THE STRUCTURE OF CHINA'S TROPICAL TIMBER MARKET,
THE CURRENT SITUATION OF INTERNATIONAL
COOPERATION OF P. R. C.,
AND THE PROSPECTS TO THE YEAR 2000

Undertaken for the

International Tropical Timber Organization

by

Mr. Lin Fengming
Mr. Xu Changbo
Mr. Lu Wenming
Ms. Zhu Minhui
Mr. Shi Feng

from the

Institute of Scientific and Technological Information
Chinese Academy of Forestry

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CHAPTER I


1 The Economical Development in China in 1988-1992

After 3 years (1988-1990) of economical development, the economy in China entered a high increase period in early 1990s. It might be said that in 1991 the economical development was still of a rehabilitational nature (GNP 7.7%), the growth rate of GNP in 1992 was 12.8%, indicating a fast increase. At present, the economic growth in China has been far higher than the average growth rate of the world, the industrialized and developing countries. The rate of economic growth of the latters are 1.8%, 1.6% (that of the ECO and EEC is 1.1%) and 6.1%, respectively.

The preliminary statistics show that the 1992 GDP in China was 2.3938 trillion RMB yuan (about 0.4586 trillion US dollars) (hereinafter referred to as 'yuan'), of which the agricultural added value was 0.5808 trillion yuan, being 24.2% of GDP, with an increase of 3.7% over the previous year; the industrial added value was 1.0116 trillion yuan, being 42.3% of GDP, with an increase of 20.8% over the previous year; the added value of construction industry was 0.1392 trillion yuan, being 5.8% of GDP, with an increase of 18%; the added value of third industry was 0.6623 trillion yuan, being 27.7% of GDP, with an increase of 9.2%. In the industrial sector, the growth rate of output value of the collective enterprises and the three types of ventures (Sino-foreign venture, cooperative venture and foreign venture) increased rapidly, being 28.5% and 48.8% respectively. The added value of non-state run industries was 61% of the total added value of the newly established industries in China. The vitality of state enterprises, especially the large and medium enterprises, increased, too. The added value of state run industries in China was 14.4% over the previous year. The added value of large and medium industries increased by 15.5%. In view of the discrepancy between regions, the growth rate of production in the coastal areas was still remarkably higher than that of inland. The added value of the newly established industries in Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan Provinces and Guangxi Zhuang Autonomous Region, was about 60% of the national total.

During the period from 1988 to 1992, the GNP increased by 46%, with an average annual increase of 7.9%. The range of increase appeared greater when compared with that in 1978 in the initial period of reform and opening (Fig 1).

In the past five years, the economic system reform continued deepening, and considerable progress has been made: (1) the continual development of the various economic sectors, (2) the
unceasing increase of market mechanism. Now in price formation, 90% of the industrial consumer goods in the total retail sales had their price determined by market. Of the total amount of farm produce and by-products purchased, those with price determined by market were 85%. Those of the production goods exported with price so determined were 70%. To sum up, the proportion of goods with market determined price has risen from about 50% five years ago to about 80% now. Grain is purchased and sold at the same price. More than 400 counties have liberated the control over grain transaction.

With the rapid economical growth in China, the scope and sectors opened to outside world are significantly enlarged. At the same time when the coastal areas are open, the areas along rivers and borders and provincial capitals are open also, forming a new overall open pattern. The customs statistics in China show that the total amount of import and export in 1992 was 0.1656 trillion US dollars, of which the total amount of export was 85 billion US dollars, with an increase of 18.2% over the previous year. The total amount of import was 80.6 billion US dollars, with an increase of 26.4%. In the total amount of export, the export by the three types of ventures rose sharply. The annual export was 17.4 billion US dollars, with an increase of 44.1% over the previous year. The proportion in the total export rose from 16.8% last year to 20.4% now. In the past five years, the volume of foreign trade in China increased above 60%, being almost eight times of 1978 (Fig 2). Now China has become the 11th large trading country in the world, more dependent on foreign trade.

The introduction of foreign capital into China tends to increase to a greater extent. In the past five years the foreign capital introduced amounted to 60.9 billion US dollars, of which direct investment by foreign enterprisers was 23.3 billion US dollars. This was 1.6 and 2.6 times of the total sum in the period from 1979 to 1987. In 1992, the amount of foreign capital in newly signed agreements reached a new high point--68.5 billion US dollars, with a 2.5 times increase over the previous year. The foreign capital actually used was 18.8 billion US dollars, with an increase of 62.7%. Of this amount the direct investment by foreign enterprisers according to agreements reached 57.5 billion US dollars, and the sum actually invested was 11.16 billion US dollars, with a 3.8 times and 1.6 times increase, respectively. With the expansion of investment scope and open areas, the three types of ventures quickly increased. Up to the end of 1992, the three types of ventures registered in China was 84,000, being 47,000 more than the figure at the end of previous year.

With energetically carrying out family planning, the growth rate of Chinese population is under further control. The statistics of relevant agency show that up to the end of 1992, the Chinese population in the main land was 1,171.71 million, of which the urban population was 32.3%, and the rural population was 67.7%. The birth rate was 18.24 per thousand, mortality 6.64 per thousand, with a natural growth rate of 11.6 per thousand. The average annual growth rate of Chinese population has decreased from 1.91% in 1958-1978 to 1.3% in 1979-1989 and 1.2% in 1990-1992.

A sampling survey in 1992 shows that the average income per capita of urban residents was 1,826 yuan, with an increase of 18.2% over the previous year. With deduction of the price factor, the actual income increase was 8.8%. The average annual net income of the individual peasants was 784 yuan, with an income of 10.6% over the previous year. With deduction of the price factor, the actual income increase was 5.9%. In the same year the GDP per capita was 2,043 yuan, about 390 US dollars.

The main objectives of national economy and social development set by the State Council of China in 1993 are: (1) the growth rate of GNP is 8%, among which the growth rate of the third industries is 9% or higher, the total value of farm output is 4%, that of industrial output is 14%; (2) the total amount of import and export in foreign trade is 0.185 trillion US dollars, with an increase of 11.7%; the total amount of export increase by 11.8%, that of import by 11.7%, maintaining necessary exchange reserve; (3) at the same time when the price reform is stepped up, the ceiling of going up

![Fig 2. The change of import and export in China in 1978—1992](image-url)
price in retail sales throughout the country should be set at about 6%; (4) the natural growth rate of population in the country should be kept under 13.88 per thousand. In view of the actual economic operation in the first half of 1993, the overall appraisal made is: the economic development keeps a vigorous momentum, but some constraining factors become also prominent.

A preliminary calculation by the State Statistics Bureau shows that the GNP in the first half of 1993 is 1.2647 trillion yuan, which, if calculated according to comparable prices, increases by 13.9% over the same period of last year. Due to high increase of investment in fixed assets and the sustainable rapid increase in industrial production, the total value of industrial output in the first half of current year increases by 25.1% over the same period of last year, making up a fast growing tendency over 20% in 12 successive months. At the same time, the economic benefits of the enterprises gradually improve too. The import and export volume in foreign trade continues to increase. The customs statistics show that in the first half of the year, the total amount of export was 37.15 billion US dollars, with an increase of 4.4% over the same period of last year. The amount of import was 40.69 billion US dollars, with an increase of 23.2%. Except the sum without payment by foreign exchange, the favourable balance was 2.55 billion US dollars. With more effort made in price reform, a preliminary market oriented price mechanism has been formed. Control over grain and oil price has been lifted in more than 90% of the areas in China. This is done also for steel products and the mill price of part of the state monopolized coal. With rapid economic development, the income of residents increases rapidly, too. In the first half of the year the income per capita of urban residents was 1,116 yuan, with an increase of 28% over the same period of last year. With deduction of price factors, the actual income increase was 13.5%. The average cash earning of individual peasants was 423 yuan, with an increase about 18%. With deduction of price factors, the actual income increase was about 7%. Now the serious problems that constrain economic development in China are: (1) excessive scale of investment in fixed assets and the decrease of macro-effect of investment; (2) severity of financial situation with obvious discrepancy between the high economic growth and the low financial revenue; (3) the striking contradiction of bottleneck constraints, especially short supply of steel and power, low capacity of railway transport and the general shortage of capital input; (4) further rise of prices, when the price index of people’s living expenses increases by 12.5% over same period of last year, with that in cities increasing by 13% (35 large and medium cities being 17.4%) and that in rural areas increasing by 11.5%; (5) low potentiality of agricultural production and decrease of input, as well as the policies aiming at strengthening agricultural construction not yet being put into effect.

The latest prediction made by the Information Centres in China shows that the growth rate of GNP in 1993 will probably be 12.7% or 11.6% and the overall price index in retail sales of commodities will increase by 11.9% or 10.1%. These are determined by two principal prerequisites: the scale of investment in fixed assets in the whole year and the range of increase of loans newly granted by banks.

2 The Forest Development in China in 1988-1992

Results of forest resources inventory in 1989-1993 show that the forest area in China now is 133.733 million ha, growing stock volume is 11.785 billion m³, stand stock volume is 10.137 billion m³ and the forest coverage is 13.92%. The forest area per capita is 0.12 ha. China ranks the seventh in forest area and growing stock in the world. In 1992 the total consumption of forest resources in China was 304.1 million m³. Except the consumption caused by disaster, the actual wood consumption in China was 244 million m³. The wood consumption per capita (including imported wood) was 0.2 m³. In view of the forest area and wood consumption per capita and in comparison with the world average per capita, China still belongs to those countries suffering from serious shortage of forest resources.

