



# Forest Resources **in** China

—The 9<sup>th</sup> National Forest Inventory

National Forestry and Grassland Administration

March, 2019



# Content



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Forests are indispensable natural resources for the subsistence and development of mankind.

In the past 40 years of reform and opening up, remarkable achievements on forest protection and development have been made through continuous promotion of afforestation and greening, forest nurturing, tightened control over forest consumption and natural forest protection. Since the 18<sup>th</sup> CPC National Congress, China has entered a new era of ecological civilization and building a beautiful China. The forest area and stock volume have continued to grow and ecological functions of forests have been continuously enhanced due to the implementation of the most stringent ecological protection system and adoption of strict ecological improvement measures, laying a solid foundation for adhering to General Secretary Xi Jinping's conviction that lucid waters and lush mountains are invaluable assets and a new start-up journey of forestry modernization and the high-quality development of forestry.

This brochure, based on the 9<sup>th</sup> national forest inventory (NFI), outlines the function, quantity, quality and changes of forest resources in China.



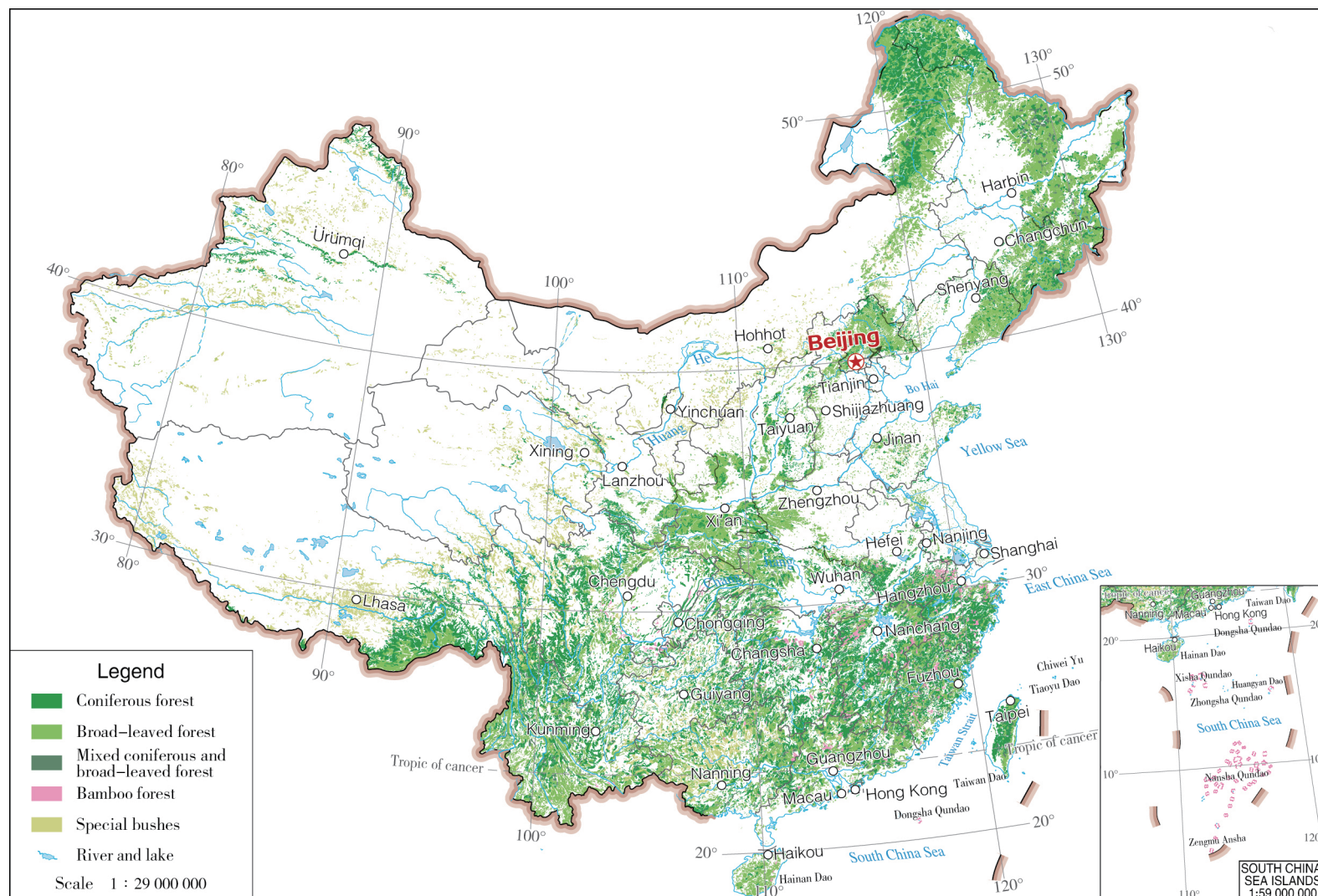
## I

# Status of Forest Resources

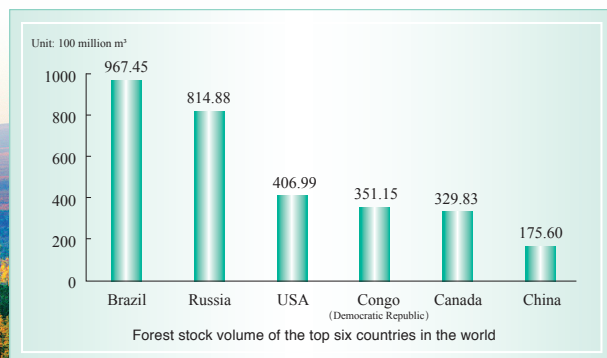
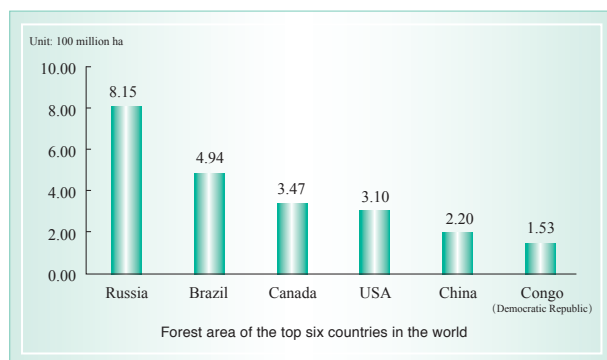
China has a forest area of 220 million ha, a forest cover of 22.96%, and a forest stock volume of 17.560 billion m<sup>3</sup>.

