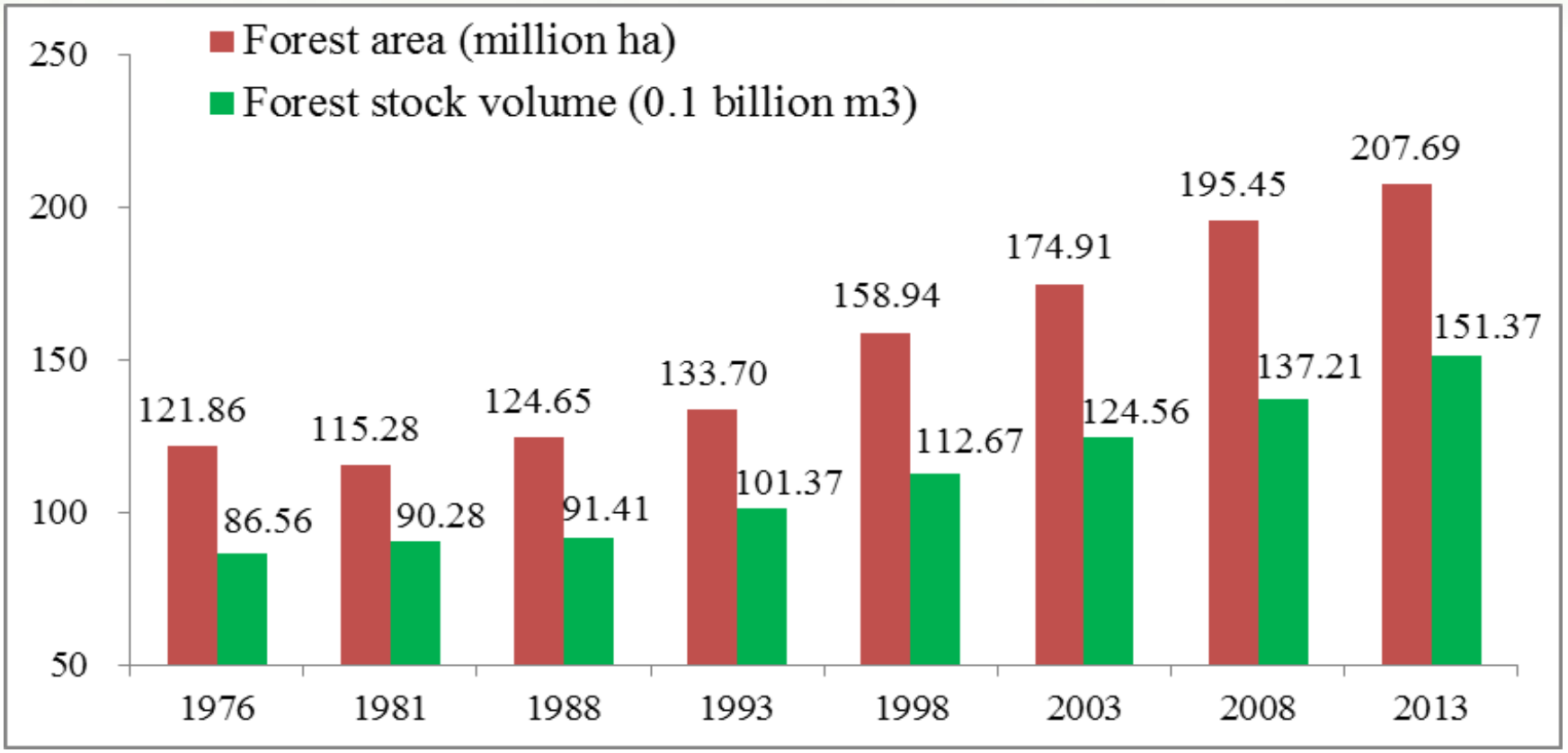
China Forest Distribution

Forest Cover Change in China

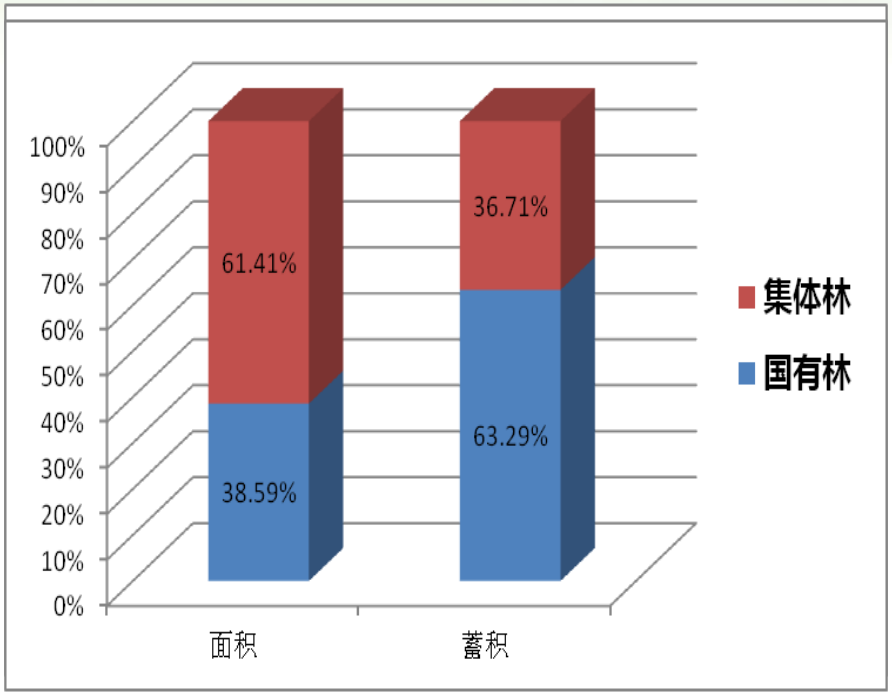


Source: SFA, 2014

China’s Forest Area and Stock Volume



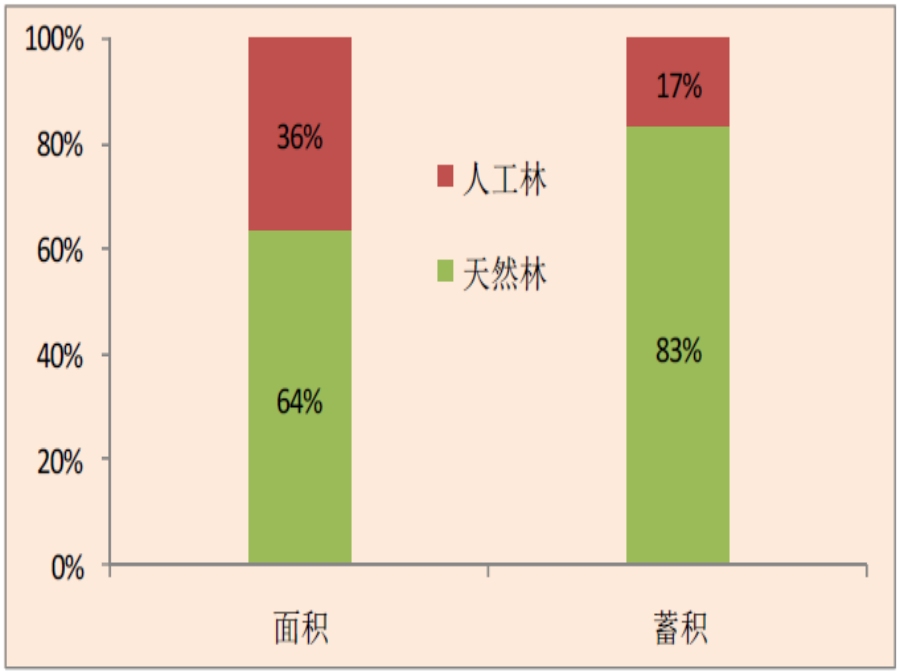
Forest Resource Structure



Tenure of Forested Land

Collectively-owned

State-owned



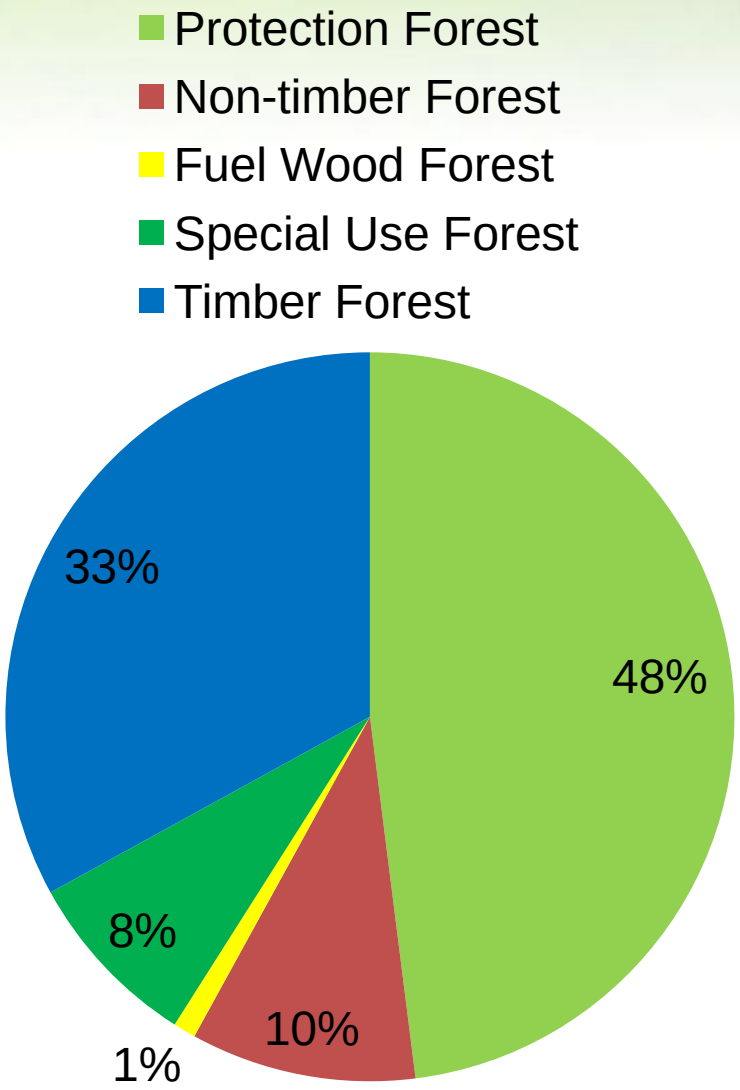
Origin of Forest

Planted forest

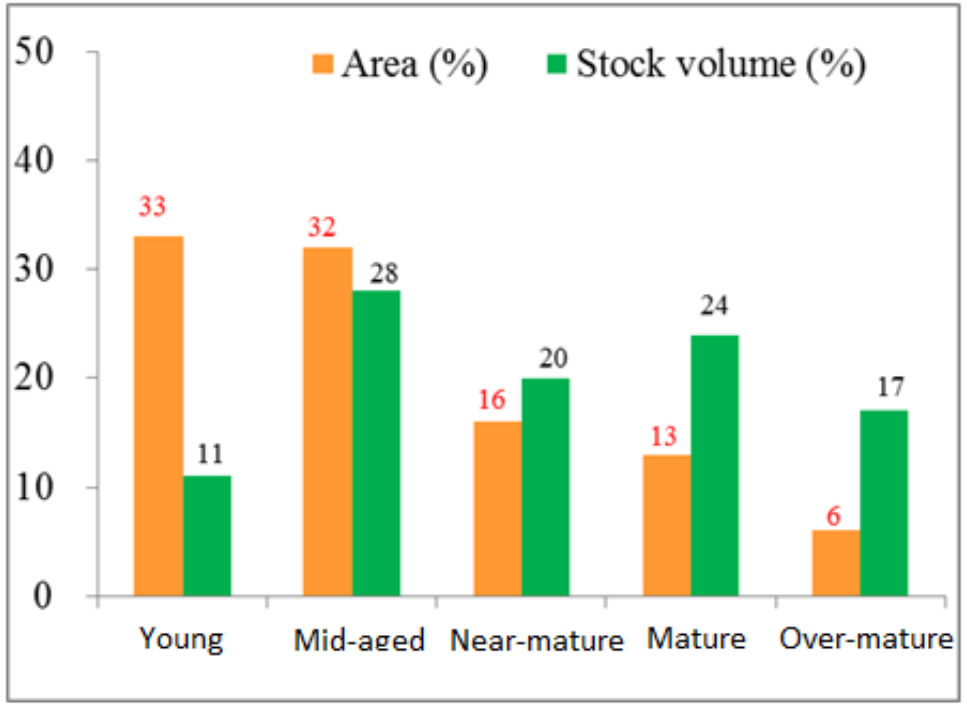
Natural forest

Source: SFA, 2014

Forest Type Structure

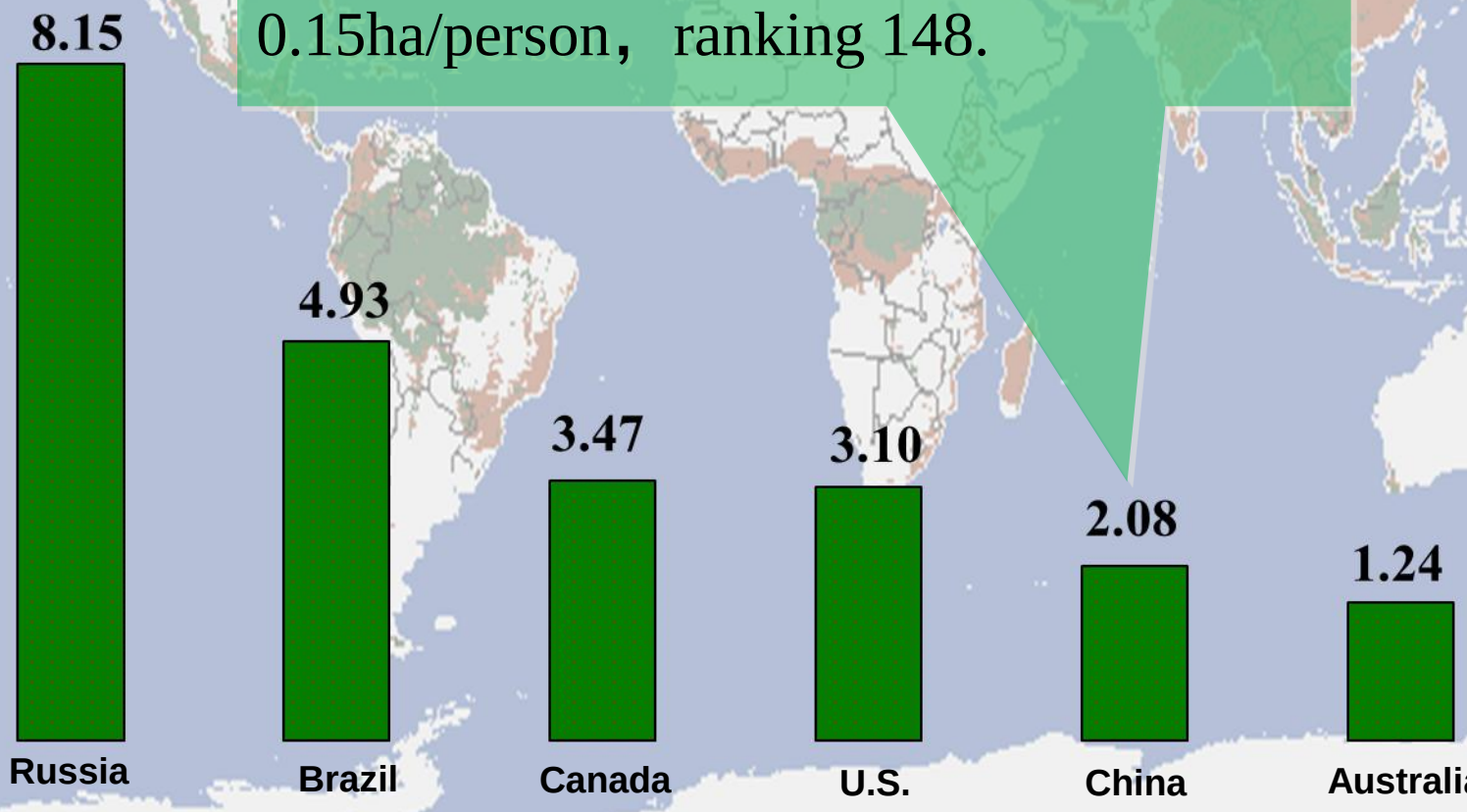


Age-class Structure



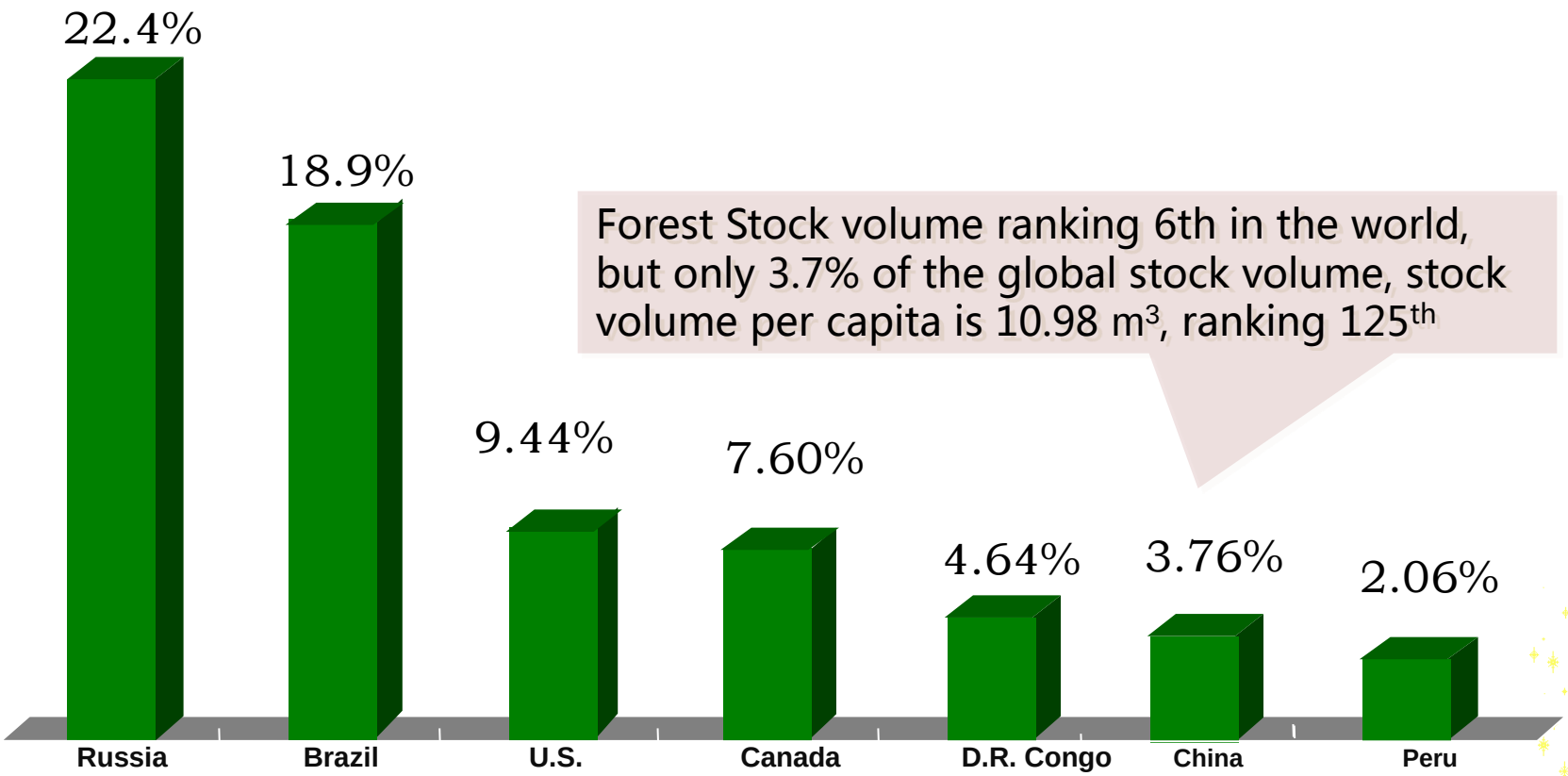
- **Global forest area decreased 129 million ha during 1990-2015**
- **Net forest area increased by 75 million ha in China, the fastest increasing country in the world**

China Forest area 4.95% of the world;
0.15ha/person，ranking 148.



Unit: 100million ha

Source: FAO, 2015



Forest Stock volume ranking 6th in the world, but only 3.7% of the global stock volume, stock volume per capita is 10.98 m^3, ranking 125^{th}

Source: FAO 2015

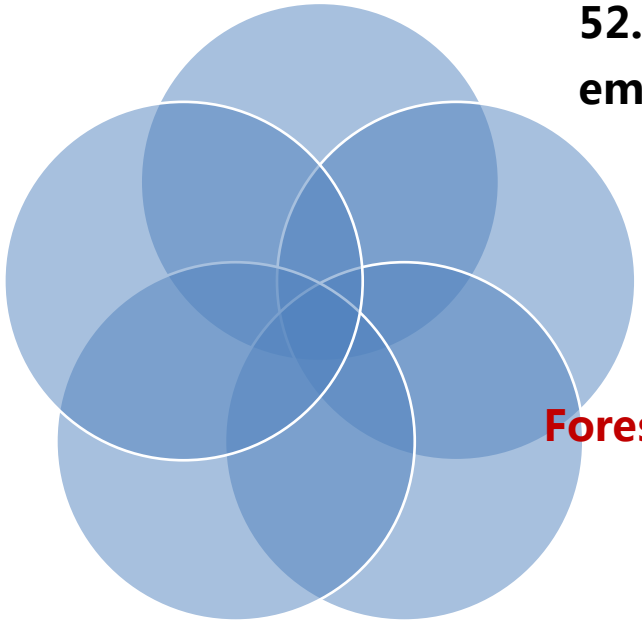
Forest and Forestry Contribution in China

Forestry Value: 5.94 Trillion RMB，8.8% of GDP

Forest Gross Biomass: 17.002 billion Tons

Total Carbon Storage: 8.427 billion ton

Employment in Forestry: 52.47million, 6.8% of employment population



Forest Ecosystem Service Value: 13.84 Trillion RMB，1/5 of National GDP

Forestry Tourism: 1.05 billion person/time

Source: SFA, 2015

Education & Technology Development

- Since 1980s, higher forestry education has made great progress, and a total of 650,000 graduates have contributed to forestry development in China

Education & Technology Development

2013-2014年

157 Universities and research academia that host M.A. education
242 Post-secondary specialized colleagues and universities
119 Vocational colleges

19,500 M.As in forestry
56,500 B.A.s in forestry
52,000 others

Forestry bachelors students VS Received vocational training 1:1