Since the birth of new China, magnificent achievements have been made in forest construction. Forests contribute over 1.8 billion m³ of industrial timber (referring only to the planned timber supply) to the rehabilitation of national economy. Huge sum of capital was accumulated for the nation. More than three million persons were employed. Through large scale construction of plantations, the area of forests established accounted for over 33 million ha, ranking first in the world. However, due to unlimited consumption of forest resources, the second forest inventory made in 1977-1981 showed a serious situation of nationwide excessive forest felling. The third forest inventory made in 1984-1988 showed that in spite of the increase of forest area, the decrease of growing stock continued, resulting in a more serious crisis in forest resources. The average annual deficit of forest resources rose from 19 million m³ in 1977-1981 to 28 million m³ in 1984-1988, with an increase of 47.36%, especially it was true of the timber forest (Table 1).

Forest quality has deteriorated with the gradual decrease of forest resources. The prominent features in deterioration are as follows:

(1) Decrease of growing stock per unit area. The average growing stock of forests in the whole country decreased form 83.44 m³/ha to 79.18 m³/ha, with a decrease of 4.45 m³/ha. The average growing stock of timber forests decreased from 85.35 m³/ha to 77.1 m³/ha, with a decrease of 8.26 m³/ha.

(2) Decrease of harvestable resource in the timber forests. In the timber forests in China, the proportion of mature and overmature forests in respect of area and growing stock decreased from 27.3% and 51.1% to 17.7% and 42.5%, respectively.

(3) Proportional decrease of coniferous timber, especially drastic reduction in growing stock of timber species. In China
the proportional area and growing stock of stands with conifers as the predominant species decreased by 3%. As to the principal timber species, the growing stock of mature and overmature forests of *Pinus koraiensis* decreased from 90.4 million m$^3$ to 45.31 million m$^3$, with a decrease of 49.87%. That of *Cunninghamia lanceolata* from 74.38 million m$^3$ to 39.08 million m$^3$, with a decrease of 47.65%. That of *Pinus yunnanensis* from 192.73 million m$^3$ to 91.02 million m$^3$, with a decrease of 52.77%. That of the valuable hardwood species such as *Fraxinus mandshurica*, *Juglans mandshurica* and *Phellodendron amurense* also decreased from 54.25 million m$^3$ to 33.07 million m$^3$, with a decrease of 39.04%.

In age structure, the low-age stands tending to increase. The age ratio of young and middle aged forests to mature and overmature forests changed from 71:29 to 80:20, and the growing stock ratio changed from 42:58 to 54:46. At the same time, the proportion of large dimension stock in the harvestable resources decreased gradually, while that of small dimension stock rose sharply.

The drastic reduction of forest resources and the continual deterioration of forest quality have brought about serious consequence. First, the already tense timber supply became more aggravated. The inadequacy of timber resources imposed more limitations on the development of national economy and the improvement of people’s daily life. Secondly, the state enterprises in the forest areas were beset with serious economic crises. The existence of about 100 out of 131 State Forest Bureaus were challenged. Thirdly, nation-wide ecological environment deteriorated. More land suffered from soil and water loss, with continuous expansion of desertification and serious shortage of water resources.

In face of such a serious situation, the central government and forestry agencies made a summary of past experience and lessons, and readjusted the forest development strategy. At the time of formulating the Forest Plan in the Eighth Five-Year Plan Period (1991-1995) and the Ten-Year Program of Forestry (1991-2000), a definite policy was issued for speeding up the culture of forest resources, strengthening the management and protection of forest resources, controlling the consumption of forest resources, readjusting the forest industry structure, promoting economic benefits and importing a part of forest products. It was also demanded that at the time of implementation of the above-mentioned Eighth Five-Year Plan and Ten-Year Program, a four-sided change in forestry in China should be effected: Change of the felling of natural forests as the main into laying a silvicultural foundation, and enhancing the establishment of plantations; Change of the sole timber production as the main into diversified forest management, comprehensive utilization and overall development; Change of extensive forest management as the main into reliance on sci-technology, intensive management and scientific management; and change of forestry agencies as the main into whole society for reforestation and all people for land greening.

In recent years, according to this development policy, the departments of forestry carried out the following works, with considerable progress made:

### 2.1 Speeding up the culture of forest resources and energetically establishing plantations

In order to speed up the culture of forest resources, in September, 1990, the State Council of the People’s Republic of China ratified the “Plan Outline of Nation-wide Afforestation and Land Greening in 1989-2000” formulated by the Ministry of Forestry. The general development objectives set in the Outline over 12 years are: the total area of afforestation is 57.165 million ha, among which the area of plantations 39.579 million ha, that of air seeding 6.16 million ha, and that of hills closed for forest culture 11.426 million ha. The annual afforestation area is 4.764 million ha. Up to the end of this century, the area of forests newly established will be 39.585 million ha. Of the total area, the area of timber forests is 16.514 million ha, that of protection forests 12.385 million ha, that of fuel forests 4.116 million ha, that of economic forests 6.02 million ha, and that of special forests 550,000 ha. The proportion of each type of forests is 41.7, 31.3, 10.4, 15.2 and 1.4%, respectively. The area of forests newly established each year is 3.299 million ha. The forest coverage of the country will increase from 12.98% to 15.3%, with an average annual increase of 0.14%.

In order to realize the objectives set in the Plan Outline, the priority projects in the forest development program in 1991-2000 are arranged as follows:

#### 2.1.1 Speeding up the construction of timber forest bases

<table>
<thead>
<tr>
<th>Period of inventory</th>
<th>Annual growth</th>
<th>Annual consump.</th>
<th>Deficit</th>
<th>Deficit of timber forests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977-1981</td>
<td>275</td>
<td>294</td>
<td>19</td>
<td>64.4</td>
</tr>
<tr>
<td>1984-1988 increment</td>
<td>316</td>
<td>344</td>
<td>28</td>
<td>96.1</td>
</tr>
<tr>
<td>(%)</td>
<td>14.9</td>
<td>17.9</td>
<td>47.36</td>
<td>49.22</td>
</tr>
</tbody>
</table>

Table 1 Fluctuation of forest growing stock in China (1,000,000 m$^3$)
Firstly, the existing forests must be well managed. Afforestation and regeneration must be strengthened. The area of regeneration in cutover areas set in the Ten-Year Program is 10.4667 million ha. Secondly, the tending and improvement of young and middle-age forests must be strengthened so as to accelerate the growth of trees. The area of stand tending set in the Ten-Year Program is 32.6667 million ha. Thirdly, the construction of high-yield and fast-growing timber forest base must be stepped up so as to increase the volume growth. It is stated in the long range forest program that in the 20 State forest areas and 5 groups of State Forestry Centres, the area of fast-growing and high-yielding timber forests to be built is 8 million ha. The area of such forests to be established first in 1991-2000 is 4.6667 million ha.

### 2.1.2 Speeding up the construction of the projected protection forests

In order to improve the ecological environment as soon as possible, the "program" demands that up to the end of this century, the area of protection forests should be over 1/3 of the total forest area. The priority projects are: the second phase project of "Three Norths" protection forests, with an afforestation area of 8.6 million ha (the important sections are at Beijing and Tianjin, with an afforestation area of 1 million ha); the first phase project of protection forests at middle and upper reaches of Yangtze River, with an afforestation area of 6.1867 million ha; the project of protection forests in coastal areas with an area of 2.0667 million ha; the greening project in Taihang Mountain with an area of 1.2 million ha; the greening project in the plain, demanding that in the year 2000 the greening of 918 counties in the plain should come up to standard demanded.

### 2.1.3 Developing economic forests and fuelwood forests according to local conditions

According to the requirements of the "program", in the year 2000, 500 famous special and excellent commodity production bases should be built, with the area of economic forests reaching 4.5 million ha, and the area of fuelwood forests reaching 4.4 million ha.

Forest resources are the foundation of forest development, also the important guarantee for high, stable agricultural production, and environment for human existence. For putting into effect the policy for culture of the forest resources as soon as possible, an unprecedented nation-wide drive for afforestation and land greening was launched under the leadership of central government and forestry agencies at all levels. Some provinces such as Guangdong and Fujian took the lead in greening the barren hills and waste land. Other provinces also set objectives in so doing. In the past few years, the afforestation area was roughly kept at 5-6 million ha. Trees planted at "four sides" amounted to 4-6 billion (Table 2, Table 3), with target over fulfilled. Up to the end of 1992, the area of plantations in China reached 33.79 million ha, ranking the first in the world. The forest coverage was 13.63%. Table 2 shows that among the total area of afforestation, the area of projected afforestation guaranteed by fund, controlled by definite project and accepted after severe test increased rapidly. Its proportional area compared with the total area of afforestation increased gradually from 30.69% in 1988 to 42.05% in 1992. Therefore, the quality of afforestation was steadily improved, and was further verified to meet a higher standard. The retention rate of the projected plantations reached 100% (Table 4).