The total biomass of forest vegetation is 18.802 billion tons, and its total carbon stock is 9.186 billion tons.

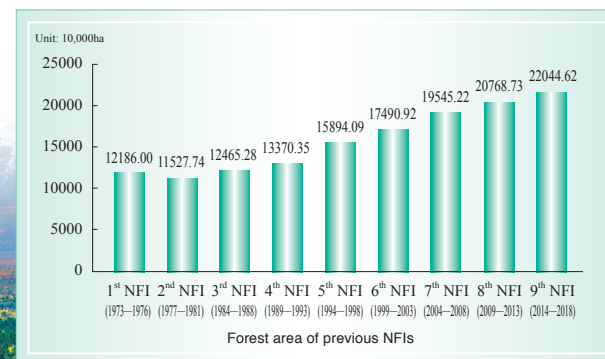
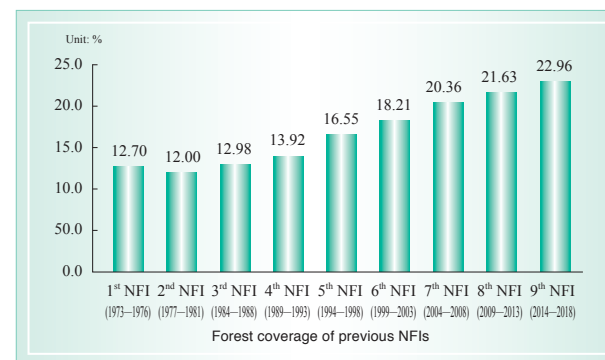
● Distribution of Forest Resources in P.R.China



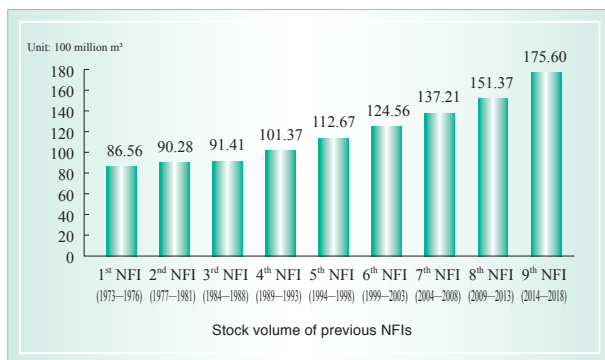
According to *Global Forest Resources Assessment 2015*, the forest area in China accounts for 5.51% of the world's total, ranking the fifth. The forest stock volume takes up 3.34% of the world's total, ranking the 6<sup>th</sup>. The plantation area in China remains the first of the world. The forest area per capita in China is 0.16 ha, less than 1/3 of the world average, while the forest stock volume per capita is 12.35 m<sup>3</sup>, only 1/6 of the world average. China is one of the top ranking countries in terms of total forest resources, but its per capita forest resources remain low.



According to the results of the nine national forest inventories conducted between 1973 and 2018, the forest cover in China has increased from 12.00% to 22.96% and the forest stock volume has increased by 8.5 billion m<sup>3</sup> in the past 40 years. Particularly since the late 1980s China has maintained "dual growth" in both forest area and stock volume for 30 consecutive years, becoming the country with the largest growth in forest resources worldwide.







## Forest Functions and Services

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The forest can offer a variety of functions for people's livelihood, such as ecological, social and product services, and plays a significant role in ecological civilization and building a beautiful China.