- The academic education on forestry have been stabilized and there is an boom on vocational trainings
- The graduate education has shifted from pure academic to research and application-blended
- The education and capacity building systems on forestry-related groups become increasingly diversified through multi-channels

Education & Technology Development

During the 12th five-year

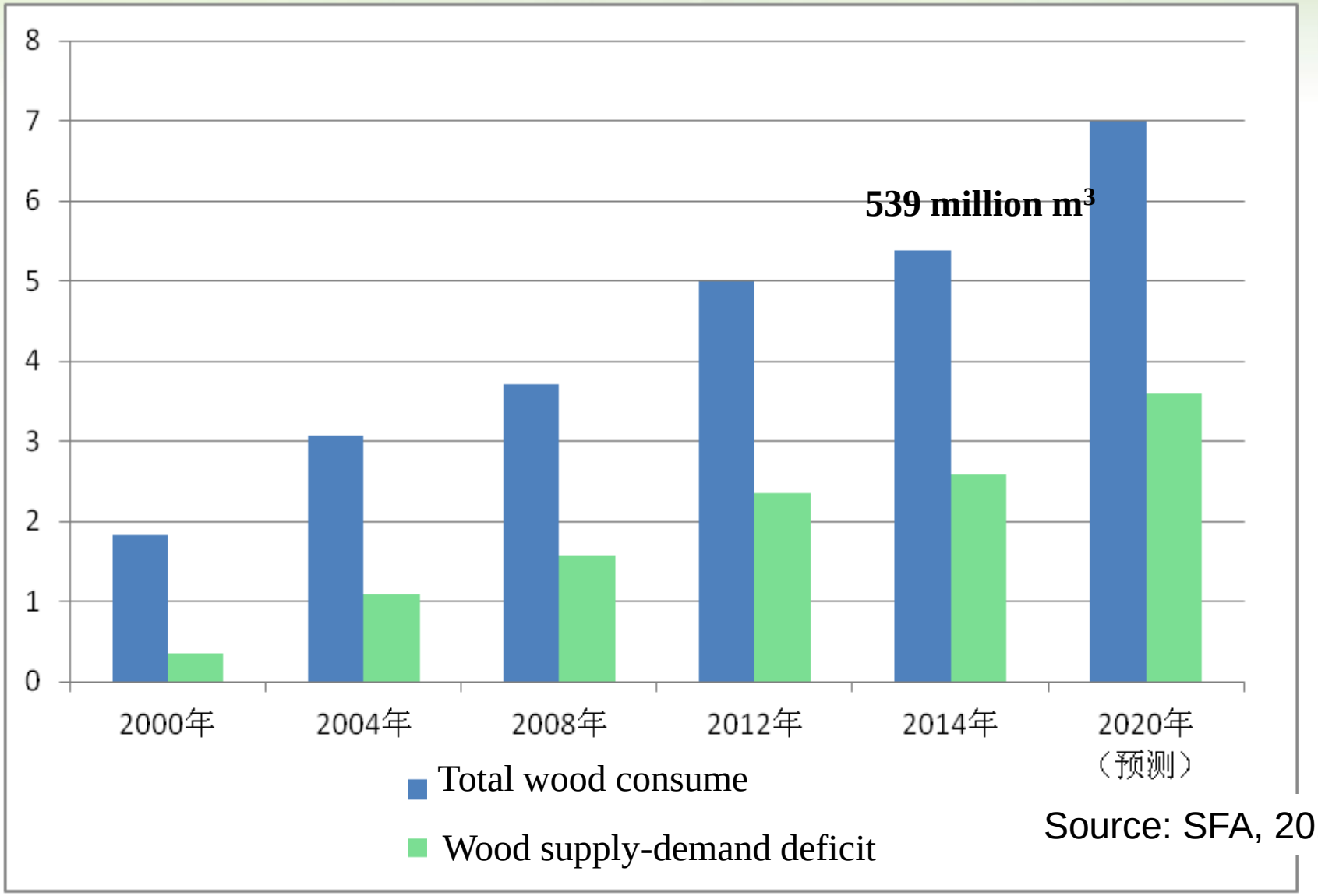
232 Forest research institutions
2,296 forestry extension agencies
34 state key labs

23 forestry standardization committees
179 territorial ecosystem positioning stations
26 state forest products quality monitoring centers

- 22 Nationally-recognized scientific technologies Awards, 4,768 scientific achievements, 3,659intellectual property rights, 661 national and industrial-wide standards, 593 new flora species
- The application of genetic breeding, digitalized forestry, restoration of ecological functions, multi-functional forestry and green timber processing has greatly promoted the forestry and technology development

Source: SFA, 2015

More high-yield planted forests are needed in China because of the big wood supple-demand deficit, with some 50% wood are imported abroad.



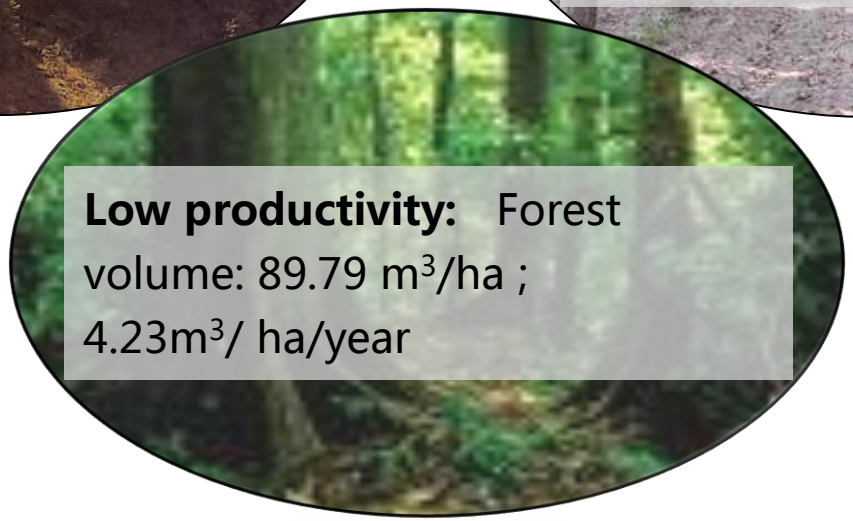
Source: SFA, 2015

Education & Technology Development

Low forest productivity： Improve forest quality

Limited timbers for use:
The mature forest 19%
Over-aged forests 41%

Inappropriate stand structures: The single-species and single-layered plantations are about 90% of the plantations



Low productivity: Forest volume: 89.79 m^3/ha ; 4.23m^3/ ha/year

Source: SFA, 2014

2 Research and Demonstration of SFM in China

China Forest Sustainable Management Experiment and Demonstration

Since 2004, China has established 12 sustainable forest management experiment and demonstration stations.

Key tasks are :

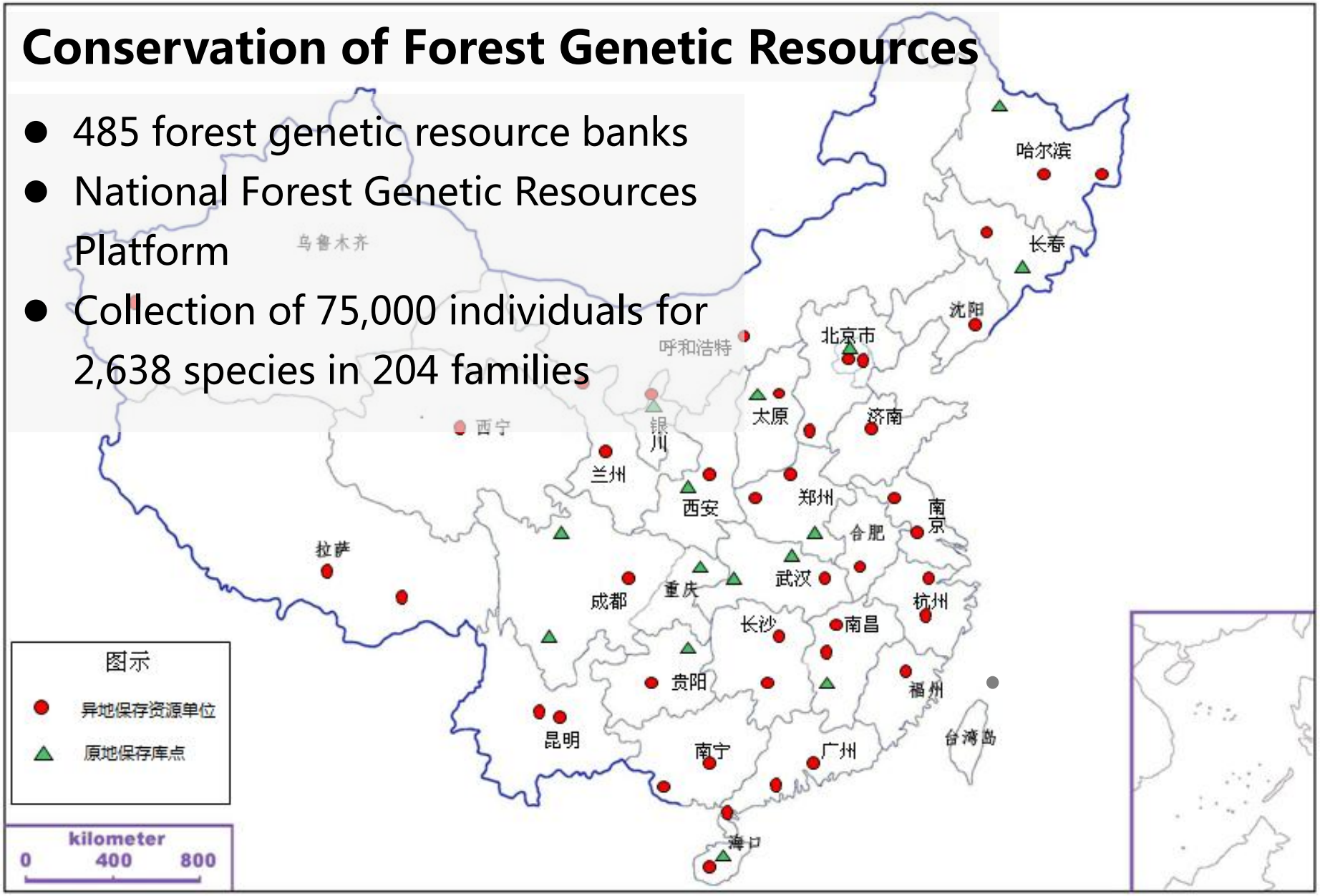
- Implementation of forest management plan
- Reform of forest quota harvesting system
- Monitoring and evaluation of forest resources