### 2.2 Strengthening the management and protection of forest resources, promoting the level of "Three Controls"

In order to strengthen the rational, effective and scientific management and protection of forest resources; the Central Committee of Chinese Communist Party, State Council and Ministry of Forestry recently issued a series of "directives" and "rules", the essential points of which are to emphasize the supervision over forest resources, under the guidance of the policy "positive elimination with preventive measures as the main", and to enforce the "Three Controls" (fire control, disease and insect control and control of abusive felling), reducing the unproductive consumption of forest resources to

<table>
<thead>
<tr>
<th>Table 2 Afforestation in China in 1988—1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1,000,000 ha)</td>
</tr>
<tr>
<td>Total area of afforestation</td>
</tr>
<tr>
<td>projected afforestation</td>
</tr>
<tr>
<td>fast growing high-yield forests</td>
</tr>
<tr>
<td>Tree planting at four sides (million tree)</td>
</tr>
</tbody>
</table>
Felling in Forests. For effective preventing and extinguishing forest fires, in January, 1988, the State Council issued Regulations on Forest Fire Control. Later in June, 1988, the Ministry of Forestry proclaimed Provisions on Some Problems in Enhancing the Management of Forest Resources. The provisions' main aim was to emphasize the supervision over the fluctuation of forest resources, and to quickly reverse the tendency of the continual decrease of forest resources. The main points were: (1) Setting up a sound control system for

Facing the serious situation of excessive felling that occurred everywhere and the abusive felling that has been repeatedly prohibited, early in October, 1982, the State Council issued the urgent directive On Putting a Stop to Abusive Felling of Forest Trees. Later in June, 1987, it issued another directive On Enhancing Management of Forest Resources in the Collective Forest Areas in south China and Resolutely Curbing Abusive

![Table 3](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>state owned forests</td>
<td>0.5097</td>
</tr>
<tr>
<td>timber forest</td>
<td>3.303</td>
</tr>
<tr>
<td>econ. forest</td>
<td>0.914</td>
</tr>
<tr>
<td>prot. forest</td>
<td>0.823</td>
</tr>
<tr>
<td>fuel forest</td>
<td>0.393</td>
</tr>
<tr>
<td>special forest</td>
<td>0.101</td>
</tr>
</tbody>
</table>

![Table 4](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification percent *</td>
<td>65.6</td>
</tr>
<tr>
<td>Retention rate **</td>
<td>91.3</td>
</tr>
<tr>
<td>manual afforestation</td>
<td></td>
</tr>
<tr>
<td>projected afforestation</td>
<td></td>
</tr>
<tr>
<td>artificial regeneration</td>
<td></td>
</tr>
</tbody>
</table>

Notes: * Qualification percent of afforestation -- the proportional qualified area of afforestation relevant to the area previously reported to higher authority. The formula for its calculation is as follows:

qualification percent (%) = the qualified area of afforestation/the area previously reported to higher authority

The qualified area of afforestation -- the survival rate of forest >= 85% of the control plantation, examined one year after planting.

** Retention rate -- the retention of the qualified area of manual afforestation and regeneration carried out in 1988 and examined in 1991. It is a result of identification in investigation.
managing forest resources; (2) Intensifying the control over land use in forestry; (3) Emphasizing supervision and inspection of afforestation and regeneration and of acceptance test; (4) Strictly controlling the felling quota and practising a licensed felling system (issuing forest felling licence); (5) Strengthening the forest survey and designing; (6) Keeping complete forest resources files and enforcing data control; (7) Setting up an objective responsibility system concerning the fluctuation of forest resources by leading carders during their tenure of office; (8) Formulating an auditing system of forest resources; (9) Enforcing strict discipline, giving discriminate rewards and punishments. In addition, the provisions also point out that the forest resources belonging to non-forestry organizations should be managed in accordance with the essential spirit of the provisions. Later in February, 1989, the Ministry of Forestry proclaimed a Resolution on the Problems of Setting Up a Nation-wide Monitoring System of Forest Resources. For effective control of forest diseases and insects, in December, 1989, the State Council issued a formal document Regulations Concerning the Control of Forest Diseases and Insects. By adopting the above measures, the "Three Controls" in forests were significantly augmented, while the unproductive consumption of forest resources was greatly reduced. For example, in 1985-1990, the unproductive consumption (including natural mortality and that caused by disasters) decreased from 48.46 million m³ to 39.843 million m³, its proportion in the total consumption also decreased from 12.2% to 12% (Table 5). Especially the consumption caused by disasters was effectively checked. For example, in 1992 the area of fire incidence was 57,700 ha, with a damaged area of 31,700 ha. The area of disease incidence was 1.5012 million ha, with an area of control of 802,700 ha, and an effective control of 53.5%. The area of insect infection was 6.3754 million ha, with an area of control of 4.1093 million ha, and an effective control of 64.5%. The area of rodent infection was 656,600 ha, with an area of control of 465,500 ha and an effective control of 70.9%. All above control indices were significantly higher than those in 1988. Now the consumption by disasters has gradually decreased. For example, in 1988 the loss by disasters was 8.01 million m³, while in 1990 it decreased to 4.843 million m³.

For effective protection of wildlife and plant resources, from 1985 onwards, the central government sooner or later issued Forest Law, Regulations for Management of Forest Type and Wildlife Type Nature Reserves, Law of Wildlife Protection, and a National List of Wildlife Engaging Priority Protection, and positive effort has been made in construction of nature reserves and national forest parks. Now the forest type and wildlife type nature reserves having been established number 420, with an area of over 44 million ha, being about 4.5% of the national territory. Of the nature reserves 52 are at the national level, 6 are included in the international "Human and Biosphere" reservation network, and 6 are designated as principal water fowl marshes in the world. In addition, the Ministry of Forestry ratified the construction of 34 forest parks, nine of which are national ones. The two largest natural tropical rain forest areas, namely a part of the tropical Xishuangbanna in Yunnan Province and the tropical forest area

### Table 5 Consumption and consumptive structure of forest resources in China (1990) *

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount (million m³)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total consumption of forest resources</td>
<td>297.264</td>
<td>100.0</td>
</tr>
<tr>
<td>1. commercial timber;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>timber turned over to the State</td>
<td>115.919</td>
<td>39.0</td>
</tr>
<tr>
<td>timber sold to other provinces</td>
<td>25.950</td>
<td>8.7</td>
</tr>
<tr>
<td>2. timber sold within province</td>
<td>27.845</td>
<td>9.4</td>
</tr>
<tr>
<td>3. timber used by enter-prices themselves</td>
<td>41.481</td>
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<tr>
<td>4.1. fuels;</td>
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<td></td>
</tr>
<tr>
<td>fuels for rural life</td>
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<td>2.6</td>
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<td>5. consumption by disasters</td>
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<td>6. other consumption</td>
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</table>

Note: * Amount of natural mortality is not included in the total.
at Jianfengling in Hainan Province are designated as national nature reserve and national forest park, respectively. The area of the Jianfengling national forest park is 46,700 ha, where from 1993 onwards all commercial timber felling will be prohibited.

2.3 Carrying out a quota system of forest felling and strictly controlling the consumption of forest resources

For strictly controlling the consumption of forest resources, and ensuring the steady growth of forest resources, early in June, 1985, the Ministry of Forestry issued the Temporary Provisions Concerning the Annual Forest Felling Quota. Later, one year was used in formulating, examining and verifying the annual forest felling quota. In March, 1987, to State Council it submitted the Report on Some Opinions about Examining and Approving Annual Forest Felling Quota for provinces, autonomous regions and municipalities directly under the Central Government. In April of the same year, the report was ratified by State Council and transmitted downward. In the report definite annual forest felling quota (growing stock) was given to each province, autonomous region and concerned municipality. For ensuring the annual forest felling quota system to be carried out conscientiously, in May, 1989, the Ministry of Forestry gave a Notice on Enforcing Control of the Forest Felling Licence, which was put into effect in October that year. In the notice definite rules were given for the duties of the agency issuing the licence, officers in charge and the unit undertaking the felling. At the same time unified forms for the "licence of state forest felling", and "licence to collectives (individuals) for forest felling" are published, respectively.

After years' effort, in 1990, the growth and consumption of forest resources for the first time reached an equilibrium. The survey made in 1988-1990 showed that the annual growth of forest resources in China was 366 million m³, with an annual consumption of 327 million m³ and a surplus of 39 million m³. The past passive situation of continual decrease of forest resources was finally changed (in 1977-1981, the annual deficit of forest resources was 18.78 million m³, that in 1984-1988 was 15.37 million m³). Yet, in 1992, the gross growth of forest resources reached 391 million m³, being 87 million m³ higher than the total consumption of 304 million m³. The continuous steady increase in forest resources was really encouraging.

2.4 Energetically promoting the comprehensive utilization of wood, wood economy and substitution, and easing the contradiction between wood demand and supply

Since the implementation of reform and open policy, along with rapid economic growth and continual increase of population, the gap between some principal forest products demand and supply widened uninterruptedly. Timber almost becomes the most wanted raw materials. For easing the increasingly sharp contradiction between wood demand and supply, a double purpose policy was adopted, namely broadening the source of materials and reducing the amount of consumption. With regard to the first purpose, effort was made to increase the production of forest products. Two measures were taken: one was making use of the mill residues, branchwood and small dimension stock to considerably develop the non-veneer type panels, and the other was to produce industrial chips, using the materials just mentioned above.

2.4.1 The booming industry of non-veneer type panels

The fibreboard industry began from the end of 1950s, and gradually entered the stage of scale production in 1960s, forming a complete industrial system from scientific research, technological design, equipment manufacture to practical production. Consequently, the wet hard fibreboard mills were rapidly established in many areas in China. In recent years, the particleboard industry affected the development of fibreboard industry. Especially the wet hard fibreboard production has been reduced to a stagnation or even shrinkage. But the medium density fibreboard (MDF) industry sprung up suddenly and engaged impressive prosperity, due to its high quality, wide scope of application and less environmental pollution. A statistic survey shows that up to the end of 1992, there were 400 fibreboard mills, with a total capacity of 1.7 million m³. Of them 13 were MDF mills, with a capacity about 330,000 m³.

In 1992, the total production of all mills in China was 1.4455 million m³, of which the wood fibreboard was 1.3018 million m³, and non-wood fibreboard 142,700 m³. Of the wood fibreboard, the MDF was 285,600 m³. In 1988-1992, the total production of fibreboard slightly slowed down, decreasing from 1.4841 million m³ to 1.4445 million m³. The hard fibreboard decreased from 1.4285 million m³ to 1.1589 million m³. On the contrary, the MDF rose from 55,600 m³ to 285,600 m³, with an increase of over 4 times.