### I Ecological services

The area of shelterbelt forests designated for headwaters conservation, soil and water conservation, wind break and sand fixation amounts to 100.8192 million ha.

China's forests hold a water conservation capacity of 628.950 billion m<sup>3</sup>, a soil fixation capacity of 8.748 billion tons, a nutrient preserving capacity of soil of 462 million tons, an air pollutants absorption capacity of 40 million tons, a dust retention capacity of 6.158 billion tons, a carbon fixation capacity of 434 million tons and an oxygen release capacity of 1.029 billion tons on an annual basis.



⦿ Water conservation

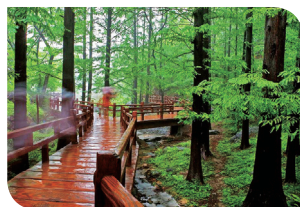


⦿ Water and soil conservation



## 2 Social services

The area of forests in China designated for special purposes, including tourism, sightseeing, livable environment, scenic spots, scientific experiments and nature conservation reaches 22.8040 million ha.



⦿ Tourism and sightseeing



⦿ Air purification

## 3 Forest goods

The total area of commercial forests designated for forest products reaches 94.5973 million ha, of which the timber forest area is 72.4235 million ha, the fuelwood forest area is 1.2314 million ha, and the economic forest area is 20.9424 million ha.



⦿ Ecological tea plantation



⦿ Camellia forest



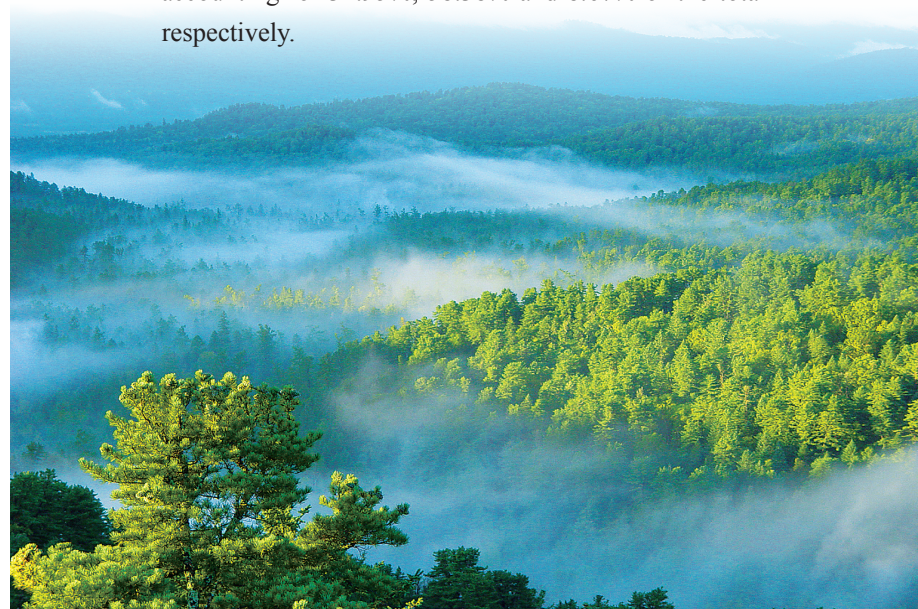
## Quantity of Forest Resources

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### 1 Forest vegetation types

Due to its complex natural geographical and diverse climatic conditions, China has diverse forest types with distinct zonal distribution. The area of natural forest vegetation in China is 138.6777 million ha, and the area of nurtured forest vegetation reaches 79.5428 million ha, accounting for 63.55% and 36.45% of the total respectively.

**Natural forest vegetation** Among the natural forest vegetation in China, the area of coniferous forest vegetation amounts to 45.7006 million ha, while the area of broad-leaved forest vegetation reaches 80.9650 million ha, and the area of bushes is 12.0121 million ha, accounting for 32.95%, 58.38% and 8.67% of the total respectively.



## Quantity of Forest Resources

◎ Area of natural forests by vegetation type

10,000 ha, %

Vegetation type group	Vegetation type	Area	Area ratio
Coniferous forests	Cold-temperate coniferous forests	1652.24	36.15
	Temperate coniferous forests	481.31	10.53
	Temperate mixed coniferous and broad-leaved forests	473.99	10.37
	Warm coniferous forests	1297.28	28.39
	Warm coniferous and broad-leaved mixed forests	663.20	14.51
	Hot coniferous forests	1.32	0.03
	Hot coniferous and broad-leaved mixed forests	0.72	0.02
Broad-leaved forests	Deciduous broad-leaved forests	5052.72	62.41
	Evergreen deciduous broad-leaved mixed forests	972.08	12.01
	Evergreen broad-leaved forests	1382.38	17.07
	Sclerophyllous evergreen broad-leaved forests	216.38	2.67
	Monsoon forests	23.93	0.30
	Rainforests	56.43	0.69
	Mangrove forests	2.20	0.03
Bushes	Bamboo forests	390.38	4.82
	Evergreen coniferous bushes	60.05	5.00
	Evergreen leathery-leaved bushes	213.25	17.75
	Deciduous broad-leaved bushes	732.17	60.95
	Evergreen broad-leaved bushes	195.74	16.30