3 Tree Breeding and Improvement in China

- **Conservation of Forest Genetic Resources**
- **Molecular Basis for Tree Breeding**
- **Tree Selection and Breeding**

Conservation of Forest Genetic Resources

- 485 forest genetic resource banks
- National Forest Genetic Resources Platform
- Collection of 75,000 individuals for 2,638 species in 204 families



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Whole-genome Sequencing and Analysis

- **Sequencing 10 whole genomes of woody plants. Such as Moso bamboo (*Phyllostachys edulis*), Plum blossom (*Prunus mume*), Eucommia (*Eucommia ulmoides*), Willow (*Salix suchowensis*), and Mulberry (*Morus notabilis*)**

LETTERS

nature genetics

OPEN

The draft genome of the fast-growing non-timber forest species moso bamboo (*Phyllostachys heterocycla*)

Zhenhua Peng[1,4], Ying Lu[2,4], Lubin Li[1,4], Qiang Zhao[2,4], Qi Feng[2,4], Zhimin Gao[3,4], Hengyun Lu[2], Tao Hu[3], Na Yao[1], Kunyan Liu[2], Yan Li[2], Danlin Fan[2], Yunli Guo[2], Wenjun Li[2], Yiqi Lu[2], Qijun Weng[2], CongCong Zhou[2], Lei Zhang[2], Tao Huang[2], Yan Zhao[2], Chuanrang Zhu[2], Xinge Liu[3], Xuewen Yang[3], Tao Wang[1], Kun Miao[1], Caiyun Zhuang[1], Xiaolu Cao[1], Wenli Tang[3], Guanshui Liu[3], Yingli Liu[3], Jie Chen[1], Zhenjing Liu[1], Licai Yuan[3], Zhenhua Liu[3], Xuchui Huang[2], Tingting Lu[2], Benhua Fei[3], Zemin Ning[2], Bin Han[2] & Zehui Jiang[1,3]

Bamboo represents the only major lineage of grasses that is native to forests and is one of the most important non-timber forest products in the world. However, no species in the Bambusoideae subfamily has been sequenced. Here, we report a high-quality draft genome sequence of moso bamboo (*P. heterocycla var. pubescens*). The 2.05-Gb assembly covers 95% of the genomic region. Gene prediction modeling identified 31,987 genes, most of which are supported by cDNA and deep RNA sequencing data. Analyses of clustered gene families and gene collinearity show that bamboo underwent whole-genome duplication 7–12 million years ago. Identification of gene families that are key in cell wall biosynthesis suggests that the whole-genome duplication event generated more gene duplicates involved in bamboo shoot development. RNA sequencing analysis of bamboo flowering tissues suggests a potential connection between drought-responsive and flowering genes.

Bamboo is one of the most important non-timber forest products in the world. About 2.5 billion people depend economically on bamboo, and international trade in bamboo amounts to over 2.5 billion US dollars per year[1]. Bamboo has a rather striking life history, characterized by a prolonged vegetative phase lasting decades before flowering, thereby inhibiting genetic improvement. Recent genomic studies in bamboo have included genome-wide full-length cDNA sequencing[2], chloroplast genome sequencing[3], identification of syntenic genes between bamboo and other grasses[4] and phylogenetic analysis of Bambusoideae subspecies[5]. Fifty-nine simple sequence repeat markers from rice and sugarcane were used in the genetic diversity analyses of 23 bamboo species[6], and 2 species-specific sequence-characterized amplified region markers were developed in the identification of different bamboo species[7].

Here, we report the draft genome of moso bamboo, a large woody bamboo that has ecological, economic and cultural value in Asia and accounts for ~70% of the total bamboo growth area. Comparative genome-wide analyses of bamboo to other grass species, including rice, maize and sorghum, yielded new genetic insights into the rapid and marked phenotypic and ecological divergence of bamboo and closely related grasses.

The moso bamboo genome contains 24 pairs of chromosomes[8] ($2n = 48$) and is characteristic of a diploid (**Supplementary Fig. 1a**). We conducted a flow cytometry analysis and estimated that it had a genome size of 2.075 Gb (2C = 4.24 pg; **Supplementary Fig. 1b**), which was very close to that estimated in a previous report[9].

Because it is difficult to generate an inbred line of moso bamboo, owing to its infrequent sexual reproduction and the long periods of time between flowering intervals, we selected five plants from a single individual rhizome of the moso bamboo ecotype (*P. heterocycla var. pubescens*) and performed whole-genome shotgun sequencing. We generated 295 Gb of raw sequence data (approximately 147-fold coverage), including Illumina short reads and 10,327 pairs of BAC end sequences (**Supplementary Table 1a**). The final assembly of 2.05 Gb was generated using the *de novo* Phusion-meta assembly pipeline that was developed in this study (**Supplementary Fig. 2**). The N50 length of the assembled scaffolds was over 328 kb, and about 80% of the assembly mapped to 5,499 scaffolds of greater than 62 kb in length (**Table 1** and **Supplementary Table 1b**). The scaffolds assembled using the Phusion-meta assembly method were much longer in length than the scaffolds generated using the SOAPdenovo program[10] (**Fig. 1a** and **Supplementary Table 1c**). Given the presence of small fragments in the assembly, the estimated size of the moso bamboo genome was approximately 2.07 to 2.10 Gb, which was supported by the analysis of the distribution of 51-mer frequencies (**Supplementary Fig. 3**). Hence, the final scaffolds of 2.05 Gb and initial contigs of 1.86 Gb covered approximately 95% and 88% of the genomic region, respectively. Sequence comparison of the assembled scaffolds to existing cDNA and survey sequences in the database and eight BAC sequences individually determined through Sanger sequencing showed good agreement in genomic coverage at over

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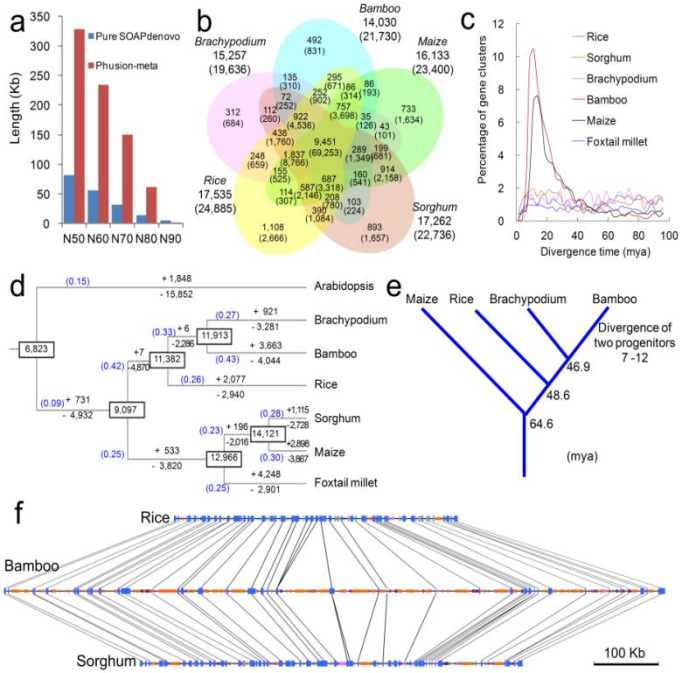
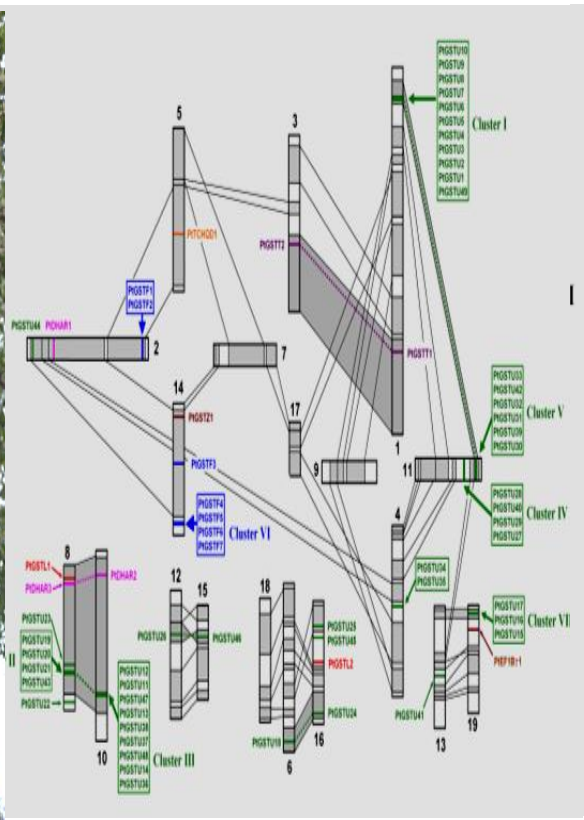


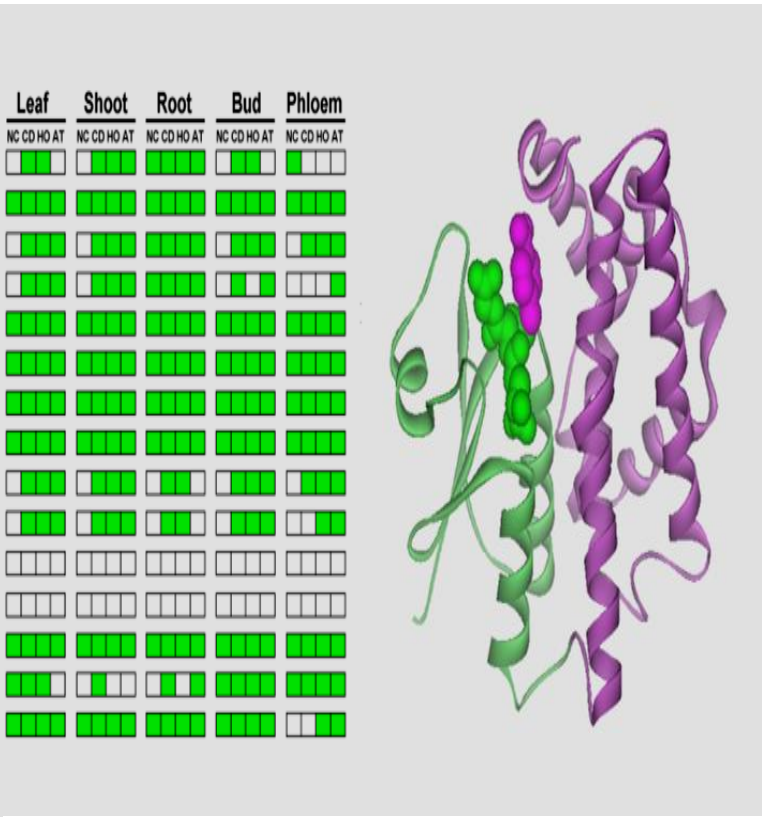
Genomic analysis of Moso bamboo

Peng et al. 2013 Nature Genetics

Whole-genome Sequencing and Analysis

- **Unveiled the evolutionary mechanisms of two gene families (*GST*s and *PRX*s), which is fundamental to understand the life cycle and adaptation of forest trees**

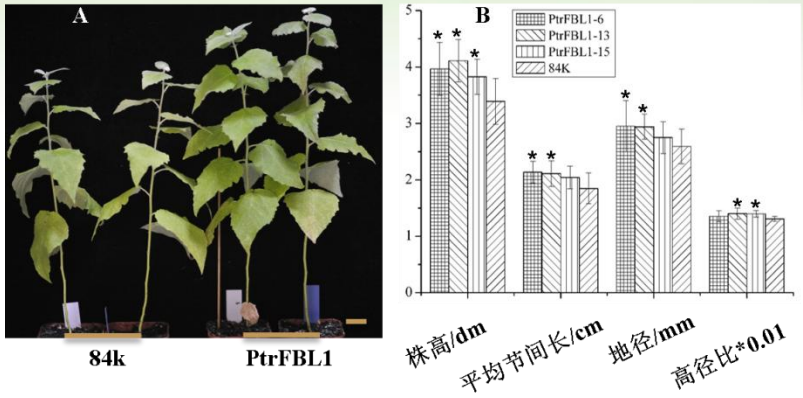


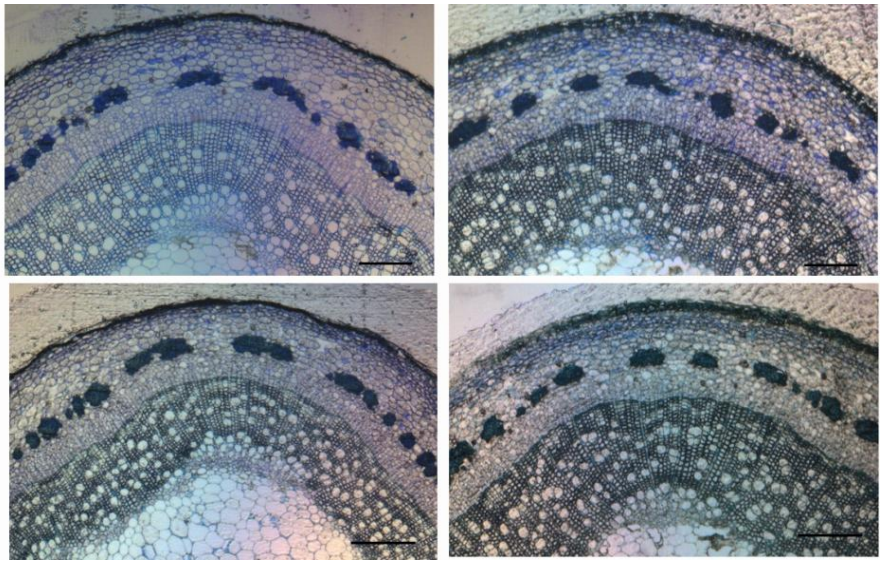


Lan et al. 2009 Plant Cell

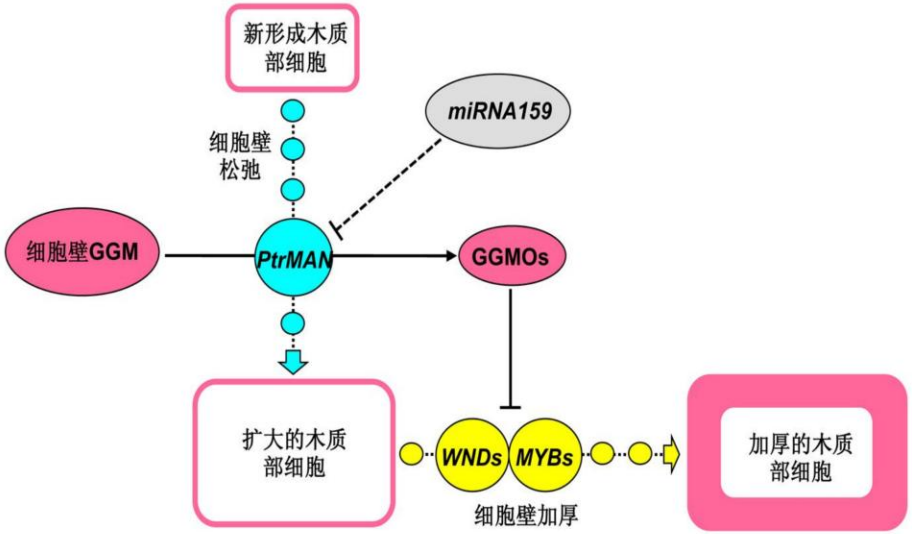
Unveiled regulatory mechanism of xylem formation