After years' effort, in 1990, the growth and consumption of forest resources for the first time reached an equilibrium. The survey made in 1988-1990 showed that the annual growth of forest resources in China was 366 million m³, with an annual consumption of 327 million m³ and a surplus of 39 million m³. The past passive situation of continual decrease of forest resources was finally changed (in 1977-1981, the annual deficit of forest resources was 18.78 million m³, that in 1984-1988 was 15.37 million m³). Yet, in 1992, the gross growth of forest resources reached 391 million m³, being 87 million m³ higher than the total consumption of 304 million m³. The continuous steady increase in forest resources was really encouraging.

2.4.2 Chip production has become a new forest industry

The particleboard industry began its operation almost at the same time with the fibreboard industry. Yet, due to the backwash of synthetic resin industry and the poor quality of home made equipment, its development was very slow. In 1978, the production of all mills totalled only 43,600 m³. After the implementation of reform and open policy, with tremendous amount of equipment introduced from Germany, the particleboard industry developed very rapidly. Up to the end of 1992, the particleboard mills numbered 200, with a total capacity of 2 million m³. The production of mills all over the country rose to 1.1585 million m³ (in 1988, it was 483,100 m³).
production started in 1991. In the three provinces in south China, the fast-growing *Eucalyptus* plantations are the chief source of raw materials, while in Northeast China and Inner Mongolia, branchwood and small dimension stock from *Betula* and *Populus tremula* regrowth are mainly used as the raw materials. In 1992, the total output of chips in China was 1.192 million m$^3$, of which 1,077 million m$^3$ was used in paper making, and 115,000 m$^3$ was used in producing panels. Except those consumed at home, a part of them was exported to Japan, Korea and Taiwan Province. The rapid development of chips industry not only partially solved the problem of material shortage in paper and panel industries, but also infused vitality into the commodity economy in the forest areas.

### 2.4.3 Energetically carrying out wood economy and substitution

The main measures in controlling consumption were to prohibit or limit the use of wood in production, advocate and encourage the use of non-wood materials (including metal, ore, bamboo and farm residual products) to substitute for wood. To serve this purpose, the State Economic Commission, State Planning Commission, Ministry of Goods and Materials and Ministry of Forestry in February, 1988, jointly issued "Some Provisions Concerning Wood Economy, Rational Utilization of Wood and Adoption of Substitutes In Stead of Wood (revised)". The provisions clearly named a series of industries, such as construction, telecommunication, railway, mine and building materials production in which the use of wood as raw materials and fuels was put under a ban. It was demanded that in the industries such as building materials production (including door, window, mouldboard, scaffold, etc.), packing materials production and furniture making, metals, wood or non-wood panels, bamboos, plastics and ores should be widely used instead of wood. It was also required that through division of labour according to specialities, wood should be processed in agreement with need to have it rationally used; that through improvement of production engineering, the mills could improve the wood quality and the efficiency of its utilization, and could reduce wood consumption in production; that through functional treatments, the life service of wood could be prolonged, with its useful function augmented. Now in urban buildings, steel windows are generally used instead of wood ones. In construction, the tools such as scaffold, the landing stage of scaffold, cement mouldboard, and so forth are generally made of bamboo, plybamboo, steel plate and steel tube: Most of the large-sized electromechanical products and plate glasses are not packed with wood pallets. In railway construction, a part of cross-ties are made of cement, while in mines metal props are used instead of wood ones.

After adopting the above measures, great change took place in the wood consumption structure in China. An in-complete statistics show that in 1992 the amount of wood substitution was 16.50 million m$^3$, among which the wood saved was 4.5 million m$^3$, and the substitutes used were 12 million m$^3$, being three times greater than 5.6 million m$^3$ in early 1980s. The statistics given by department of goods and materials show that since the implementation of the Sixth Five-Year Plan (1981-1985), economic, legal and administrative measures have been taken for wood economy, and the amount of substitutes used reached about 140 million m$^3$, playing an important role in controlling wood consumption and bringing about a general equilibrium between wood demand and supply. Since the implementation of the Sixth Five-Year Plan, although GNP had doubled, yet, the total wood consumption still remained at the level as that in the early period of the Sixth Five-year Plan, with the amount of wood consumption considerably reduced.

#### 2.5 Importing a part of wood and forest products to make up for the inadequacy of home produced wood (for details, please see Section 3)

After adopting the above measures and many years' effort, from 1990 onwards, the forest resources in China show a dual increase in both area and growing stock, with the volume growth slightly higher than the forest felling, putting a stop to the continual decrease of forest resources. It was, indeed, an encouraging sight! The 1993 statistics of forest resources in China show that the forest area reached 134 million ha, growing stock was 11.79 billion m$^3$, with a forest coverage of 13.92%. Compared with the figure of inventory in 1984-1988, the increase of forest area was about 9 million ha, the increase of growing stock was about 490 million m$^3$, with an increase of forest coverage of 0.95%. At the same time, the consumption of forest resources gradually decreased annually. The growth and consumption of forest resources reached an equilibrium in 1988. From that year onwards, the tendency of growth surpassing consumption continued for many years. For example, in 1984-1988, the total annual growth of forest resources in China averaged 329 million m$^3$, and the average annual consumption was 345 million m$^3$, with an annual deficit of 16 million m$^3$. In 1989-1993, the total average annual growth increased to 400 million m$^3$, while the average annual consumption decreased to 320 million m$^3$. The annual net growth increment was about 80 million m$^3$. The above facts show that the forest resources in China had involved from a rehabilitation stage into a steady increase stage.

#### 2.6 The current main problems in forestry in China

In the past few years, although significant achievements were made in forestry in China, yet, the forestry is still confronted with a serious situation, due to excessive density of population, scarcity of forest resources, and some other historical factors. From the demand of forest products necessary to economic reconstruction and the requirements of ecological environment and social needs, there still exists a yawning gap. In fact, up to present time, forestry is still a weak industry in national economy. Its backwardness not only restrains the development of national economy, but also produces ill effect on the people's living. Such a tendency has not been changed radically. The China's forestry development is still in the initial stage and should be paid special attention to. The main problems now existing in China are as follows:
2.6.1 Continual decrease of harvestable forest resources and forest quality

Although the total amount forest resources reached an equilibrium in growth and consumption with growth slightly over consumption, yet the harvestable forest resources were still on the decrease, because of the continual decrease of the timber forests, especially the mature and overmature timber forests. For example, in 1984-1988, the growing stock of the mature and overmature timber forests were 2.62 billion m³, while in 1990 it decreased to 2.588 billion m³, and in 1992 decreased to 2.453 billion m³. The decrease of growing stock per unit area, the dwindling of large dimension stock resources and the gradual disappearance of valuable tree species were the main features indicating the qualitative degradation of forests.

2.6.2 Lack of effective supervision mechanism and excessive felling not effectively checked

Although forest felling quotas have been proclaimed in all areas, yet, due to lack of effective supervision mechanism in some areas more forests were felled but less was reported to concerned governments. Even there occurred forest felling without a licence. In 1991, the prescribed forest felling quota in the whole country was 248.056 million m³, yet the actual consumption was 28.827 million m³ higher than the prescribed amount, with an overrun of 11.6%. Of them the consumption of commercial timber was 118.766 million m³, with an overrun of 15.3%, and the consumption of wood by peasants was 51.544 million m³, with an overrun of 13.8%. The consumption of fuels in urban and rural life was 85.736 million m³, with an overrun of 33.7%. The consumption of timber in farming industry was 6.434 million m³, with an overrun of 0.9%. But the consumption of wood for other uses was 14.403 million m³, with a decrease of 50.5%, far lower than the prescribed quota.

2.6.3 Low ownership per capita of forest resources and low consumption per capita of forest products, showing serious shortage of wood supply

In view of the total amount of forest resources in China, both the forest area and growing stock are large and high, ranking in the foreground in the world. But, due to high population density, when the forest area is calculated by ownership per capita, China is a country with rarity of forest cover. Based on a calculation of the forest resources in 1992, the ownership per capita of forest is 0.11 ha, and the growing stock per capita is 9.45 m³. Both are far lower than the world average.

This holds true for the production and consumption of wood and chief forest products in China, too. For example, the wood (log) production in 1992 was 228 million m³, possibly standing only next to USA, CIS, India and Brazil, ranking the fifth in the world. The total output of panels was 4.289 million m³, following USA, CIS, Indonesia, Germany and Japan, ranking the seventh in the world. But, due to high population density and low consumption per capita, the average annual consumption per capita of wood (even including the imported forest products) was about 0.2 m³, and that of panels was only 5.23 m³/1000 men.year. The former was 31.2% of the world average of 0.64 m³/man.year, whereas the latter was about 22.5% of the world average of 23.2 m³/1000 men/year. If compared with the developed countries, the difference was more significant. Even this low level can hardly be maintained by reliance on only the home produced wood. A part of forest products had to be imported annually to meet the urgent demand of domestic market.

2.6.4 Irrational structure of wood consumption, with a high proportion of fuels

It can be seen from what stated above that in recent years, though the fuelwood consumption in China decreased year after year, yet, the annual fuelwood consumption still remains at a level of 80-90 million m³, being almost over 1/3 of the total wood consumption in China (Table 5). It included not only those fuels consumed in the countryside, but also a considerable part consumed in small cities and towns as energy source in daily life. In addition, a part of township by-product lines also used wood as fuels. The high proportion of fuels not only directly influenced the supply of industrial timber, but also was one of the causes resulting in fast and excessive consumption of forest resources.