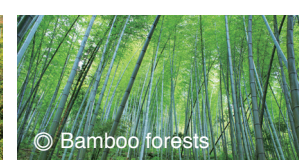
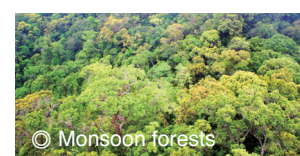
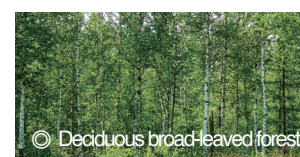
**Nurtured forests** Among the nurtured forests in China, broad-leaved forests and coniferous forests are dominant types, of which the area of broad-leaved forests reaches 26.4502 million ha, accounting for 33.25%; and the area of coniferous forests is 26.1149 million ha, taking up 32.83%.

## Quantity of Forest Resources

◎ Area of nurtured forests by vegetation type

10,000 ha, %

Vegetation type	Area	Area ratio
Coniferous forests	2611.49	32.83
Mixed coniferous and broad-leaved forests	456.16	5.73
Broad-leaved forests	2645.02	33.25
Bushes	1990.83	25.03
Other woody types	250.78	3.16



## 2 Composition of forest community

In terms of forest area, the total area of arbor forests is 179.8885 million ha, taking up 82.43%; the total area of bamboo forests amounts to 6.4116 million ha, accounting for 2.94%; and the total area of special bushes reaches 31.9204 million ha, making up 14.63%.

### Arbor forests

**Main arbor tree species** Broken down by dominant tree species, the top 10 tree species (groups) in terms of area of arbor forests are listed in the following table. The total area of forests dominated by the tree species accounts for 46.30% of the total, while the stock volume takes up 43.83% of the national total.

#### Quantity of main arbor tree species (group) in arbor forests

10,000 ha, 100 million m<sup>3</sup>, %

Dominant species (group)	Area	Area ratio	Stock volume	Stock volume ratio
<i>Quercus</i>	1656.26	9.21	14.18	8.32
<i>Cunninghamia lanceolata</i>	1138.66	6.33	8.52	5.00
<i>Larix gmelinii</i>	1083.51	6.02	11.23	6.58
<i>Betula</i>	1038.34	5.77	9.23	5.41
<i>Populus</i>	825.49	4.59	6.12	3.59
<i>Pinus massoniana</i>	804.30	4.47	6.26	3.67
<i>Eucalyptus</i>	546.74	3.04	2.16	1.26
<i>Picea asperata</i>	439.34	2.44	9.73	5.70
<i>Pinus yunnanensis</i>	425.74	2.37	5.01	2.94
<i>Platycladus orientalis</i>	370.82	2.06	2.32	1.36
Total	8329.20	46.30	74.76	43.83

There are more than 2,000 species of arbor trees in China. The number of arbor trees reaches 189.243 billion, with a stock volume of 17.058 billion m<sup>3</sup>.

Arbor trees are the main body of forest vegetation, and their role and status are usually reflected by the importance value of arbor species. The greater the number of tree species in the forest vegetation, the wider the distribution and the larger the individual, the higher the importance value of the tree species is. Broken down by the importance value, the top 20 arbor tree species are listed in the following table. The total number of trees of the 20 species is 97.351 billion, accounting for 51.44% of the national total, while their total stock volume reaches 9.046 billion m<sup>3</sup>, making up 53.03% of the national total.

#### Quantity of main arbor tree species

100 million trees, 100 million m<sup>3</sup>

No.	Tree species	Importance value	Number of trees	Stock volume	Main distribution provinces
1	<i>Cunninghamia lanceolata</i>	23.23	211.72	10.79	Fujian, Hunan, Jiangxi, Guangxi
2	<i>Betula platyphylla</i>	16.58	128.26	10.33	Inner Mongolia, Heilongjiang
3	<i>Pinus massoniana</i>	14.79	100.33	9.08	Fujian, Guangxi, Guizhou, Hubei
4	<i>Larix gmelinii</i>	10.99	80.83	9.36	Inner Mongolia, Heilongjiang, Xinjiang
5	<i>Quercus mongolica</i>	10.74	82.94	5.83	Heilongjiang, Jilin, Inner Mongolia
6	<i>Populus</i>	6.84	42.68	4.40	Henan, Shandong, Inner Mongolia
7	<i>Populus davidiana</i>	5.77	36.59	3.43	Heilongjiang, Inner Mongolia
8	<i>Pinus yunnanensis</i>	5.59	40.29	4.87	Yunnan, Sichuan, Tibet
9	<i>Schima superba</i>	4.74	32.09	1.90	Guangdong, Jiangxi, Fujian, Zhejiang
10	<i>Betula dahurica</i>	4.21	25.01	1.93	Inner Mongolia, Heilongjiang, Jilin
11	<i>Cupressus funebris</i>	3.89	31.27	2.25	Sichuan, Tibet
12	<i>Quercus glauca</i>	3.44	22.41	1.14	Fujian, Guizhou, Shaanxi
13	<i>Quercus liaotungensis</i>	3.43	26.47	1.83	Liaoning, Shaanxi, Shanxi
14	<i>Pinus tabulaeformis</i>	3.32	25.55	1.60	Shaanxi, Shanxi, Liaoning, Hebei
15	<i>Acer pictum</i>	3.20	16.32	1.33	Jilin, Heilongjiang, Liaoning
16	<i>Liquidambar formosana</i>	3.14	12.97	0.90	Guangxi, Guizhou, Anhui, Fujian
17	<i>Picea asperata</i>	2.91	9.82	6.97	Tibet, Xinjiang, Sichuan
18	<i>Tilia amurensis</i>	2.90	13.10	1.82	Jilin, Heilongjiang
19	<i>Abies fabri</i>	2.84	6.80	9.44	Tibet, Sichuan
20	<i>Eucalyptus urophylla</i>	2.71	28.06	1.26	Guangxi, Guangdong