- Explained the molecular regulation of auxin (IAA) in the progress of xylem differentiation.
- Identified the regulatory mechanism on the development of secondary cell wall





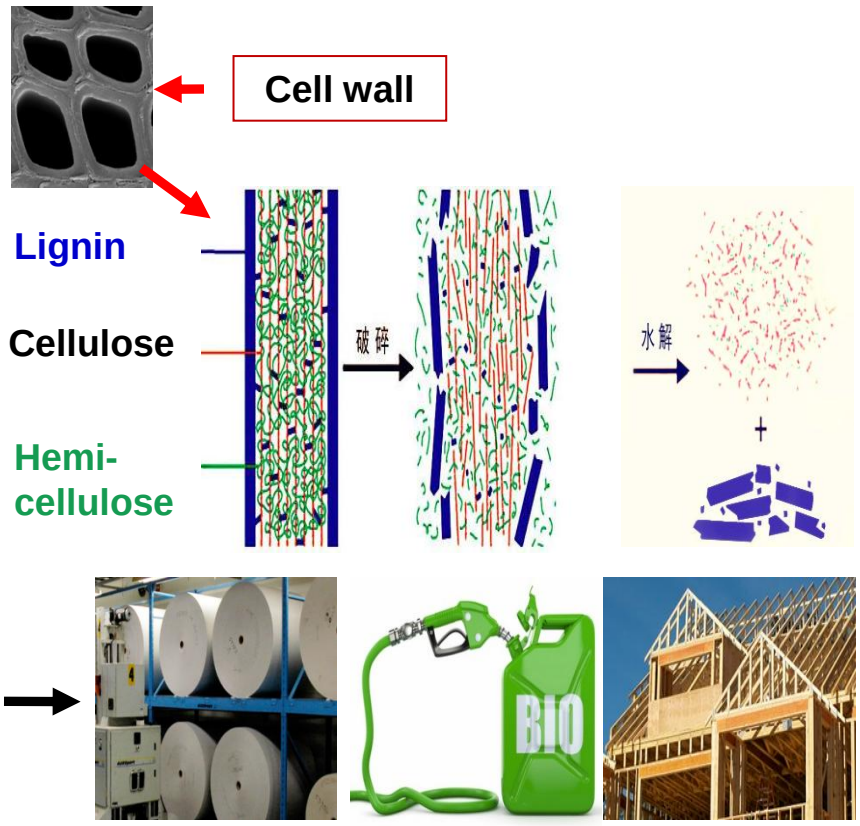
Over expressed *PtrFBL1* gene promoted cambium division in *Populus*



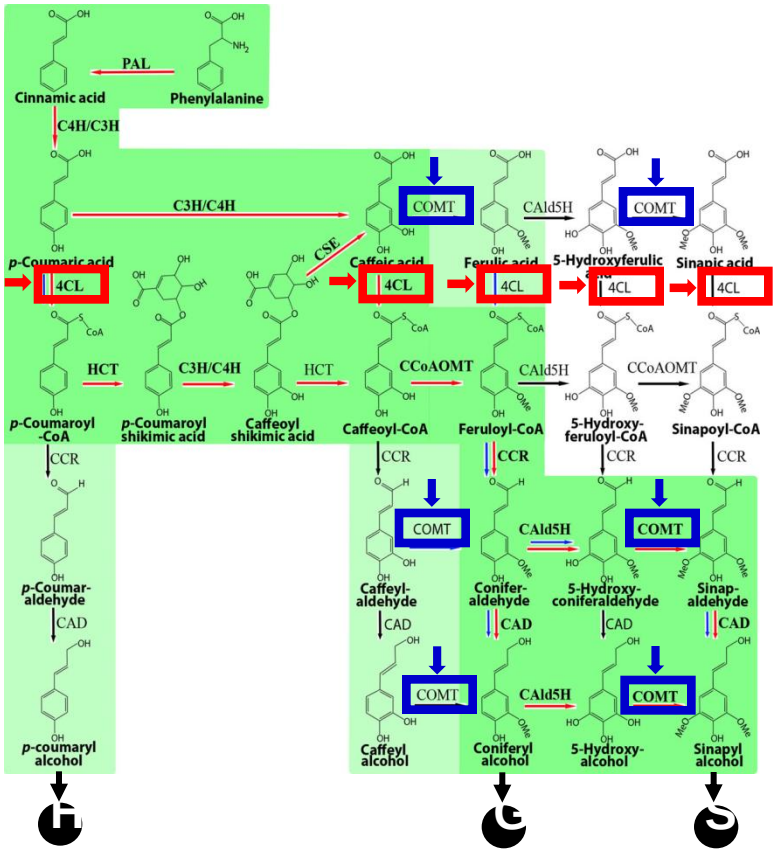
PtMAN regulating secondary cell wall formation

Unveiled regulatory mechanism of xylem formation

- Unveiled the molecular pathway of key enzymes that synthesize lignin, which is critical to improve the efficiency of pulping and bio-energy transformation



The use of cell walls in pulping and bio-energy products

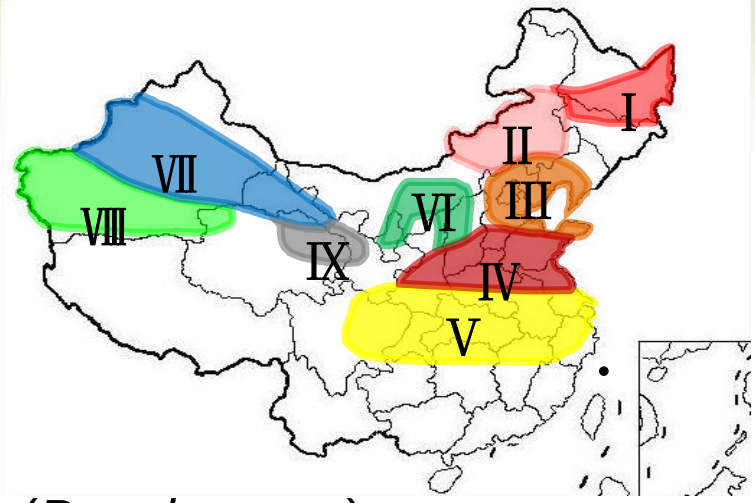


Important genes in the lignin synthesis pathway

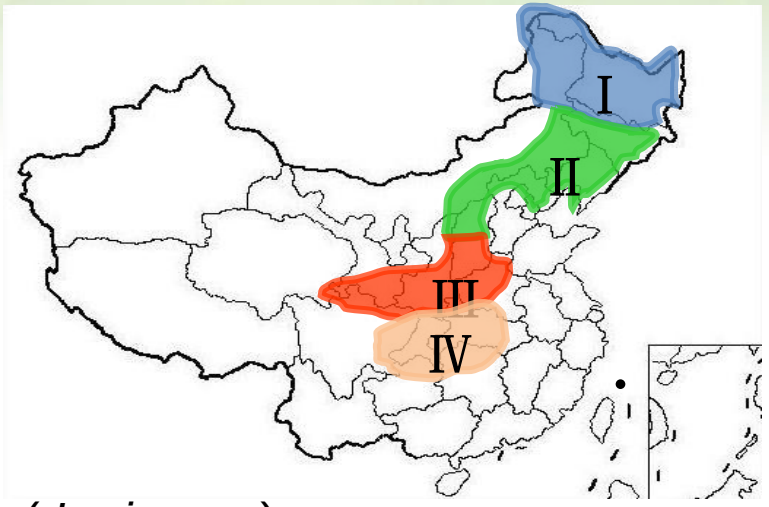
Genetically improved varieties and families

- 226 national bases of tree improvement.
- The ratio of using improved genetic materials: 61%
  - Breeding for timber production
  - Breeding of economic trees
  - Breeding of tree resistance under stresses

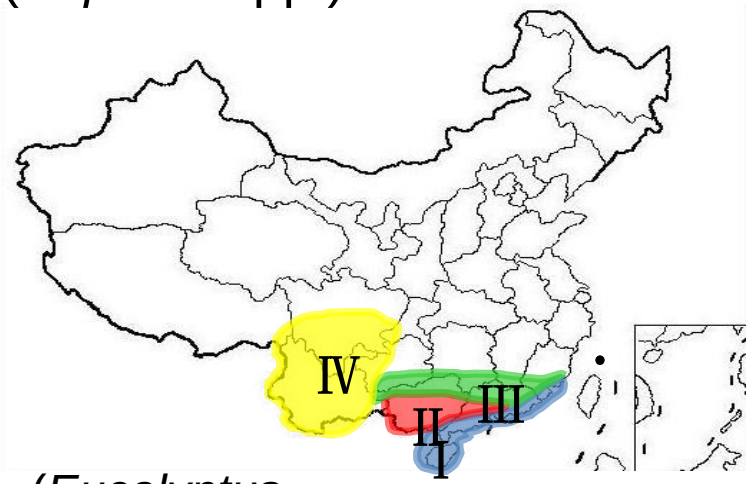
Breeding Zones for Key Tree Species



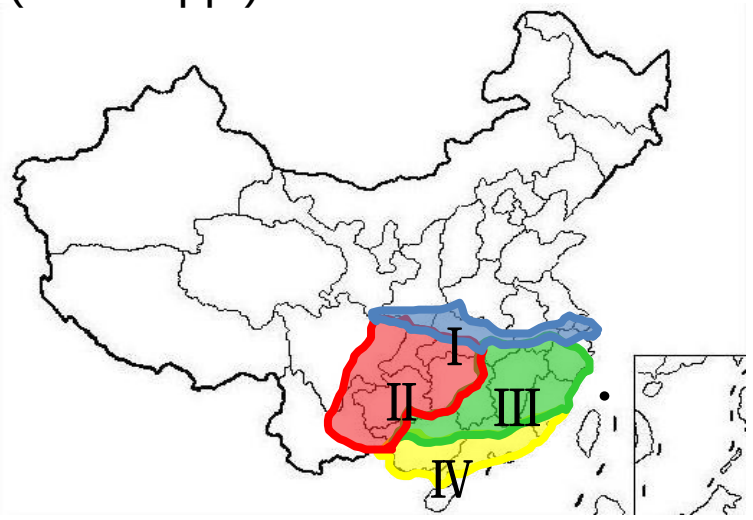
(*Populus* spp.)



(*Larix* spp.)



(*Eucalyptus* spp.)



(*Cunninghamia lanceolata*)

Main Timber-oriented Species Breeding

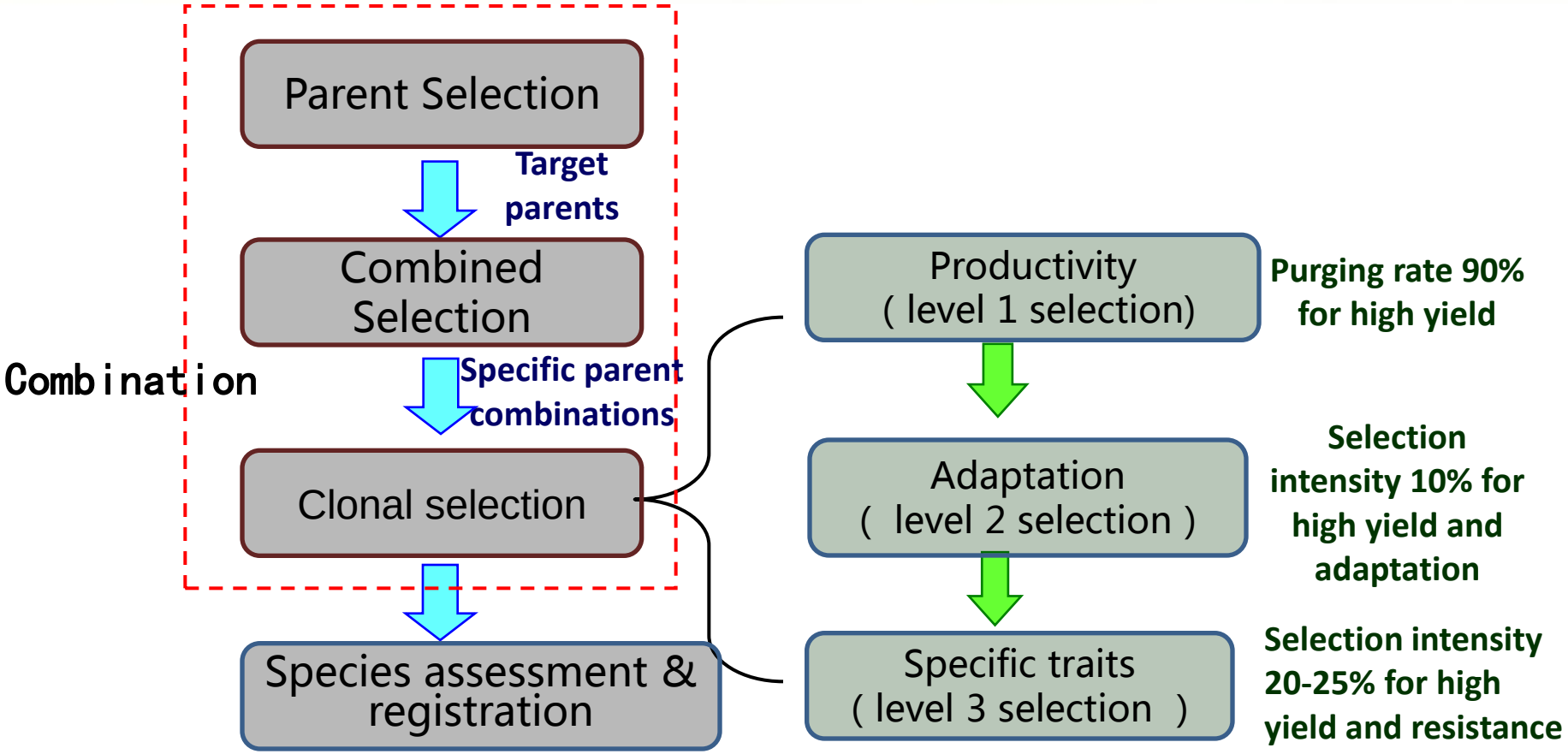
Established 2nd or 3rd advanced seed orchards for trees, such as *Cunninghamia lanceolata, Pinus massoniana, Larix* spp.