2.6.5 A low ratio of deeply processed products with low economic returns

At present time, the amount of deeply processed forest products with high added value, such as wood pulp, panels and the forest products undergoing secondary conversion is still small. Moreover, the proportion they share in the total wood consumption is also low. For example, in 1992 the wood pulp production in China was 1.534 million t, and the production of wood panels was about 4 million m³. The wood consumption in producing both products totalled about 14.30 million m³, being only 6.3% of the total wood consumption in the same year, and being 10% of the industrial timber consumption. Evidently this figure is far lower than that in the developed countries with a different forest product structure. For example, in 1991, the two kinds of forest products in the developed countries shared a 50% and 60% in the total amount of wood and industrial timber consumption, respectively, far higher than that of China.

At the same time, the ratio of the primary products to those undergoing a secondary processing is also very small. Taking the sawnwood for example, up to present time, the proportion of artificially dried squares and planks is less than 25%. It is estimated that the proportion of finished panels will reach about 20% in 1995. The small percent of products undergoing secondary processing not only hinders the widening of the scope of application and prolongation of the products’ life service, but also directly affects the increase of economic returns.

3 An Analysis of Forest Products Trade in China in 1988-1992
Before 1970s, the economy in China was largely of the nature of self-sufficiency. The volume of forest products trade was small as it was in other economical sectors. Only a small amount of forest products trade in the form of barter was made with the former USSR, mainly importing a part of coniferous timber. After 1980s, with the implementation of reform and open policy, the economic construction entered a stage of rapid growth. It was accompanied by the increasing growth of population and the gradual decrease of forest resources. Consequently, the already serious contradiction between wood demand and supply became more obvious and acute. The serious shortage of timber and forest products became one of important factors that constrained the economic development and affected the improvement of people’s life. Under such conditions, in order to ensure the normal proceeding of economic construction, to satisfy the least demand of people’s life, to prevent the forest resources from further destruction, and to maintain the already infirm ecological environment, new important decisions were made by the Government. As the nation was not yet wealthy enough and pressed for shortage of foreign exchange, the Government allocated a part of foreign exchange to import timber and various sorts of forest products.

3.1 The status of forest products import in China in 1981-1992

In 1981-1992 the cumulative amount of forest products imported was worth 22.055 billion US dollars, being 2.5% of the national total 883.22 billion US dollars in the same period. Among the various sorts of goods imported, the forest products ranked the fourth in terms of sum of money next to steel, grain and chemical fertilizers. All the forest products, if converted (the conversion ratio is: sawnwood 1:0.6, plywood and veneer 1:0.5, pulp 1:4, paper and paper board 1:5.5) in volume of log, were equal to 125.774 million m³ of wood (Table 6), being about 19.3% of the planned total amount of wood in China in the same period.

Among the imported forest products mentioned above, log was the staple goods and the cumulative total of import of the 12 years was 7.04 billion US dollars, being about 32% of the total import. Next were paper and paper board, worth 6.45 billion US dollars, being about 29% of the total. The third was pulp and waste paper, worth 4.099 billion US dollars, being 19% of the total. The fourth was plywood, worth 3.972 billion US dollars, being about 18% of the total (Fig 3).

The various sorts of forest products to be viewed from the change of figures shown in Table 6 all tended to increase obviously in the same periods. Only in 1989 and 1990, due to a nationwide economic readjustment, the amount of forest products imported was evidently lower. From that time onwards, along with rapid economic development, the import of forest products was again on the large scale increase. The import of all grades of log (including tropical timber) due to the export-limiting policy of certain countries, never reached the same level as that in mid 1980s. Among other forest products, the product with the highest amount of import was veneer, with an annual increase of 83.7%. Next was sawnwood, with an annual increase of 19.9%. Others in descending order were plywood - 17.9%, paper and paper board - 11.1%, log - 8.7%, pulp and waste paper - 6%.

In view of the import of forest products in the past years they were of four major sorts: log, plywood, pulp, paper and paper board. Coniferous timber dominated in the imported log. For example, in the total amount of imported log in 1988-1989, the coniferous timber was 84.9% and 88.1%, respectively. Only in the past two years, due to price rise of timber from North America and the production of plywood mills with foreign investment put into operation one after another, the import of coniferous log began to decrease. However, in the total amount of imported log in 1991-1992, it was still as high as 60.8% and 47.6%, respectively. Coniferous log was mainly imported from USA, and it was largely Douglas fir and Tsuga. Among the total amount of imported coniferous log in 1988-1989, those imported from USA were 61.6% and 41.7% (Table 7). Due to the high price of American log, more and more coniferous log was imported in recent years from the former USSR and New Zealand. For example, in 1990 the coniferous log imported from the former USSR was 1.318 million m³, being 37.9% of the total import in the current year. The log imported from New Zealand was mainly Pinus radiata, and the quality of which was inferior to that of American log. However, due to low price (in 1992, 1 m³ of American log was 125.7 US dollars, while that from New Zealand was only 76.7 US dollars), more and more log was imported from that country. In 1988, log of Pinus radiata imported was only 178,000 m³, while in 1992 it rose to 347,000 m³, with the amount almost doubled. The imported plywood was mainly made of tropical timber. For details, please see this Section 2.

Owning to timber shortage in China, about 90% of pulp for paper making was straw pulp and a small amount of bamboo pulp. In order to produce high grade paper and special paper to meet market demand, considerable amount of wood pulp (including waste paper), paper and paper board had to be imported from abroad each year. In 1981-1992, the pulp and waste paper imported to China were worth 4.099 billion US dollars, paper and paper board 6.449 billion US dollars. Both of them were about 48% of the total import in the same period.

Fig 3. The proportion of all sorts of forest products imported in China in 1981—1990
<table>
<thead>
<tr>
<th>Year</th>
<th>Logs (1000 m³)</th>
<th>logs (1000 USD)</th>
<th>Sawnwood (1000 m³)</th>
<th>Sawnwood (1000 USD)</th>
<th>Plywood * (1000 m³)</th>
<th>Plywood * (1000 USD)</th>
<th>Veneer (1000 m³)</th>
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**Notes:** * The amount of plywood imported in 1992 did not include finished plywood, composite with particles as core, and multi-layer plywood. If these were included, the total amount of plywood imported was 2.5963 million m³, with 660.512 million US dollars.
The pulp, paper and paper board were mainly imported from Canada, USA, Sweden and Finland. In recent years, more and more were imported from New Zealand and Chile. Due to reasonable price, the export of the latter two countries to China tended to increase obviously. The waste paper and paper board as raw materials for paper-making were mainly imported from Hong Kong and Macao in an early period. However, in recent years, they are also imported from USA.

The coniferous log imported to China in the past was largely consumed in coastal areas in East and South China where economy developed rapidly. Only a small part was consumed in a few big cities (Beijing and others). Since the implementation of reform and open policy, economy developed rapidly in the above-mentioned coastal areas. The peasants and urban residents who first got wealthy, engaged themselves in a heated new house building. Therefore, the demand for timber went up sharply. As the traditionally used *Cunninghamia lanceolata* gradually ran out, they had to buy the high priced imported timber (mainly used to make door, window or for inner fitting up). Moreover, a part of imported coniferous timber was also used in house rebuilding or inner fitting up.

### 3.2 The import of tropical forest products and their processing and utilization in China in 1988-1992

In the past, of the imported tropical forest products, log and plywood were consistently the staple goods, and only a small part of them was sawnwood and veneer. The statistics show that the import of tropical forest products in China in 1988-1992 was shown in Table 8.

From Table 8, it can be seen that in 1988-1992, except sawnwood, the import of all other forest products tended to increase steadily. The decline of import in 1989 and 1990 was mainly due to the economic readjustment in the nation. In view of the average annual rate of increase, the veneer has the highest increase rate, next is sawnwood, while log ranks the third (Fig 4).

The hardwood log imported to China was mainly *Parashorea* spp. and other tropical hardwood suitable for producing plywood, and they were mainly produced in Sarawak state in Malaysia. The change of import of tropical hardwood in China in 1988-1992 is shown in Table 9. Except Malaysia, some tropical hardwood was also imported from Myanmar, Thailand, and Laos. In addition, a small part of tropical hardwood was also imported from Papua New Guinea, Fiji and a few African countries such as Gabon and Guinea.

The plywood imported in China was mainly tropical forest products, 60% of which was imported from Indonesia. A part of plywood was imported from Malaysia. The import of plywood from the two said countries is shown in Table 10.

The amount of sawnwood and veneer imported to China, compared with that of log, plywood and pulp was consistently very small. Only in recent two years, due to the decrease of imported log, and shortage of log used to produce plywood at home, large scale import of sawnwood was made. In the past years: 30-60% of sawnwood imported was tropical wood, mainly imported from Malaysia and Indonesia. In addition, a small part of valuable timber was imported from Myanmar and Cambodia. The rest 50% of imported sawnwood was largely temperate wood, mainly imported from Canada, the former USSR and Mongolia (Table 11).

A very small amount of veneer was imported in China and mainly was tropical forest product. Most of them came from Malaysia and Indonesia (Table 12).