**Major precious tree species** The number of precious tree species in China is about 33.054 billion, accounting for 17.47% of the total number of arbor trees, with a stock volume of 2.596 billion m<sup>3</sup>, accounting for 15.22% of the total arbor forest stock volume in China. Ranked by importance value, the top 20 precious tree species are listed in the following table. The total number of trees of the species is 27.667 billion, accounting for 14.62% of the total number of arbor trees in China, and the total stock volume is 2.102 billion m<sup>3</sup>, making up 12.32% of the total arbor forest stock volume in China.

**Age group structure** According to distinct biological

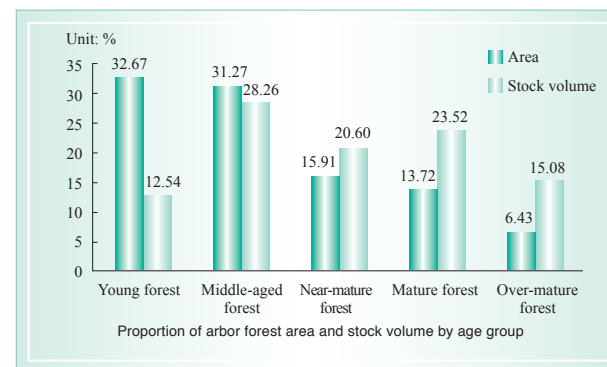
#### Quantity of main precious tree species

100 million, 100 million m<sup>3</sup>

No.	Tree species	Importance value	Number of trees	Stock volume	Main distribution provinces
1	<i>Quercus mongolica</i>	10.74	82.94	5.83	Heilongjiang, Jilin, Inner Mongolia
2	<i>Cyclobalanopsis glauca</i>	3.44	22.41	1.14	Fujian, Guizhou, Shaanxi
3	<i>Quercus liaotungensis</i>	3.43	26.47	1.83	Liaoning, Shaanxi, Shanxi
4	<i>Tilia amurensis</i>	2.90	13.10	1.82	Jilin, Heilongjiang
5	<i>Quercus acutissima</i>	2.68	19.05	0.87	Sichuan, Yunnan, Henan
6	<i>Castanopsis fargesii</i>	2.42	13.66	1.20	Fujian, Jiangxi, Guizhou
7	<i>Quercus fabri</i>	2.18	14.45	0.54	Guizhou, Jiangxi, Anhui, Hunan, Zhejiang
8	<i>Quercus variabilis</i>	1.92	14.28	0.81	Hubei, Shaanxi, Yunnan, Sichuan
9	<i>Juglans mandshurica</i>	1.67	6.02	1.19	Jilin, Heilongjiang, Liaoning
10	<i>Quercus aliena</i>	1.60	10.11	0.86	Gansu, Shaanxi
11	<i>Pinus koraiensis</i>	1.53	7.72	1.03	Heilongjiang, Jilin
12	<i>Fraxinus mandshurica</i>	1.40	5.26	0.73	Heilongjiang, Jilin
13	<i>Betula costata</i>	1.28	5.66	0.80	Heilongjiang, Jilin, Hebei
14	<i>Castanopsis sclerophylla</i>	1.26	7.68	0.32	Jiangxi, Zhejiang, Fujian
15	<i>Castanopsis hystrix</i>	1.06	6.02	0.57	Guangdong, Yunnan, Guangxi
16	<i>Dalbergia hupeana</i>	0.99	3.90	0.10	Hubei, Hunan, Jiangxi, Yunnan
17	<i>Betula luminifera</i>	0.98	4.44	0.41	Hubei, Shaanxi, Guizhou
18	<i>Fagus longipetiolata</i>	0.90	5.81	0.41	Sichuan, Hunan, Guizhou
19	<i>Fraxinus rhynchophylla</i>	0.86	4.98	0.33	Jilin, Liaoning
20	<i>Sassafras tzumu</i>	0.83	2.71	0.23	Hunan, Jiangxi, Fujian, Anhui

attributes, growth process and management and utilization purpose, arbor forests are categorized into young forests, middle-aged forests, near-mature forests, mature forests and over-mature forests by age group in China.