Cunninghamia lanceolata 3rd advanced Seed orchard

Liping Guizhou 3 year-old Grafted

Established a Multi-level Tree Breeding System

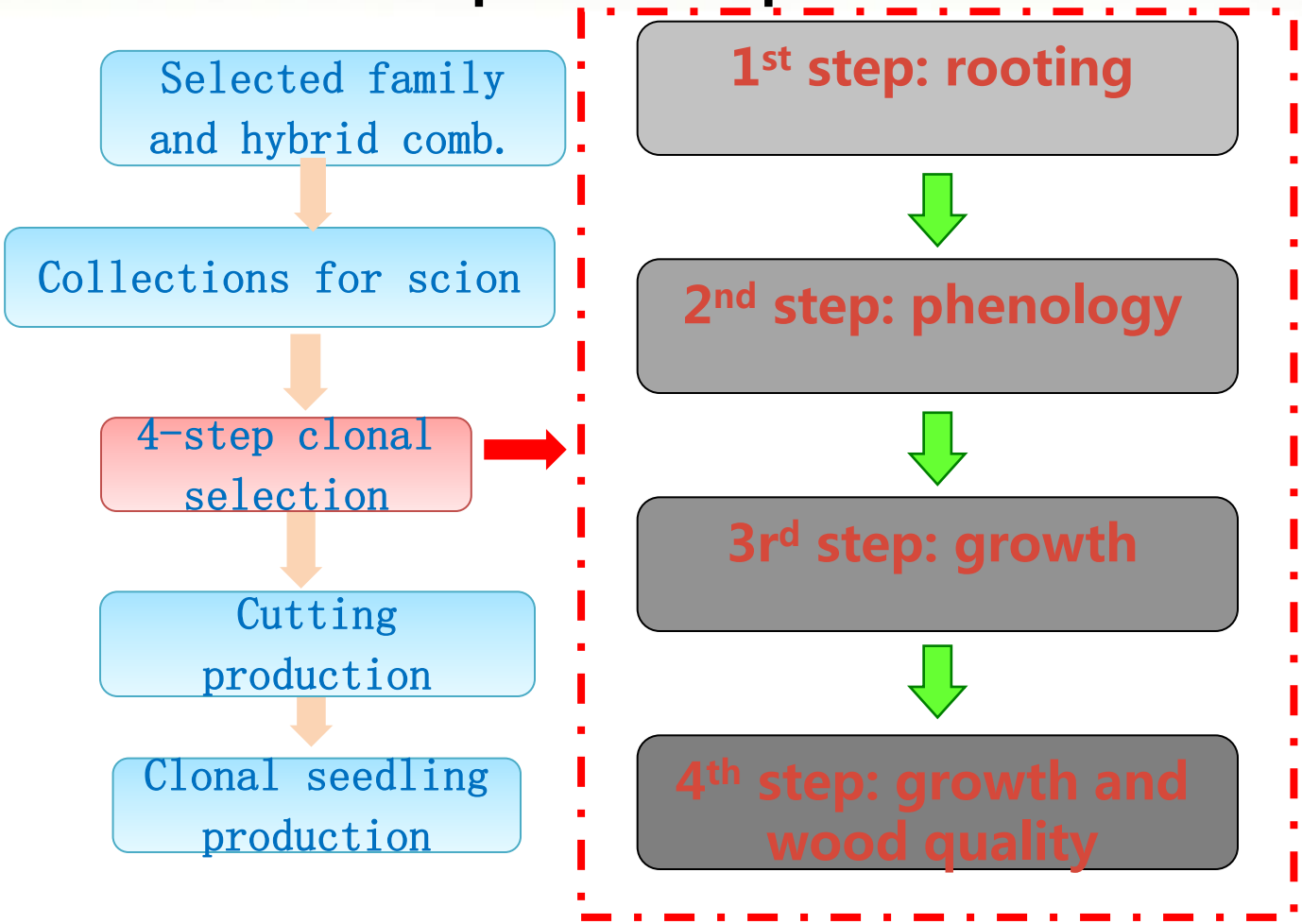
Broadleaf tree (*Populus* , *Eucalyptus*) "three in one" multi-level breeding procedure



Established a Multi-level Tree Breeding System

Conifer (*Larix*、*Cunninghamia lanceolate*)

a 4-step selection procedure



Poplar (*Populus* spp.)

- Total area of planted poplar in China is 8.54 million ha.
- Poplar plantation is 18.1% of China's total planted forest areas.
- Conserved 4800 individuals of poplar genetic resources
- Established 12 genetic resource banks for poplars

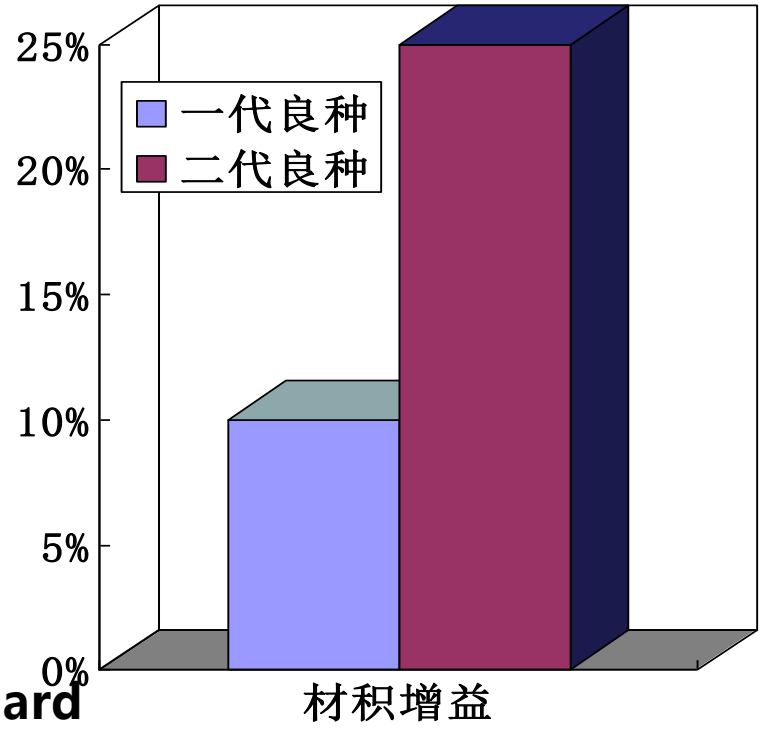
Poplar (*Populus* spp.)

- Selected 49 improved clones and 96 varieties in past 15 years.
- Covered 82% of poplar plantation, and increased volume by 10-15%

Masson pine (*Pinus massoniana*)

- Established 2nd advanced seed orchard: 593.33 ha; the genetic gain reached 25%

Masson pine 2nd advanced seed orchard



Masson pine (*Pinus massoniana*)

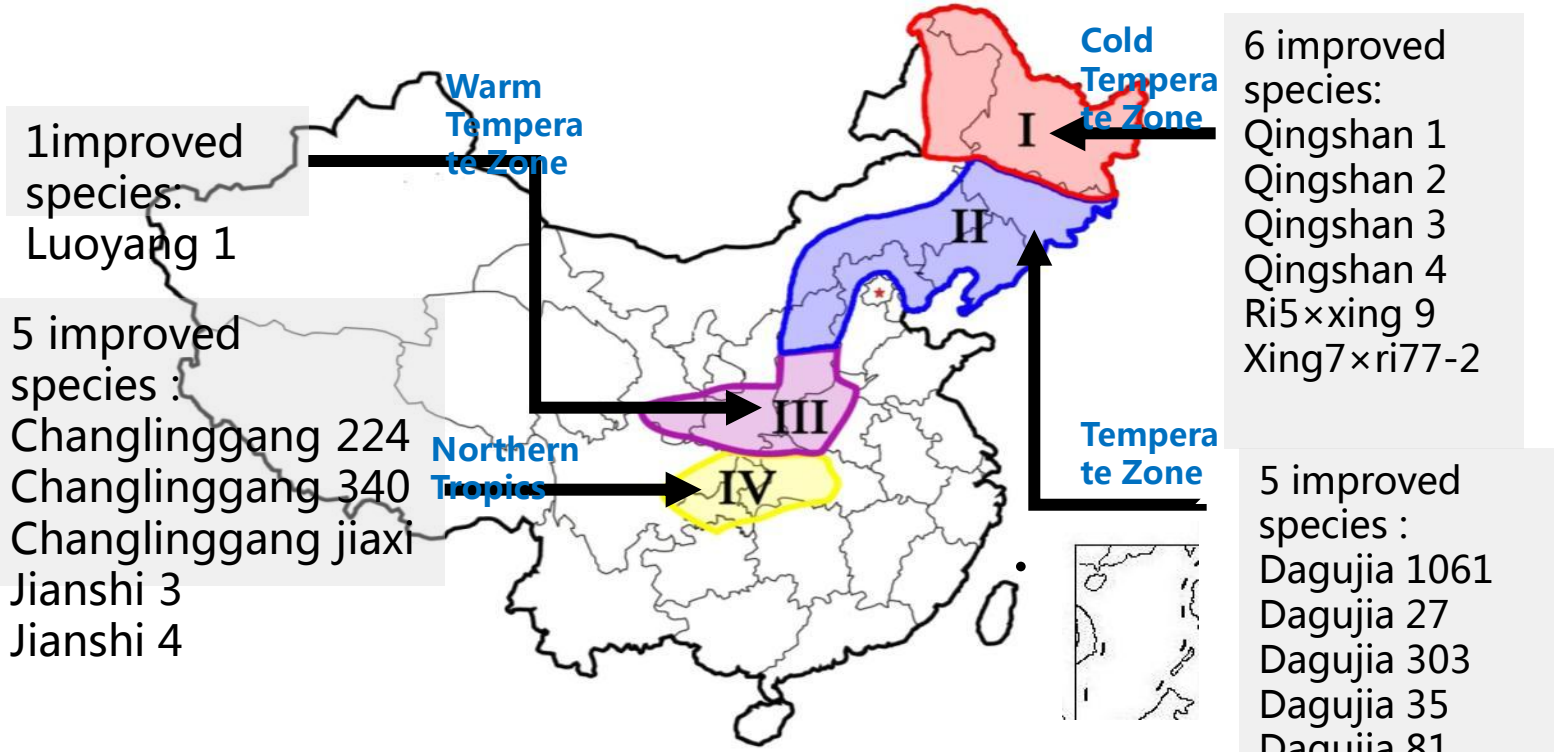
- Developed 31 new varieties for use in plantations

Larix (*Larix* spp.)

Total area of *Larix* is 10.69 million ha , in which plantations take the 4th position overall in China

Larix(*Larix* spp.)

- A total of 17 improved clones covered 4 breeding zones;
- Improved materials have been used in 53,300 ha, covering 16 provinces



Breeding zones for *Larix*

Breeding for economic trees

Walnut (*Juglans regia*)

- 10 new varieties for frost-resistance and high-fat
- Invented a rooting technology, which improved the rate of rooting to 95%

Camellia oleifera (*Camellia oleifera*)

- Selection of second generation of varieties, yield of 450-750 kg/ha
- Improved seedling production by 20 times
- Yield increased by 300% **through a series of new technologies**

Tree Selections for Resistance

- Selection of Drought Resistance
- Selection of Salinty Resistance
- Selection of Heavy-metal Resistance

Tree Selections of Drought Resistance

Drought-resistance *Populus*
Dengkou in Inner Mongolia

Jatropha curcas
Jatropha in Yunnan

Haloxylon ammodendron
Minqin in Gansu

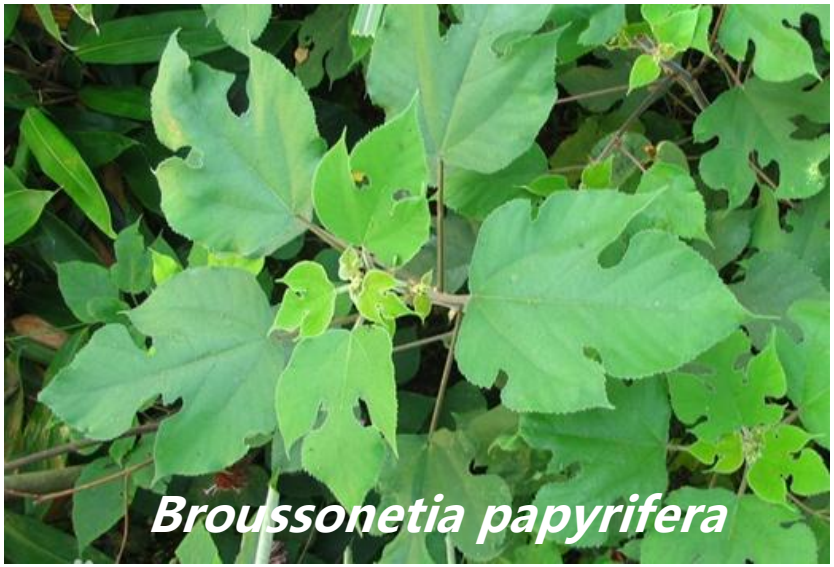
Tree Selections of Salinty Resistance

- **Selection of new genetic materials for salt tolerance, such as *Tamarix* spp., *Fraxinus americana*, *Populus* spp., *Ulmus* spp.**

Tree Selections of Heavy-metal Resistance

Woody plants for high accumulation of heavy-metals (Sb, Pb, Zn, Cd, Cu), such as *Zenia insignis*, *Broussonetia papyrifera*, *Paulownia fortunei*, *Amorpha fruticose.*


Zenia insignis


Broussonetia papyrifera

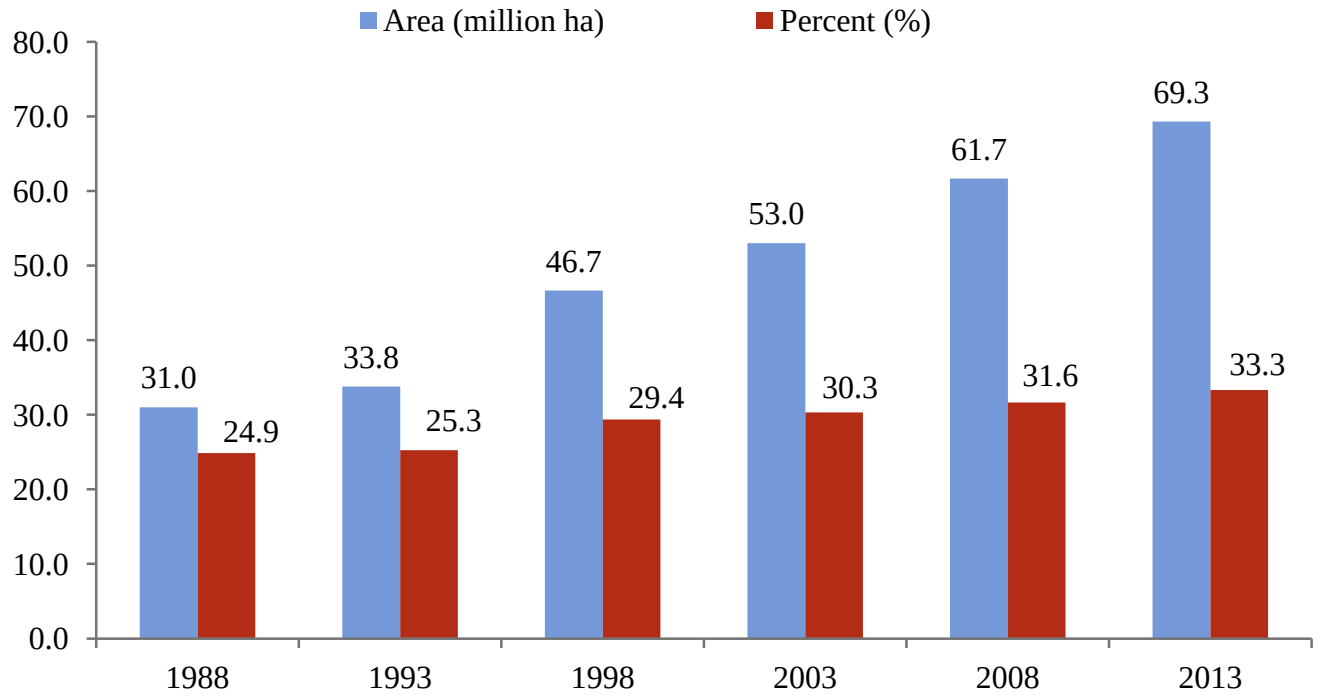

Paulownia fortunei

4 Planted forest technology in China

- **Silvics for Timber Production**
- **Silvics of Bamboo Forest**
- **Shelterbelts techniques**
- **Close-to-nature management of planted forest**
- **Aerial Seeding Afforestation**

Planted forests are major resources for timber production in China

- About 46% of timber production is harvested from planted forests in China. It is urgent to develop new techniques for better planted forests.