### Table 7 The import of log in China in 1988—1992

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>1989</th>
<th>1990</th>
<th>1991</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount of log imported</td>
<td>10.675</td>
<td>6.41</td>
<td>4.193</td>
<td>4.097</td>
<td>4.67</td>
</tr>
<tr>
<td>Import of coniferous log</td>
<td>9.476</td>
<td>5.65</td>
<td>3.474</td>
<td>2.491</td>
<td>2.225</td>
</tr>
<tr>
<td>Prop. of import (%)</td>
<td>84.9</td>
<td>88.1</td>
<td>82.8</td>
<td>60.8</td>
<td>47.6</td>
</tr>
<tr>
<td>Import of hardwood</td>
<td>1.191</td>
<td>0.76</td>
<td>0.719</td>
<td>1.606</td>
<td>2.445</td>
</tr>
<tr>
<td>Prop. of import (%)</td>
<td>11.2</td>
<td>11.9</td>
<td>11.2</td>
<td>39.2</td>
<td>52.4</td>
</tr>
<tr>
<td>Conf. log import from USA</td>
<td>5.836</td>
<td>2.358</td>
<td>1.784</td>
<td>1.815</td>
<td>1.029</td>
</tr>
<tr>
<td>Prop. of the total log</td>
<td>52.3</td>
<td>36.8</td>
<td>42.5</td>
<td>44.3</td>
<td>22.0</td>
</tr>
<tr>
<td>Prop. of the total hardwood</td>
<td>61.6</td>
<td>41.7</td>
<td>51.4</td>
<td>72.9</td>
<td>46.2</td>
</tr>
</tbody>
</table>
As to the consumption structure of imported tropical timber, about 80% of it was used to produce plywood, about 15% was used to make high grade furniture, door, window or for inner fitting up. Another 5% was used to make fishing boats. In recent years, more and more foreign enterprisers (including those from Taiwan Province) came to the mainland China

Table 8 The import of tropical forest products in China in 1988—1992 *

<table>
<thead>
<tr>
<th>(Year)</th>
<th>Amount and sum</th>
<th>Log</th>
<th>Sawwood</th>
<th>Veneer</th>
<th>Plywood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Amount</td>
<td>940.4</td>
<td>210.7</td>
<td>17.7</td>
<td>1199.6</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>132.854</td>
<td>24.267</td>
<td>7.61</td>
<td>487.866</td>
</tr>
<tr>
<td>1989</td>
<td>Amount</td>
<td>337.1</td>
<td>44.8</td>
<td>12.5</td>
<td>827.1</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>57.572</td>
<td>8.991</td>
<td>5.567</td>
<td>311.379</td>
</tr>
<tr>
<td>1990</td>
<td>Amount</td>
<td>960.6</td>
<td>153.8</td>
<td>5.4</td>
<td>1301.6</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>95.671</td>
<td>18.750</td>
<td>2.185</td>
<td>491.195</td>
</tr>
<tr>
<td>1991</td>
<td>Amount</td>
<td>1394.6</td>
<td>88.0</td>
<td>27.1</td>
<td>1416.7</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>180.054</td>
<td>15.450</td>
<td>11.374</td>
<td>539.277</td>
</tr>
<tr>
<td>1992</td>
<td>Amount</td>
<td>1775.9</td>
<td>459.6</td>
<td>206.8</td>
<td>1423.6</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>233.944</td>
<td>424.050</td>
<td>49.458</td>
<td>377.395</td>
</tr>
</tbody>
</table>

Note: * The figures in the table include those of sole foreign ventures and cooperative ventures.

Fig 4. The development trend in import of tropical forest products in China in 1988—1992
investing in construction of plywood mills. Up to the end of 1992, the mills totalled 16, with a total annual capacity about 650,000 m³. These mills were mostly foreign-Sino ventures, chiefly set up in the coastal areas in East, South and Northeast China, such as Guangzhou, Shenzhen and Zuhai cities in Guangdong Province, Fuzhou city in Fujian Province, Shanghai Municipality, Nantong and Wuxi cities in Jiangsu Province, Qingdao city in Shandong Province, Dalian city in Liaoning Province and Tianjin Municipality. Only a few were set up in inland cities, such as Wuhan Municipality and Beijing Municipality. These mills used chiefly imported equipment in production. Almost all the raw materials were tropical timber imported from the countries in Southeast Asia. The scale of production was generally greater than that of the Chinese plywood mills that have already existed. A part of their products was directly exported. A part of them was sold as exported goods to the Chinese company, specialized in foreign trade or Chinese company responsible for import of plywood as imported goods (purchased with foreign exchange). Except the above-mentioned cooperative ventures who used imported materials, the large plywood mills early set up in the coastal areas (at Guangzhou, Shanghai, Tianjin and Beijing) also had to use imported materials, because the home produced log was on the decrease, and a great number of small plywood mills were set up in various forest areas. Imported timber was rarely used in ship-building and furniture making, and most of the timber used in these industries were valuable hardwood. A certain amount of wood was consumed by some wealthy fisherfolk in the coastal areas in building fishing boats or for boat maintenance. Besides, some furniture companies in cities in the coastal areas such as Guangdong, Shanghai, Jiangsu, Shandong, Fujian, Zhejiang, and Hainan Provinces and

<table>
<thead>
<tr>
<th>Table 9 The import of tropical hardwood log in China in 1988—1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount of hardwood imported</td>
</tr>
<tr>
<td>Import of tropical hardwood</td>
</tr>
<tr>
<td>the prop. of import (%)</td>
</tr>
<tr>
<td>Import of hardwood from Malaysia</td>
</tr>
<tr>
<td>the prop. of the total import (%)</td>
</tr>
<tr>
<td>import of Parashorea spp.</td>
</tr>
<tr>
<td>the prop. of import (%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 10 The import of plywood in China in 1988—1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount of plywood imported</td>
</tr>
<tr>
<td>Import of tropical plywood</td>
</tr>
<tr>
<td>the prop. of import (%)</td>
</tr>
<tr>
<td>Import of plywood from Indonesia</td>
</tr>
<tr>
<td>the prop. of the total import (%)</td>
</tr>
<tr>
<td>Import of plywood from Malaysia</td>
</tr>
<tr>
<td>the prop. of the total import (%)</td>
</tr>
</tbody>
</table>
Municipalities, also imported tropical timber (including sawnwood) as raw materials to make high grade solid wood furniture, door, window or for inner fitting up. These furniture are expensive goods, chiefly exported or used in the newly built luxury restaurants and commercial buildings, only a small part is supplied to domestic market for use by the common people.

Although in recent years the panel industry in China is relatively developed, yet the contradiction between demand and supply is still outstanding. In order to meet the urgent need in economic construction and that for people's life, large amount of plywood has to be imported every year. As the plywood has pretty natural grain, generally, it can be directly used without special finishing treatment. Moreover, its excellent performances open up wide field of application and win the admiration of customers. The imported plywood is widely used in China. Tremendous amount of it is used in industrial production and high grade furniture making. Even luxury restaurants, modern office building, ordinary shops and people's homes for inner fitting up are also important fields of its application. Now the imported plywood in domestic building material market has become the object of panic purchasing. But the increasing price of imported tropical log and the drastic rise of tropical plywood price have produced great impact on their consumption. An analysis of demand and supply in domestic market shows that the critical point about tropical plywood is not a question of demand but the high price. In view of the current level of consumption, if the price is tolerable, the potential demand of the market is very great. As to the tropical veneer, the annual import in China is nonsignificant, and it is mainly used for surface finishing. But in recent years, due to shortage of imported log for plywood production, the large Chinese plywood mills and cooperative ventures began to import veneers for plywood production. Imported veneers were used as top and bottom plies, while the core was made of native materials. This was the chief cause bringing about the

<table>
<thead>
<tr>
<th>Table 11</th>
<th>The import of sawn wood in China in 1988—1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Total amount of sawnwood imported</td>
<td>392</td>
</tr>
<tr>
<td>Import of tropical sawnwood the prop. of sawnwood (%)</td>
<td>211</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Import of sawnwood from Malaysia the prop. of total trop. sawnwood (%)</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Import of sawnwood from Indonesia</td>
<td>103</td>
</tr>
<tr>
<td>the prop. of total trop. sawnwood (%)</td>
<td>48.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 12</th>
<th>The import of veneer in China in 1988—1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Total amount of veneer imported</td>
<td>24.6</td>
</tr>
<tr>
<td>Import of tropical veneer the prop. of import (%)</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Import of veneer from Malaysia</td>
<td>8.2</td>
</tr>
<tr>
<td>Import of veneer from Indonesia</td>
<td>4.4</td>
</tr>
</tbody>
</table>
high increase of veneer import in 1992.

3.3 The development in foreign trade for export of Chinese forest products in 1988-1992

Due to shortage of timber resources in China, the export volume of forest products was very small. Especially the export volume of log, sawnwood and plywood which consumed large amount of wood was non-significant (Table 13). In recent years, as the Eucalyptus plantations in Guangdong and Hainan provinces enter harvest period and wood mills start to produce chips, China begins to export forest products to Japan.

The principal forest products exported from China are always economic forest products, such as walnut, chestnut, date and bamboo shoot; next are papers. The wooden art articles and furniture rank the third and the fourth. In addition, huge amount of rosin and other products is exported every year. In recent years, the annual export of rosin is kept about 200,000 t, with 228,000 t exported in 1991 and 226,000 t exported in 1992, ranking first in the world, being over 50% of the world total.

4 The Chinese forest product trade policy and measures

Since the implementation of reform and open policy, with the rapid economic development, the world trade developed rapidly, too. In 1980-1992, the total volume of foreign trade was increasing at an average annual rate of 13%. In fact, China has developed from a large potential market to a large formal market with increasing capacity. Its position in the world trade has risen from the thirty second in 1978 to the eleventh in 1992. It is estimated that in Eighth Five-Year Plan period (1991-1995), the total amount of import will be 0.3 trillion US dollars. In 1995, the total amount of import and export in China will reach 0.2 trillion US dollars, and China will become one of the 10 largest trading countries in the world. At the same time, the forest product trade in China will develop at a considerably high rate. The FAO statistics show that the total amount of forest product import and export in China (including Taiwan Province) has increased from 1.96 billion US dollars to 4.73 billion US dollars. The average annual rate of increase was as high as 7.6%, far higher than the world average of 4.7%. Especially, the import of forest products expanded by a greater margin, with an average annual increase rate of 8.8%, while the world average was only 4.6%.