- The area of young forests is 58.7754 million ha, with a stock volume of 2.139 billion m<sup>3</sup>;
- The area of middle-aged forests is 56.2592 million ha, with a stock volume of 4.822 billion m<sup>3</sup>;
- The area of near-mature forests is 28.6133 million ha, with a stock volume of 3.514 billion m<sup>3</sup>;
- The area of mature forests is 24.6766 million ha, with a stock volume of 4.011 billion m<sup>3</sup>;
- The area of over-mature forests is 11.5640 million ha, with a stock volume of 2.572 billion m<sup>3</sup>.



Chinese fir in young forests



Masson pine in middle-aged forests



Bamboo forest

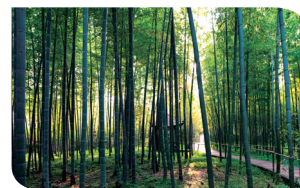
China, known as the "kingdom of bamboo", is one of countries with the richest and widely-distributed bamboo resources in the world, and has a long history of using bamboo resources. China has more than 500 bamboo species in 39 genera. The number of cultivated economic bamboo species reaches 50, including *Phyllostachys pubescens* (Moso bamboo), *Phyllostachys praecox* and so on.

The area of bamboo forest is 6.4116 million ha, of which the area of Moso bamboo forest is 4.6778 million ha, accounting for 72.96%; the area of other bamboo forest is 1.7338 million ha, accounting for 27.04%.

The Moso bamboo forest is distributed in 13 provinces. Four provinces including Fujian, Jiangxi, Hunan and Zhejiang, have an area of over 700,000 ha respectively. The total area of Moso bamboo forest in the above-mentioned provinces amounts to 3.7062 million ha, accounting for 79.23% of the national total.



Mottled bamboo forest



Moso bamboo forest

#### Area and culms of moso bamboo forest

10,000 ha, 100 million culms

Statistic unit	Moso bamboo forest	
	Area	Culms
Total	467.78	113.60
Fujian	107.95	26.89
Jiangxi	103.73	25.58
Hunan	80.39	15.69
Zhejiang	78.55	21.41
Anhui	31.24	7.84
Guangdong	17.27	4.04
Guangxi	16.33	4.31
Hubei	14.40	2.87
Sichuan	7.26	2.19
Guizhou	6.08	1.34
Jiangsu	2.64	0.93
Chongqing	1.29	0.34
Henan	0.65	0.17

#### Special bushes

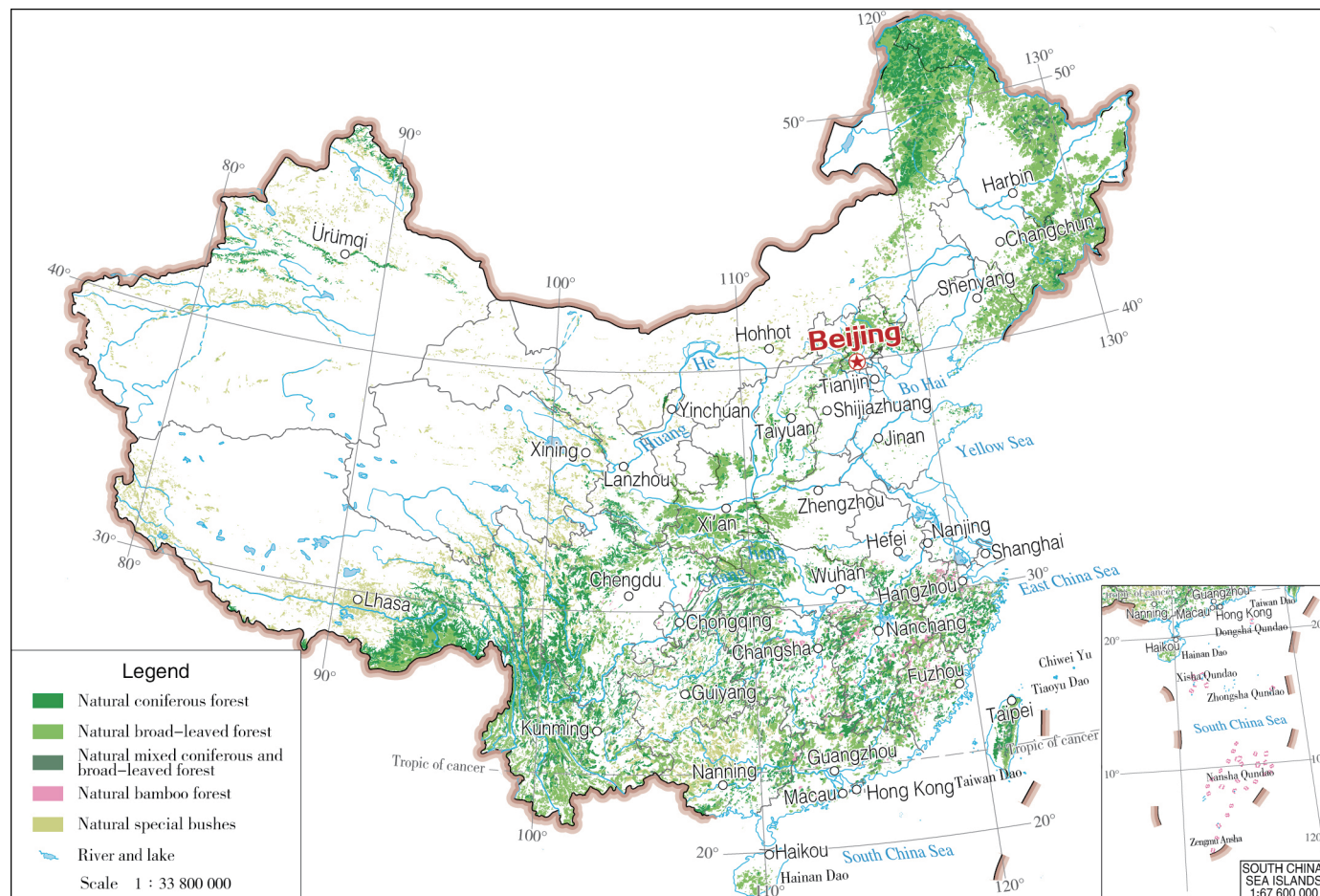
In China, bushes designated for economic use, bushes situated in areas with annual precipitation below 400 mm, bushes growing above the arbor distribution (vertical) line, and bushes growing in tropical and subtropical karst areas and dry-hot (drought) valleys are classified as special bushes, and they are included in calculating forest cover. The area of special bushes is 31.9204 million ha, mainly distributing in the arid regions of the west, the karst areas in the southwest and the dry-hot (drought) valleys where arbor tree species are hard to survive.