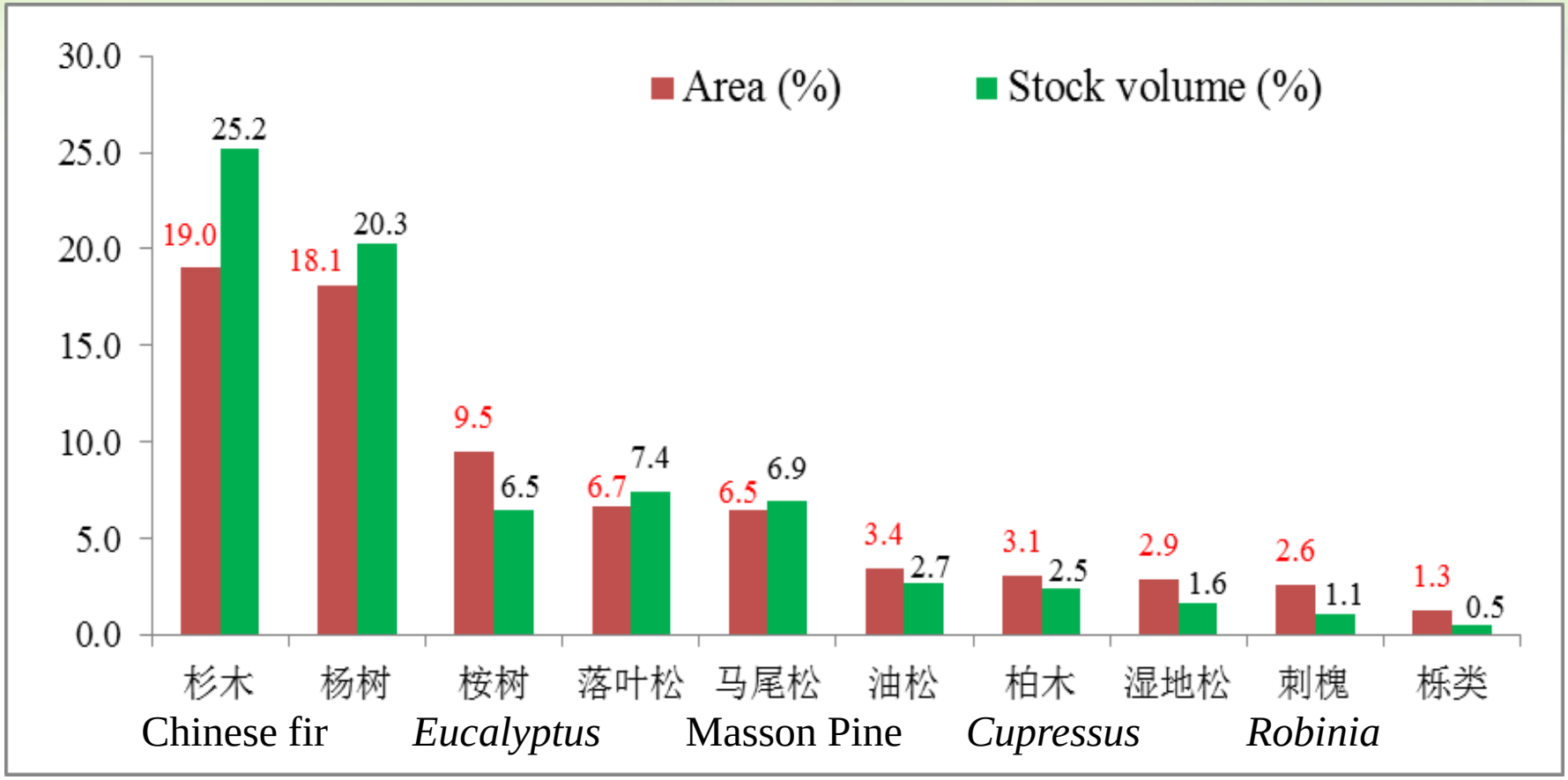


The areas of planted forests in China (SFA 2015)

The target-oriented cultivation has been widely applied in timber plantations in China

Main tree species are as followings:

- Chinese fir (*Cunninghamia lanceolata)*
- Larches (*Larix* spp.)
- Masson pine (*Pinus massoniana*)
- Poplar (*Populus* spp.)
- Eucalyptus (*Eucalyptus* spp.)


30.0
25.0
20.0
15.0
10.0
5.0
0.0
Area (%)
Stock volume (%)
25.2
19.0
20.3
18.1
9.5
6.5
7.4
6.7
6.9
6.5
3.4
2.7
3.1
2.5
2.9
1.6
2.6
1.1
1.3
0.5
杉木
杨树
桉树
落叶松
马尾松
油松
柏木
湿地松
刺槐
栎类
Chinese fir
Eucalyptus
Masson Pine
Cupressus
Robinia
Populus
Larix
Chinese pine
Slash pine
Quercus

Technical system for cultivating large-diameter & fast-growing forest

- The large-diameter wood fast-growing orientated cultivation technical models of six main tree species(including Chinese fir, poplar, etc.) were established,; and guided by the models, the forest productivity increased by an average of 20%.


Chines fir - jiangxi


Larch stand - Heilongjiang


Masson pine -Guizhou


Poplar Beijing


Eucalyptus -Guangxi


Paulownia – Henan

Technical system for the target tree management

- The technical systems for Chinese fir and larch target tree management for knot-free timber were established. The stem volume, volume recovery and stem wood processing quality are improved.

落叶松

杉木

Techniques for maintaining soil fertility in the long term


Larch litter decomposition

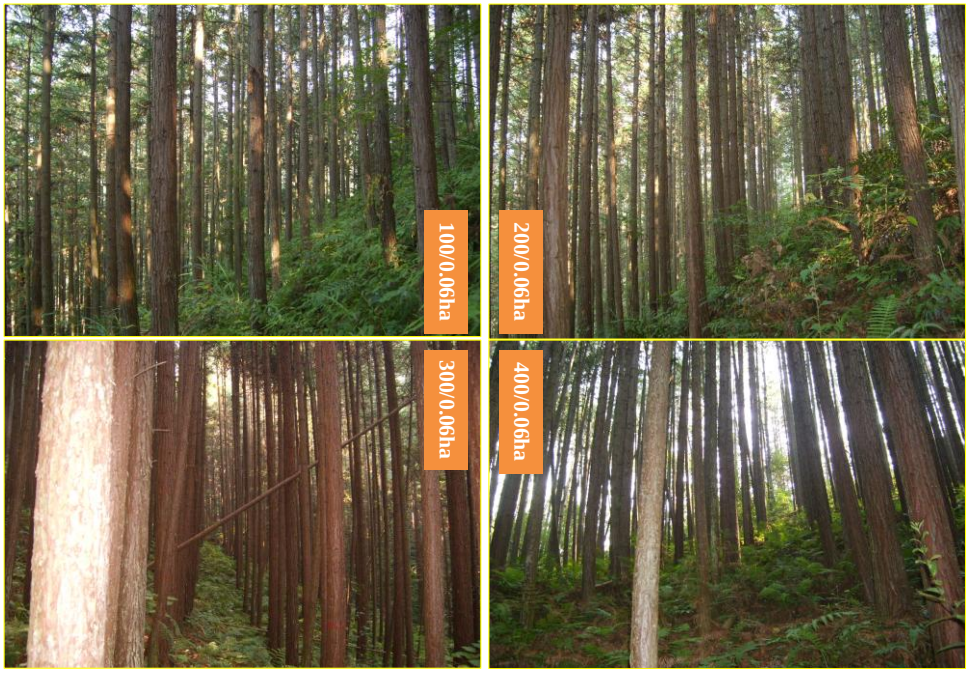
The techniques proposed for Larch, Chinese fir and Masson pine.

- Tree composition
- Avoiding successive planting
- Understory vegetation mgt.

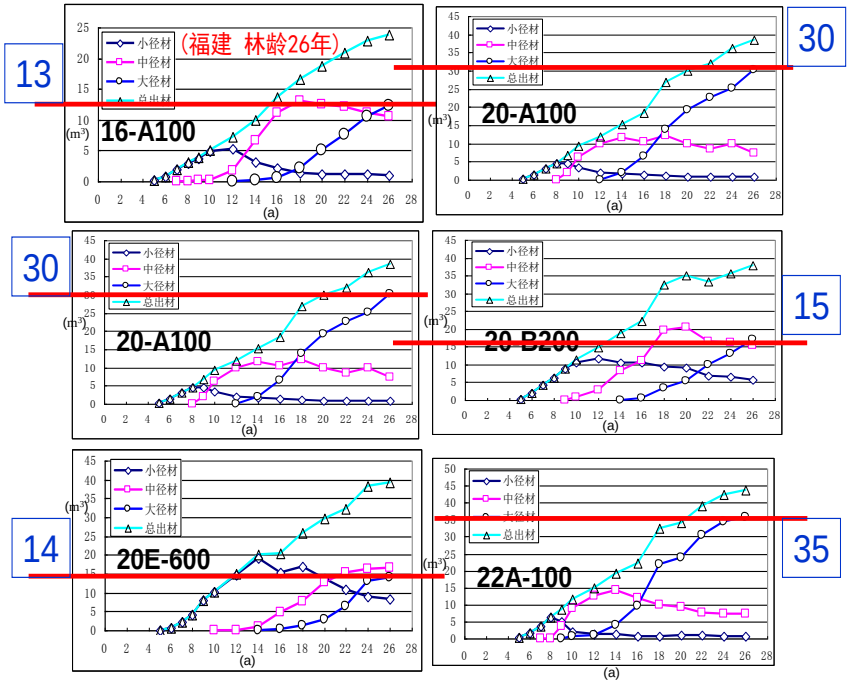

Chinese fir undergrowth management

Density trials technology for main conifers

- Based on more than 30 years of continuous observation, the stand density effects of different wood assortment of Chinese fir, Masson pine, larch were revealed, and the stand density control technologies were created.



Chinese fir density test plantation-36 years



Dynamic effect of Chinese fir stand density structure-36 years

Density trials of Cuninghamia

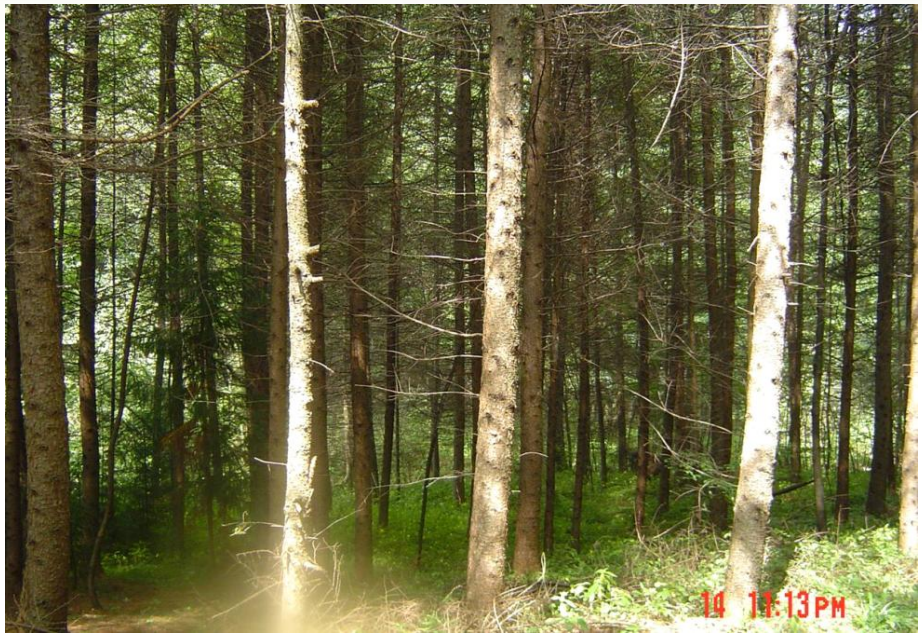
1×1m
self-thing

1×2m

2×3m

Planted in 1981. Shaowu, Fujian Provinces

Density trials for Larix



1×1.5m

1.5×2m

Planed in 1991. Yichang, Hubei Provinces

Density trials for Mason Pine

1×2m

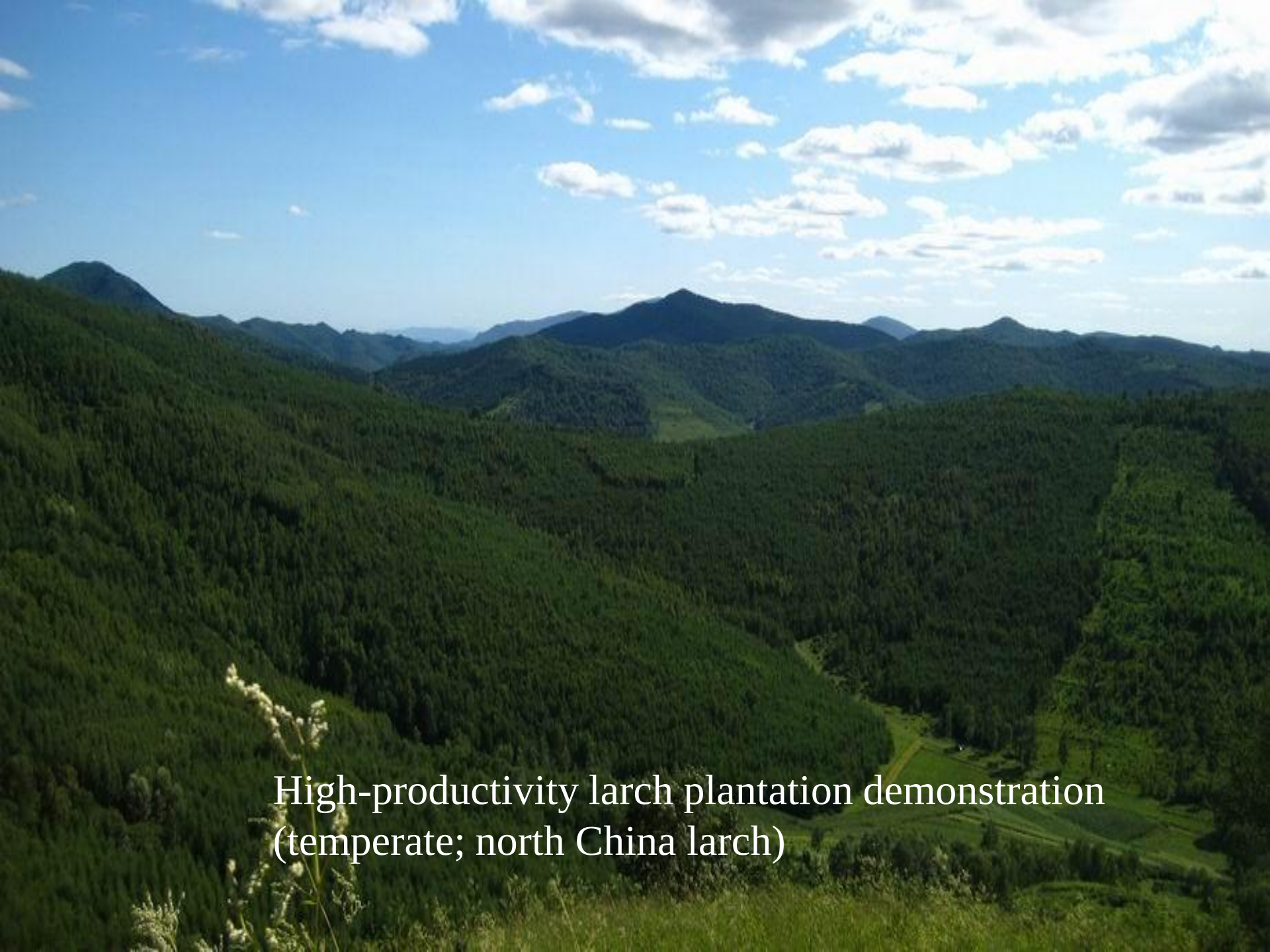
2×3m

Planted in 1989. Daqingshan, Guangxi

Demonstration and extension of target oriented cultivation technology

- The six tree species (including Chines fir, etc.) plantations for demonstrating the targeted oriented cultivation technologies were established, and the afforestation area of more than 350,000 ha was extended in China.

Chinese fir fast-grown demonstration plantation (subtropical)



High-productivity larch plantation demonstration (temperate; north China larch)

High-productivity Masson pine plantation demonstration (subtropical)


Fast-growth Poplar plantation demonstration

Fast-growth Eucalyptus plantation demonstration
(South sub-tropical)

Fast-growth
Paulownia plantation

High-value broadleaf tree species

- The creation were achieved in the big-diameter target tree cultivation and the growth promotion of heartwood of teak, southwest birch, red cone and *Dalbergia odorifera*.

Target trees selection in Tectonia plantation

The large-diameter fast-growing orientated cultivation technology

- Tending and thinning
- Target-tree management techniques

降香黄檀 (*Dalbergia odorifera*)
西南桦 (*Betula alnoides*)
土沉香 (*Aquilaria sinensis*)
柚木 (*Tectona grandis*)
红锥 (*Castanopsis hystrix*)
土沉香 (*Aquilaria sinensis*)

- **Local** agarwood **concreting technique:** traditional skinning – punch –drip producing perfume
- By this new technique, the agarwood production increased greatly.

Bamboo forest cultivation

- The existing bamboo forest area is 6.01 million ha in China.
- High-yield cultivation technology for bamboos were proposed for the use of bamboo shoots, pulp, panels.
- This promoted the sustainable development of bamboo industry, and increased the farmers' income.