Now China is in a transition stage from planned economy to market economy. For early coupling of China’s economy with the world economy, and for early resuming the membership of GATT, China is prepared to actively participate the international division of labour, and according to international standard to readjust its trade policies. In the field of forest product trade, China will continue to stick to the principle of keeping supply of each other’s needs, mutual benefit on equality, harmony and cooperation, to make cooperation in trade extensively with all partners. Based on the economic development in China and her resources, the trade in Chinese forest products will no doubt expand in the coming years, and would not decline.

4.1 Policies adopted to continuously encourage the import of raw materials and primary goods

Due to shortage of timber resources, it is specially felt that the large dimension stock is inadequate. To meet the market demand, from 1980 onwards, timber import began increasing. In the early period, as the price of imported timber was higher than that of home produced timber, a price subsidy policy was once adopted so that the price of imported timber was tolerable in domestic market. In recent years, due to sharp rise of the price of home produced timber and the going up of domestic consumption level, the price subsidy policy has been cancelled, but a new tariff preference policy is formulated. Recently, the tariff schedule proclaimed by Chinese Government by which the tariff of certain commodities are turned to a lower rate will be put into effect on December 31, 1992. With regard to timber, the import tariff of coniferous and hardwood is turned

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>amount</td>
<td>sum</td>
<td>amount</td>
<td>sum</td>
<td>amount</td>
</tr>
<tr>
<td>Log</td>
<td>314</td>
<td>75110</td>
<td>475</td>
<td>64700</td>
<td>91.2</td>
</tr>
<tr>
<td>Sawn-wood</td>
<td>3</td>
<td>1220</td>
<td>4</td>
<td>1840</td>
<td>86</td>
</tr>
<tr>
<td>Veneer</td>
<td>2</td>
<td>2560</td>
<td>4</td>
<td>4520</td>
<td>2</td>
</tr>
<tr>
<td>Plywood</td>
<td>8</td>
<td>2650</td>
<td>9</td>
<td>2960</td>
<td>21</td>
</tr>
<tr>
<td>Chips (1000t)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>292</td>
</tr>
</tbody>
</table>

Table 13 The export of Chinese forest products in 1988—1992 (1000 m³, US$)
from an original rate of 3% to a lower rate of 2%; that of coniferous and hardwood sawnwood from 9% to 7.5%; that of coniferous and hardwood veneer used for plywood production from 12% to 9%; and that of coniferous and hardwood veneer for finishing from 30% to 25%.

4.2 Policies adopted to encourage foreign enterprisers to come to invest in the construction of the forest product processing bases

To make up for the inadequacy of capital and technology at home, and to encourage foreign enterprisers to come for investment, the Chinese Government early in 1986 had issued the State Council’s Provisions to Encourage Foreign Enterprisers to Come for Investment. Later on, a series of provisions and measures were issued, including Provisions to Encourage Overseas Chinese and Fellow Countrymen in Hong Kong and Macao for Investment. According to relevant provisions, the types of enterprises (companies) that can benefit by the preferential policies are those that produce products for export or those that produce hi-tech. products. In forestry the priority projects and products to be developed are: (1) the construction of famous, special, excellent and rare timber forests and the storage and processing of forest products; (2) comprehensive utilization of wood; (3) new types of panels, such as OSB, waferboard, MDF, gypsum particleboard, and cement particleboard; (4) reprocessing of tannin, shellac, rosin and turpentine.

The enterprises (companies) investing in China and belonging to the above-mentioned types may enjoy the following preferences:

(1) Production conditions: they have priority to get water, power supply, to use the transport and telecommunication equipment, charged at the same rate as that for local state-run enterprises.

(2) Customs duties: (a) the machines, equipment, components, spare parts imported according to a contract for production, and the materials used in mill construction, plant installation, and for machine and equipment bracing, and the company owned cars and stationery are exempt from customs duty and the industrial and commercial consolidated tax; (b) the imported raw materials, auxiliary materials, spare parts, components, fittings, and packing materials to be processed or assembled into finished products for manufactures of other countries as well as produced for export are exempt from import tariff according to the amount of raw materials processed and the amount of finished products.

(3) Export and import licence: (a) the mechanical equipment, vehicles needed in production, raw materials, fuels, bulk materials, components, spare parts, devices and attachment are allowed to be imported without before hand applying for a licence; (b) the goods produced within the management scope of the enterprise and not governed by a licence are checked and accepted by the custom house according to an export contract; for the goods governed by an export licence, the enterprise on basis of its annual export plan takes an export licence every half a year. The export goods governed by an export licence prescribing an export quota totalled 138 in assortment. The forest products include only such item as rosin, resin, log and sawnwood. Along with the deepening of reform, the number of goods governed by an import or export licence will gradually decrease. It is estimated that within 5-6 years most goods may be imported without an import licence. The licence governing the import of timber, wood pulp and plywood will be cancelled on December 31, 1994.

(4) Income tax: When the operation of the enterprise engaged in general goods production with a management period over 10 years begins to the profitable, no business income taxes are imposed on it for the first two years. In the third to fifth years, only half of the business income taxes are imposed. The foreign enterprise engaged in forest products production and set up in the economically undeveloped remote border areas on expiry of duty exemption and tax reduction may apply to the tax administration under the State Council for approval for tax reduction in next 10 years, namely paying only 15-30% of the taxes annually.

4.3 Policies adopted to encourage expended export of forest products

The export of forest products from China was small due to shortage of timber resources over the past long period. Moreover, the goods exported were mainly forest by-products and primary products. The serious disequilibrium of balance in forest products trade and the huge trade deficit were a heavy load on the economy of a developing country who was at the initial period of industrialization, and severely restricted the overall economic development. To be lifted from such a passive position, and to turn the unilateral complementary trade into a mutual one, the Chinese is formulating a policy to energetically develop the forest product export and actively establish industrial bases for forest product export. The main measures are as follows:

4.3.1 Establishment of forest product production bases

To expand the export of forest products, the Government has decided to establish some forest product production bases before the end of this century, with forestry combined with industry. These bases include pulp industry base, panel (including plywood, particleboard and MDF) industry base, rosin processing industry base, bamboo product processing industry base, furniture industry base and tannin production base.

4.3.2 Improvement of the forest product structure for export

The establishment of the above-mentioned forest product industry bases will turn the export trade with the raw materials and primary products as the main goods into a trade with the finished products and deeply processed products as the main goods.
4.3.3 Multi-channel fund raising

In order to speed up the establishment of the forest product processing bases, a policy of multi-channel fund raising is adopted by the Chinese Government: joint investment by forestry agency and concerned industry, joint investment by central and local governments, and foreign-Sino investment (including foreign investment and international loan).

4.3.4 Reform of management system

Reform of management system will be gradually enforced so as to ensure the implementation of this policy and to create a liberal economic environment. The reform is so oriented: change the past management by administrative sectors or local governments into management in line with industry, actively develop the industrial group companies, and enlarge the scale of management over production so as to increase the economic returns.

4.3.5 Adoption of incentive and preferential policies

To encourage the establishment of the forest products (especially the deeply processed products) production bases for export, the Government will treat the units and enterprises (companies) participating in the establishment of these production bases preferentially in tax imposition, use of foreign exchange, import of raw materials and introduction of technology and equipment.

4.4 Policies adopted to increase overseas investment and to establish forest product production bases

In the past few years, under the ideological guidance of making full use of the "two markets, and two types of resources" and of actively participating the international division of labour, all Chinese enterprises (companies) continued to carry out a multiple market strategy, with describable progress made in overseas investment, and with initial scale of operation formed. The statistics made by the Ministry of Economy and Foreign Trade show that up to the end of 1992, the number of joint ventures, Chinese ventures and cooperative ventures has amounted to 4,117, with the overseas investment totalling 1.85 billion US dollars. Of these ventures, the forest enterprises and forest product processing industries were 10, with an amount of investment of 300 million US dollars. Of the projects of investment in forestry, money was mainly spent in purchasing the right of forest exploitation, in New Zealand, USA, Canada and Fiji. In addition, a company was set up in Papua New Guinea. The projects of forest product process include pulp, paper making, wood conversion, plywood and active carbon production. The pulp and paper making enterprises were set up in North America, while the wood conversion, plywood and active carbon enterprises were set up in the developing countries, such as the Huaxi Industrial and Commercial Wood Co. Ltd. in Brazil, and the joint venture, Beijing-Link Active Carbon Co. Ltd. (Bellin Co.) in Sri Lanka.

To sum up, the Chinese projects of overseas investment and sum of money (including forest industry projects) are limited, compared with those of foreign investments in China. The forestry in China is different from other industries. Other industries may make use of the ample raw material resources and cheap labour in China, and great market demand to attract more foreign investments. On the contrary domestic forestry was pressed for shortage of timber resources. In the world, countries who allow log to be exported become fewer. In order to meet the tremendous demand of a ponderous market, the forestry in China has to take the way in increasing the overseas investment, making use of forest resources of other countries, and energetically developing cooperation with the countries rich in forest resources. The development trend shows that from now on, the projects of overseas investment in forest industries and the sum of money to be invested will considerably increase in a short period. With the aggravation of the continual decrease of domestic timber resources, some large wood processing enterprises in big cities far from the forest area, due to short supply of large dimension stock, have been reduced to a position of being half closed down. More serious was the case with the wood conversion and plywood industries. However, these large enterprises in big cities possess well trained technical force (including technical workers and engineers), competent management experience, and sophisticated production equipment, and even ample capital. They are capable to make overseas investment. It is estimated that these enterprises will take measures to boost overseas development, with steps increasingly quickened.