### 3 Natural forests

The Chinese government has implemented strict natural forest protection policies and made great efforts to conduct the mountain-closure for natural regeneration of forests. In 2016, China completely stopped commercial logging of natural forests. The area of natural forest in China is 138.6777 million ha, with a stock volume of

13.670 billion m<sup>3</sup>, and a stock volume per ha of 111.36 m<sup>3</sup>. The natural forest is mainly distributed in five provinces, including Inner Mongolia, Heilongjiang, Yunnan, Tibet and Sichuan. The area of natural forest in the five provinces accounts for 58.99% of the national total.

◎ Distribution of natural forest in P.R.China







## Quantity of Forest Resources



Broken down by dominant tree species (groups), the top ten natural forest tree species are listed in the following table. The forest area of the ten species accounts for 44.23% of the national total, and their stock volume makes up 50.50% of the national total.

② Area and stock volume of dominant species (groups) in natural arbor forest

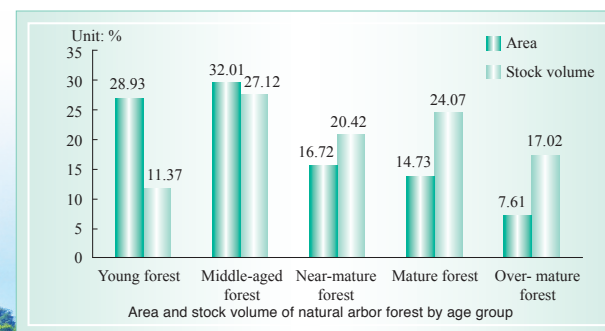
10,000 ha, 100 million m<sup>3</sup>, %

Forest type	Area	Ratio	Stock volume	Ratio
<i>Quercus</i>	1467.21	11.95	13.64	9.98
<i>Betula</i>	997.31	8.12	8.94	6.54
<i>Larix gmelinii</i>	767.22	6.25	8.86	6.48
<i>Pinus massoniana</i>	552.38	4.50	4.38	3.21
<i>Picea asperata</i>	398.15	3.24	9.54	6.98
<i>Pinus yunnanensis</i>	381.20	3.11	4.69	3.43
<i>Abies fabri</i>	357.67	2.91	13.22	9.67
<i>Cupressus funebris</i>	209.69	1.71	1.48	1.08
<i>Pinus densata</i>	150.83	1.23	3.32	2.43
<i>Cunninghamia lanceolata</i>	148.46	1.21	0.97	0.70
Total	5430.12	44.23	69.04	50.50



The natural arbor forest is categorized by age group as follows:

- The area of young forest is 35.5163 million ha, with a stock volume of 1.554 billion m<sup>3</sup>;
- The area of middle-aged forest is 39.2912 million ha, with a stock volume of 3.707 billion m<sup>3</sup>;
- The area of near-mature forest is 20.5272 million ha, with a stock volume of 2.791 billion m<sup>3</sup>;
- The area of mature forest is 18.0885 million ha, with a stock volume of 3.291 billion m<sup>3</sup>;
- The area of over-mature forest is 9.3386 million ha, with a stock volume of 2.327 billion m<sup>3</sup>.