Bamboo forest oriented cultivation

Bamboo timber forest

Bamboo shoot forest

Bamboo pulp forest

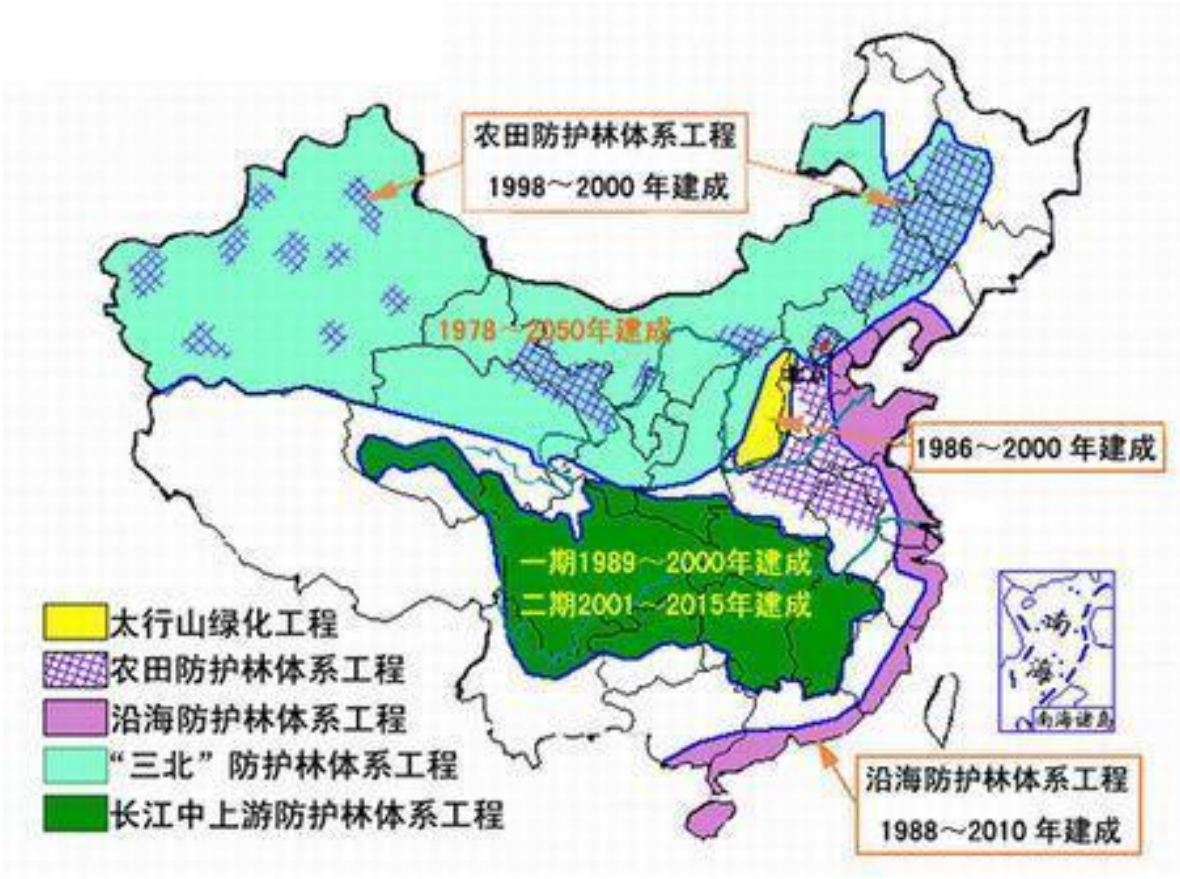
- By intensive cultivation, the production output of bamboo shoots and bamboo timber was significantly increased.

Management level	yield of shoots (t/ha/a)		
	Phyllostachys praccox	*Dendrocalamus latiflorus*	*Bambusa oldhami*
Extensive	7.5	15	3.0- 6.0
Intensive	15-22.5	45- 75	10.0- 11.7

Management level	yield of culms (t/ha/a)		
	Phyllostachys edulis	*Bambusa textilis*	*Neosinocalamus affinis*
Extensive	7.5	3- 4.5	3.0- 4.5
Intensive	22.5- 30	15- 22.5	15.0- 18.0

Protection forest construction technologies

The great progress in the forest cultivation technology researches for farmland protection forest, afforestation of sand prevention, Yangtze river protection forest, coastal protection forest, etc. was achieved.



Map of China's protection forest system planning

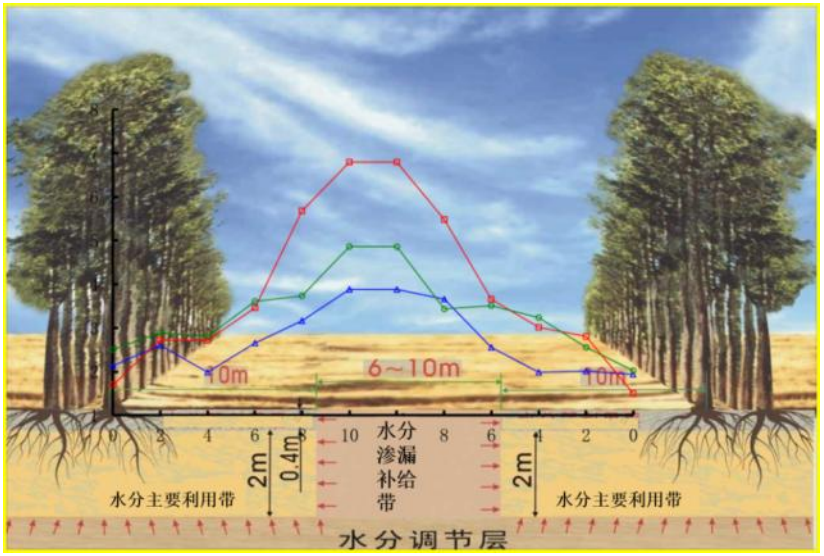
Farmland protection forest technologies

The stability of food production was guaranteed by applying the grid farmland protection forest construction technology.

Farmland protection forests

Afforestation technologies for sand control

- 46 integrated sand prevention demonstration areas in national desertification land in different type were set up, and the key sandy area protection forest construction technologies such as low coverage were proposed.

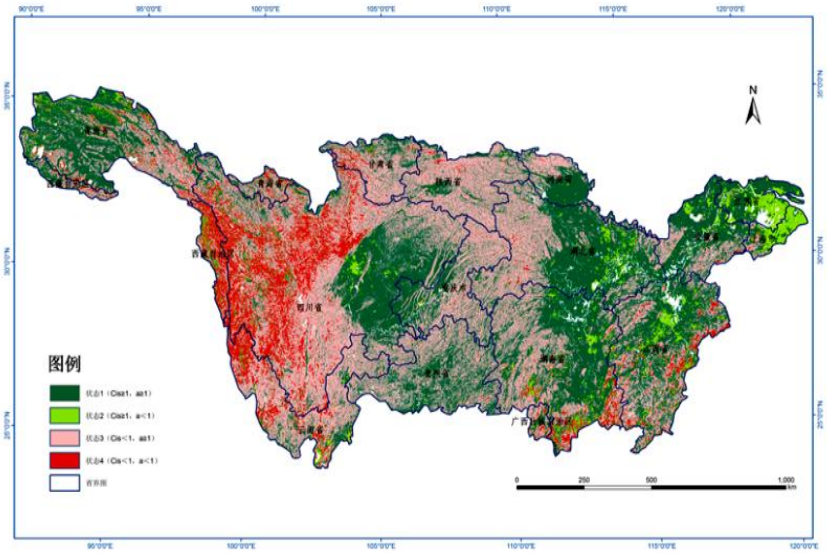


The rain regulation by low coverage afforestation of sand control

Fixing sand forest in 2 row tree and I belt grass pattern

Yangtze river protection forest technology

- To contain the water loss and soil erosion, protection forest system combined multiple-use forest and multiple tree species were established.
- Supported by the technologies, 9 million ha of forests were planted, and whole basin forest coverage is increased from 19.9% to 35%.



Map of identifying the Yangtze river basin protection forest key allocation area

Identifying the Yangtze river basin protection forest

Technologies for coastal forest protection

- The remarkable achievements were made in the coastal vegetation restoration and reconstruction, shelter forest structure adjustment, protective efficiency improvement of technologies.

Mangroves in Qi'ao island of Hainan : mangroves were gotten large recovery, and the protection effects increased by 20-25%.

Rhizophora stylosa

Close-to-nature plantation management

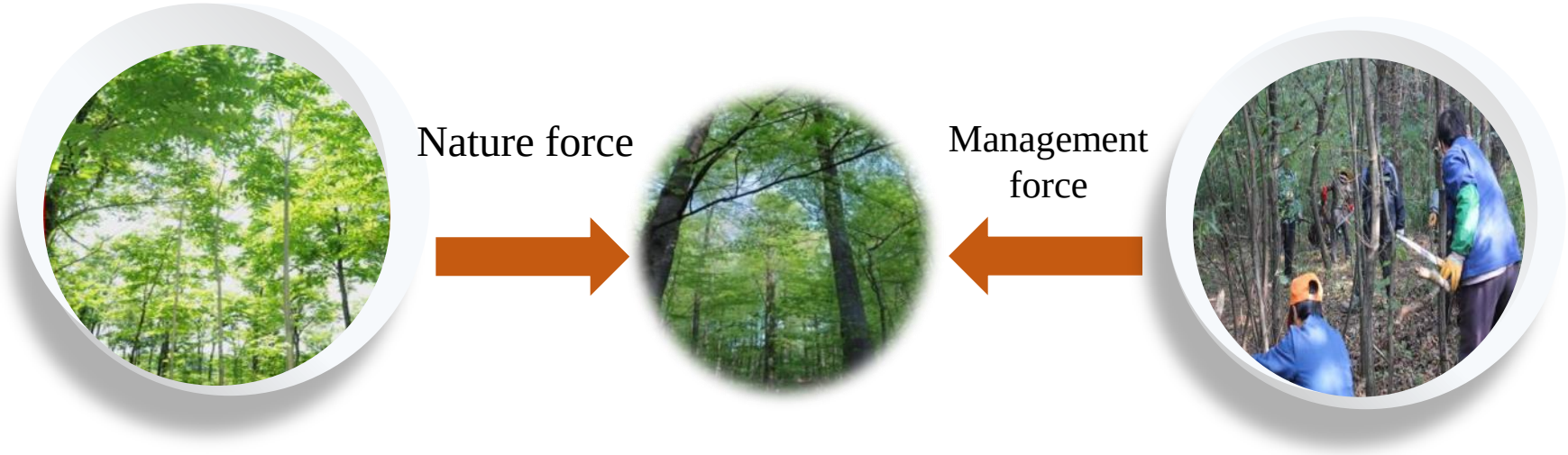
- Close-to-nature plantation management in south China: Pingxiang City of Guangxi Province

- Close-to-nature plantation management in north China: Hebei Mulan Forestry Administration

Close-to-nature plantation management

- Scientific hypothesis of close-to-nature forest management: A better effect can be gotten by applying the synthesized force of nature and human to manage forests together

- Management resultant force: system stability, structural optimization, process speed, good composition



Close-to-nature plantation management in south China: Pingxiang City of Guangxi

Typical experiment and demonstration in Pingxiang city was for 10 years, the successful natural transformation of masson pine and eucalyptus plantations was made, the growth of the forest was promoted and the soil nutrient balance was maintained..

Pingxiang, Guangxi , sub-tropical monsoon climate

Close-to-nature management of Mason pine plantation

2006

2008

2009

2012

2016

Close-to-nature plantation management in north China: Mulan, Hebei

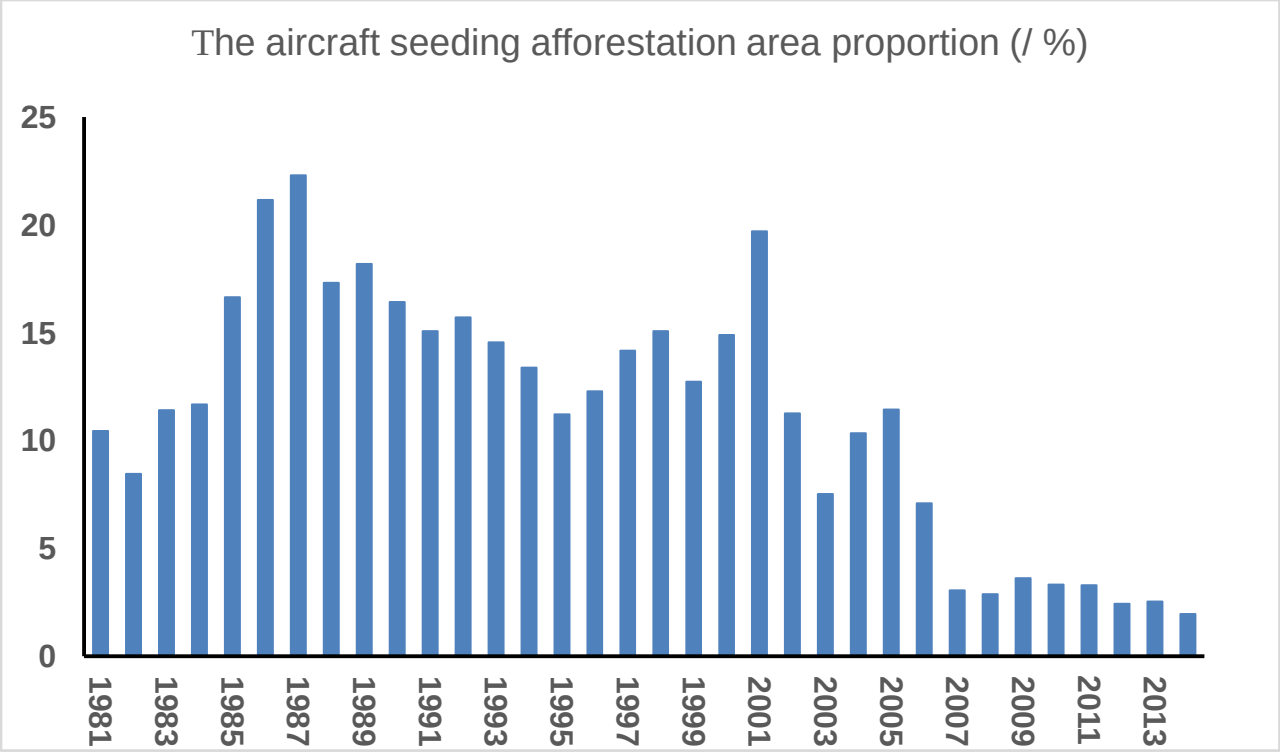
Adopting a small watershed as a close to nature management unit for multi-objective technology system was put forward. Within the same operating cycle, the volume of north China larch in the model is bigger than conventional management model by 378 m3 / ha, 73.4% higher.