The Chinese government has attached great importance to nurturing plantation resources, and carried out large scale afforestation and greening. China has greatly developed and steadily expanded the plantation resources. The plantation area ranks China the first in the world. The total area of plantations in China reaches

79.5428 million ha, with a stock volume of 3.388 billion m<sup>3</sup>, and 59.30 m<sup>3</sup> per ha. Provinces including Guangxi, Guangdong, Inner Mongolia, Yunnan, Sichuan and Hunan have a large cover of plantations, accounting for 43.50% of the national total.

© Distribution of Plantation in P.R.China





Broken down by dominant tree species (groups), the top ten tree species in terms of plantation area are Listed in the following table. The total area of these species (groups) accounts for 63.65% of the national total, and their stock volume makes up 68.47% of the national total.

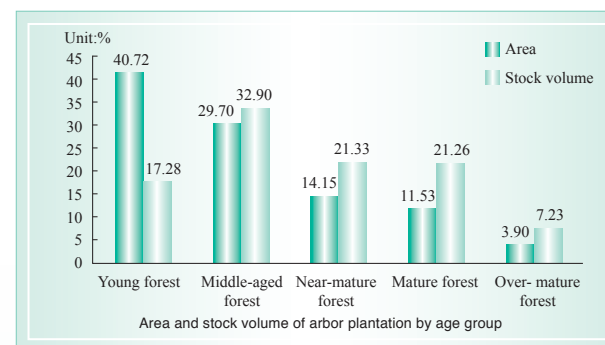
◎ Area and stock volume of dominant species (groups) for arbor plantations

10,000 ha, 100 million m<sup>3</sup>, %

Plantations Type	Area	Ratio	Stock volume	Ratio
<i>Cunninghamia lanceolata</i>	990.20	17.33	7.56	22.30
<i>Populus</i>	757.07	13.25	5.46	16.12
<i>Eucalyptus</i>	546.74	9.57	2.16	6.37
<i>Larix gmelinii</i>	316.29	5.54	2.38	7.01
<i>Pinus massoniana</i>	251.92	4.41	1.88	5.54
<i>Robinia pseudoacacia</i>	177.84	3.11	0.52	1.52
<i>Pinus tabulaeformis</i>	167.76	2.94	0.81	2.40
<i>Cupressus funebris</i>	161.13	2.82	0.84	2.49
<i>Hevea brasiliensis</i>	138.28	2.42	1.05	3.11
<i>Pinus elliotii</i>	128.65	2.25	0.54	1.61
Total	3635.88	63.65	23.20	68.47

Plantations are classified by age group as follows:

- The area of young forest is 23.2591 million ha, with a stock volume of 585 million m<sup>3</sup>;
- The area of middle-aged forest is 16.9680 million ha, with a stock volume of 1115 million m<sup>3</sup>;
- The area of near-mature forest is 8.0861 million ha, with a stock volume of 723 million m<sup>3</sup>;
- The area of mature forest is 6.5881 million ha, with a stock volume of 720 million m<sup>3</sup>;
- The area of over-mature forest is 2.2254 million ha, with a stock volume of 245 million m<sup>3</sup>.



Chinese fir forest



Poplar forest



## Quality of Forest Resources

The forest stock volume is 94.83 m<sup>3</sup> per ha, the average annual increment of forests is 4.73 m<sup>3</sup> per ha, the average number of trees per ha is 1052. The average crown closure is 0.58, the average DBH is 13.4 cm, and the average tree height is 10.5 m, and the proportion of mixed forest area is 41.92%.

Based on comprehensive evaluation:

- High-quality forests take up 20.68%;
- Medium-quality forests take up 68.04%;
- Low-quality forests take up 11.28%.

In the light of forest growth status and severity of damaged forests, the overall health of arbor forests is evaluated, with the results shown as follows:

- The area of healthy arbor forests accounts for 84.38%;
- The area of sub-healthy arbor forests accounts for 12.12%;
- The area of moderately healthy arbor forests accounts for 2.52%;
- The area of unhealthy arbor forests accounts for 0.98%.



◎ High quality forests



◎ Low quality forests

## National Forest Inventory

Since the 1970s, China has established the continuous national forest inventory (NFI) system at an interval of five years. The internationally recognized continuous forest inventory methods have been introduced and used in the system. With the province (autonomous region/municipality) as a survey unit, 415,000 permanent sample plots are re-surveyed once every five years to investigate, measure and record relevant indicators showing the quantity, quality and structure of forest resources, forest ecological conditions, forest functions and benefits. The data on forest resources status and dynamic changes are consequently collected to evaluate the ecological status of forest resources and forest functions and benefits at the national and provincial levels.

By the year of 2018, a total of nine NFIs had been accomplished.



## National Forest Inventory