Fragmented basin before management

High-quality forest basin after management

The aerial-seeding afforestation

- By the end of 2015, the aerial-seeding afforestation accounts for about 12% afforestation area.
- Key technology: by seed coating



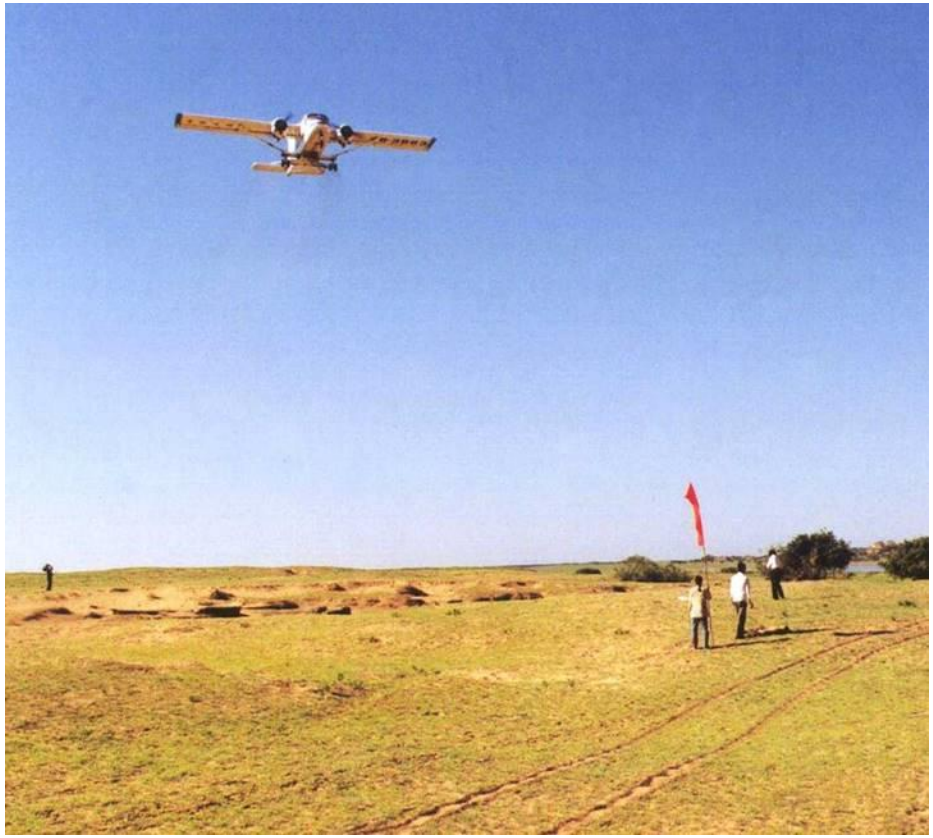
The aerial-seeding afforestation

PLA Air force aerial-seeding afforestation

Mu Us sandy land

The aerial-seeding afforestation

- Early working system



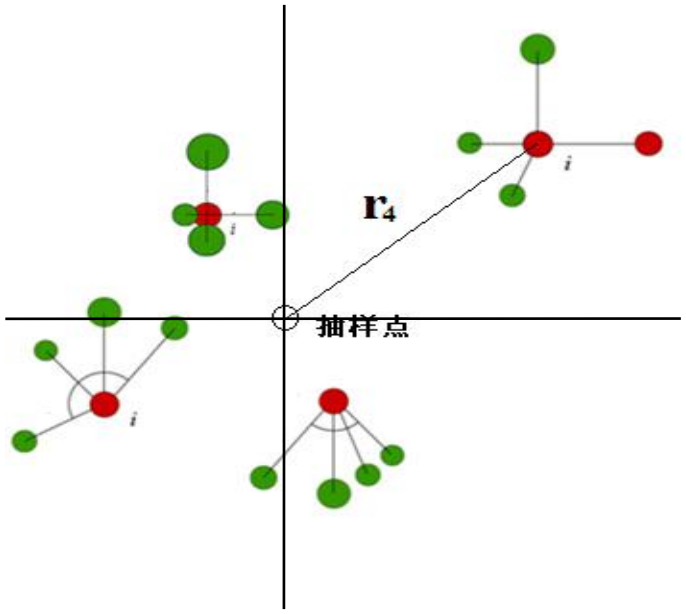
5 Natural forest management in China

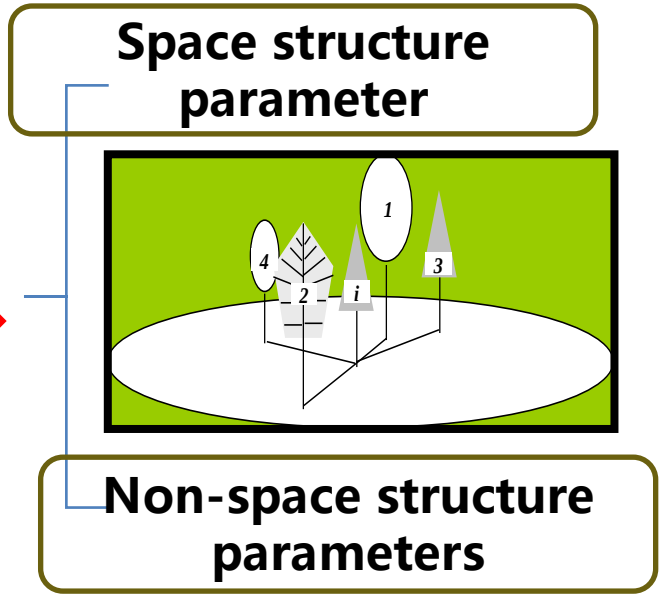
Structured forest management technology proposed has been developed

- Forest types by parameters of natural degree
- Management goals by parameters of urgent degree
- Forest structure adjustment by parameters of space structure
- Management effects assessment by parameters of states analysis

Key technique

- Stand space description with parametres by measuring 4-reference adjacent trees
- Applied in 60,000 ha in China



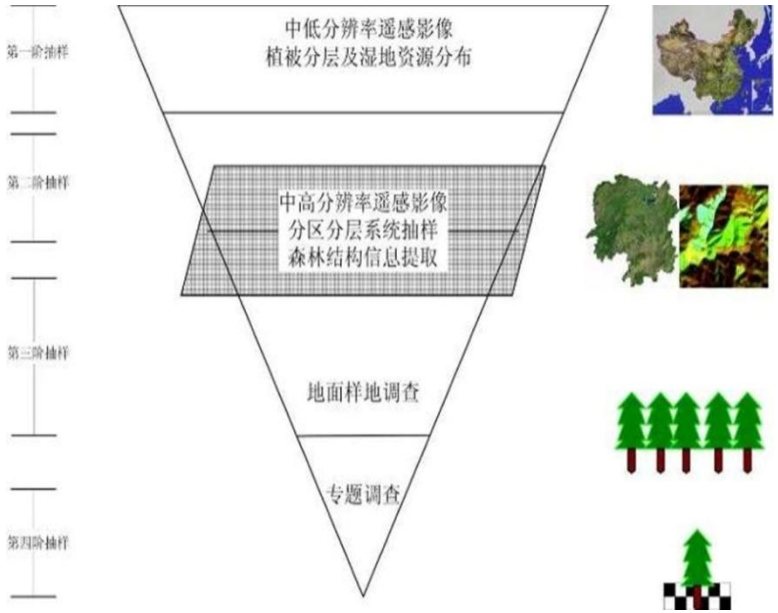


6 Forest conservation and forest health in China

Forest Resources Monitoring Technology

- The forest biomass measurement technology has been innovated
- The remote sensing monitoring application system is developed , the remote sensing data information extraction platform , improves the efficiency by 20%-30% and the monitoring accuracy of 5%-10%

Operational system of remote sensing monitoring of National Forest Resources



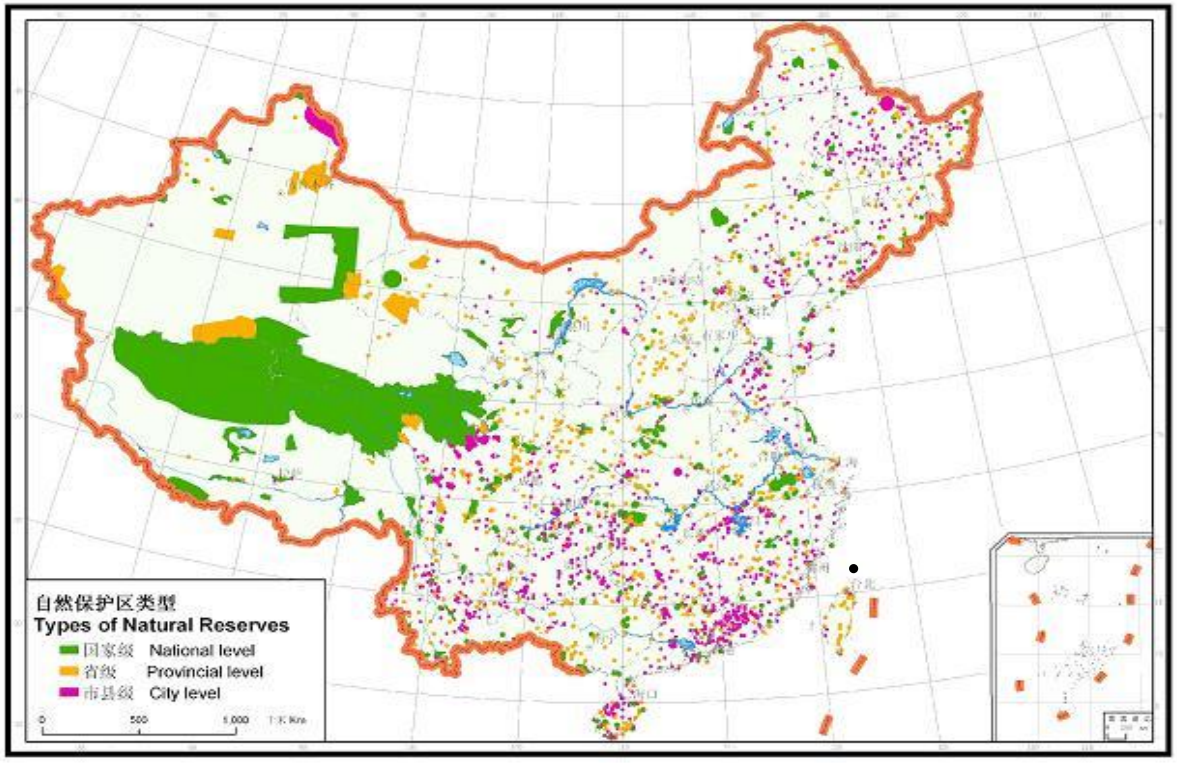
Sampling system for integrated monitoring of forest resources

Long-term Forest Ecosystem Research Stations

- 118 long-term forest ecosystem research stations had been established. Technological supports are provided for forest management and restoration of degraded forests by researching the structure and function of forest.

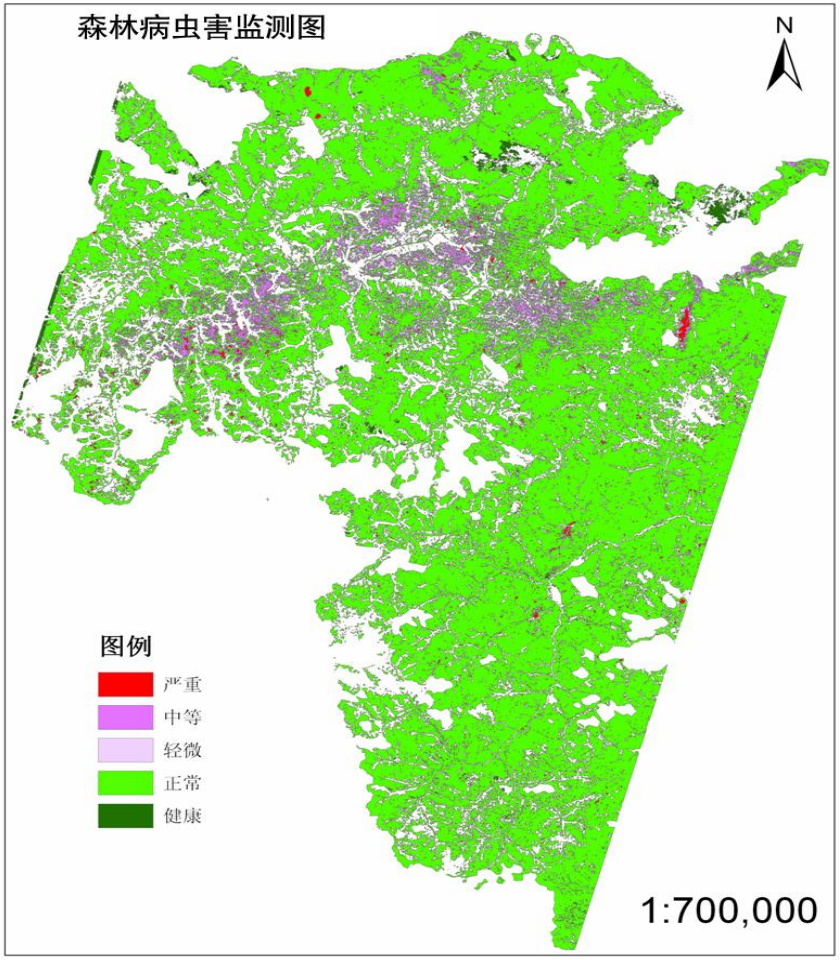
Biological Conservation

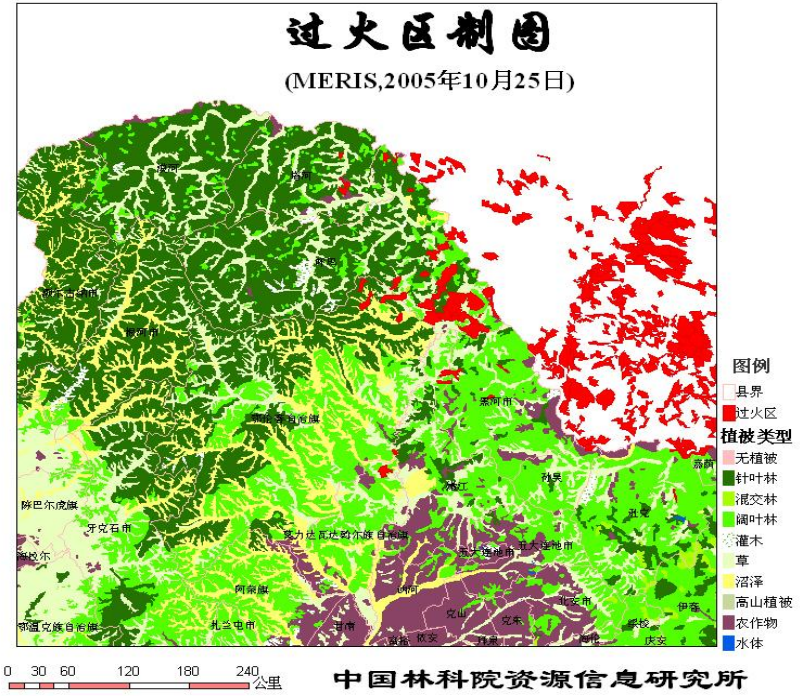
- 2,189 nature reserves, accounting for 13% of the land area of China, had been established in Chinese forestry system by the end of 2015；
- Nearly 200 botanical gardens or arboretum have been established，which preserved off-site tree species over 2000, with 120 key species among it.



Forest-fire prevention

- Established a fire monitoring and control system which had effectively improved the capacity of forest fire monitoring.



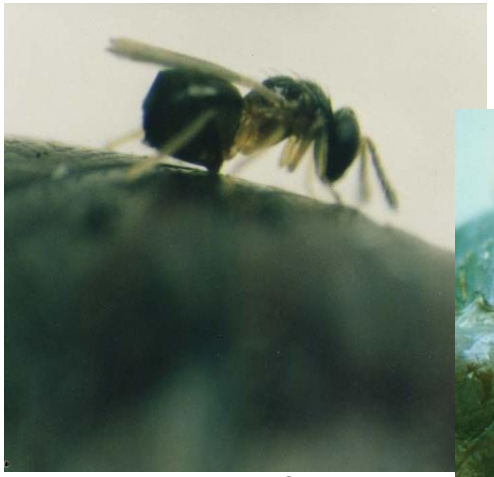


Forest pests and disease control

- **white moth** （*Hyphantria cunea*）
  - The technology using the *Chouioia cunea Yang* and NPV virus to combat the white moth was developed
  - which has dramatically reduced the pest incidence rate to below 0.1% in the designated control area, and it has been applied in 2/3 of white moth-stricken areas in China

（*Hyphantria cunea*）

Larvae of American white moth



***Chouioia cunea* females spawn in American white moth pupae**

Alternative chalcephora breed host in Tussah Silkworm

- **Non-polluted Technique for *Massicus raddei* control**

➢ The massicus is the most influential pest in northeast of China.

➢ The integrated system ranging from larve to adult of the pest has been applied, and covers over 150,000 hectares.

Adults of Massicus

Ash Ding s.guani larvae are parasitic on Massicus larvae

Ultravioletlighttrap for the adult mountain longicorn beetles

7 Conclusions and suggestion

- **Significant progresses have been made on forest silviculture in China**
  - Greatly supports the goal of increasing both the forest cover and forest volume
  - Especially on the planted forest cultivation and tree breeding

- **There is a still long way to go for forest silviculture in China in the years to come**
  - Only about 120 species out of 2000 species were studied
  - The quantity and quality of the forest should be improved

- **Strengthen cooperation in forest researches among Asian and Oceania countries on:**
  - Sustainable forest management
  - Adaption to climate change
  - Biodiversity conservation
  - Difficult site vegetation restoration
  - Forestry information technology

谢 谢

Thank you