It is expected that the priority areas of Chinese overseas investment in forest industry will still be the countries rich in forest resources in the Asia and Pacific Ocean Region. The main projects of investment will be resource exploitation and production of primary products, then shifted to the development of refined and deeply processed products. In the Asia and Pacific Ocean Region, the countries in Southeast Asia should be the object of first consideration, because they are comparatively nearer the mainland China. Besides, due to poor industrial basis and weak technical force, it is suitable for them to employ the Chinese technology and equipment. In addition, there are other important favourable factors, such as low price of Chinese equipment, low level wage for the Chinese technicians, more overseas Chinese in these areas, more capital with them, and more interest they take in developing industries.

For implementing the ITTO PD 42/88 project, we investigated Pupua New Guinea, Indonesia and Malaysia (including the Peninsula and Sarawak State). Besides, we also inspected Brazil and France. According to our recommendations, the Government of Beijing Municipality sent two investigation groups to Pupua New Guinea and Sarawak, and has made an initial decision to set up wood conversion and veneer industries in those two countries. In the future, we will continue to provide help to those Chinese enterprises (companies) who would like to make overseas investment in industries.

Except the Asia and Pacific Ocean Region, rapid development international cooperation with Russia was also made by China
in recent years in the Far East and Siberia areas, but most projects are of the nature of resource exploitation as the major items. Besides, it is expected that the international cooperation by China with the countries of Latin America (Brazil as the main) and with certain countries in West Africa rich in forest resources will be developed to some extent.

5 Outlook for Forestry and the Demand and Supply of Forest Products in China in 2000

5.1 The Chinese population and economic development in 2000

The predication made by the concerned agency under State Council shows that up to the end of this century the population of the mainland China will reach 1.25 billion or approximate 1.3 billion, with an expected average annual rate of increase of 0.81 per thousand or about 1.1 per thousand (1992-2000).

Under the background of the reform and open policy, magnificent economic achievement was made in China in 1980s, with the first phase objective realized in the modernization drive. Compared with the GNP of 1980, the increase of GNP in 1990 was 1.36 times, with an average annual increase of 9%. In 1990s the planned average annual rate of increase was 6%, but recently, it was readjusted, initially set at 8-9%. If this rate of increase can be realized, it means that up to the end of this century, the GNP can be quadrupled, compared with that of 1980. The people's living level will rise from a tolerable living to being comparatively well-off*. An initial socialist market economy system will be established. The quality of the overall national economy and the integrated national strength will be raised to a new level*.

To realize the objective of economic development of 1990s, on the basis of the principle of "persist development", the Chinese Government will continue to carry out the policy in optimizing the industrial structure. Up to the end of this century, the priority industries and the six sectors of structural readjustment are as follows: continuing to strengthen the agricultural and water conservancy construction (including forestry), speeding up the basic industry and infrastructure construction, fastening and developing the pillar industries, reorganizing and remodelling the light industries, speeding up the development of the third industries, giving full play to the sci-tech. productivity and promoting the training of talented persons. To realize the objective of economic development of 1990s, in addition to reliance on domestic strengths, better use should be made of the international market, capital, technology and resources. A preliminary prediction shows that the import and export trade in China in 1990s will increase at an average annual rate of 11.5%, being higher than that in 1980s, and that the scale in utilizing foreign capital will be further widened. It is estimated that in the period of the Eighth Five-Year Plan, the amount of imported raw materials, equipment and technology will total 0.35-0.4 trillion US dollars.

5.2 The timber demand in China in 2000

In coordination with the preparation of a national economical development plan in 2000, and with the long range forest program, early in the mid 1980s, the Ministry of Forestry had organized the relevant units and experts to make many-sided predictions and researches on the timber demand and supply in 2000 in China. The work was carried on as late as the early 1990s. The principal data on which the researches were based were agricultural and industrial gross products, the total of national income, the scale of infrastructure construction, the growth rate of population and the wood consumption of all the organizations that need wood supply.

The units and experts participating in these predictions and researches employed different methods, and due to time

Note: * Being comparatively well-off is a relative dynamic conception. In terms of a wealthy living, it is a medium level living between the tolerable and the wealthy living. With the tolerable living as reference, it is a symbol of living stage, being higher than the tolerable living, but is not wealthy enough. Compared with all countries round the world, China is a nation between the low income nations and the medium income nations. An initially determined quantitative standard is as follows:

(1) the national level of being comparatively well-off is -- the GNP per capita is 2,400 yuan, average annual income per capita is 1,400 yuan, area per capita of living quarters with a concrete structure or brick-wood structure is 15.5 square meters, daily uptake per capita of calorie is 2,600 K.cal., the expected average life span is 70, the percentage of children entering middle school is 55-60%. With these as the statistic standard, people in China being comparatively well-off were 57.7% in 1990.

(2) The urban standard of being comparatively well-off is -- the GNP per capita is 5,000 yuan, the area per capita of living quarters is 8-10 square meters (two living rooms for a three membered family), average annual income per capita is 2,380 yuan, daily uptake of calorie 2,600 K.cal., an expected life span is 70, popularization of middle school education, the percentage of children entering middle school is 90%, the work day is 5.5 days/week, universal adoption of a holiday system of two weeks/year, and the greening area per capita is 9 square meters.

(3) The rural standard of being comparatively well-off is -- average annual net income per capita is 1,100 yuan, uptake of enough nutrients that can largely satisfy the physical need, the area per capita of living quarters with a concrete structure or brick-wood structure is over 80%, an expected life span is 70, the least schooling period for each laborer is 8 years, the proportion of households enjoying power supply is over 95%.
differences in prediction, the results obtained were not in agreement with each other. Now these are three prediction figures concerning the wood demand in 2000 in China (Table 14).

In the above-mentioned three predictions, an analysis was made of the wood demand structure either in production or in construction, with conclusions drawn respectively. A comparative consumption structure of wood in production and construction in China in 2000 so predicted is shown in Table 14.

### Table 14 The predicted wood demand in China in 2000

<table>
<thead>
<tr>
<th>Level of demand</th>
<th>Total wood demand</th>
<th>Demand in production and construction</th>
<th>Fuelwood</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>%</td>
<td>Amount</td>
</tr>
<tr>
<td>High</td>
<td>280</td>
<td>78.6</td>
<td>60</td>
</tr>
<tr>
<td>Medium</td>
<td>230</td>
<td>78.3</td>
<td>50</td>
</tr>
<tr>
<td>Low</td>
<td>210</td>
<td>71.4</td>
<td>60</td>
</tr>
</tbody>
</table>

### Table 15 The wood consumption structure in production and construction in China in 2000

<table>
<thead>
<tr>
<th>Item</th>
<th>High level</th>
<th>Medium level</th>
<th>Low level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>%</td>
<td>Amount</td>
</tr>
<tr>
<td>Total wood consump.</td>
<td>220.0</td>
<td>100.0</td>
<td>180.0</td>
</tr>
<tr>
<td>Consump. in production</td>
<td>142.0</td>
<td>64.5</td>
<td>116.661</td>
</tr>
<tr>
<td>pit prop</td>
<td>13.4</td>
<td>8.783</td>
<td>6.0</td>
</tr>
<tr>
<td>packing</td>
<td>6.0</td>
<td>6.0</td>
<td>5.0</td>
</tr>
<tr>
<td>paper making</td>
<td>30.0</td>
<td>19.05</td>
<td>15.355</td>
</tr>
<tr>
<td>furniture</td>
<td>16.0</td>
<td>2.65</td>
<td>2.0</td>
</tr>
<tr>
<td>plywood</td>
<td>3.0</td>
<td>2.65</td>
<td>2.0</td>
</tr>
<tr>
<td>car and ship</td>
<td>2.8</td>
<td>4.80</td>
<td>2.0</td>
</tr>
<tr>
<td>farm use</td>
<td>4.0</td>
<td>8.0</td>
<td>2.0</td>
</tr>
<tr>
<td>sleeper</td>
<td>0.8</td>
<td>1.35</td>
<td>0.54</td>
</tr>
<tr>
<td>maintenance</td>
<td>23.0</td>
<td></td>
<td>1.35</td>
</tr>
<tr>
<td>marketing</td>
<td>34.0</td>
<td></td>
<td>1.35</td>
</tr>
<tr>
<td>match</td>
<td></td>
<td></td>
<td>0.522</td>
</tr>
<tr>
<td>pencil</td>
<td></td>
<td></td>
<td>0.151</td>
</tr>
<tr>
<td>other use</td>
<td>9.0</td>
<td>50.0 *</td>
<td>78.0</td>
</tr>
<tr>
<td>Consumption in construction</td>
<td>78.0</td>
<td>35.5</td>
<td>35.2</td>
</tr>
<tr>
<td>urban constr.</td>
<td>29.0</td>
<td></td>
<td>29.0</td>
</tr>
<tr>
<td>rural constr.</td>
<td>32.0</td>
<td></td>
<td>32.0</td>
</tr>
</tbody>
</table>

Note: * including wood consumption in general society, not included in the national plan.
Demand for forest products in China is self-reliance, namely devoting major efforts to the development and rational utilization of own forest resources. It is not reliable, also impossible to excessively rely on the import of forest products. This is not only limited by foreign exchange reserve, but also the world market cannot supply enough forest products to meet China's demand. On the other hand, China has a vast land suitable for developing the fast-growing industrial timber forests, especially in the tropical and subtropical areas south of the Yangtze River, where stands established for 3-5 years can provide fibres and wood used in making non-veneer panels. Moreover, there are bountiful bamboo resource. For these reasons, and for forest development in China in 1990s, the forest departments propose the following objectives:

5.3.1 Accelerating afforestation, promoting the quality of forests established and early fulfilling the afforestation and land greening program

The area of nation-wide afforestation should be fulfilled in 1-2 years, earlier than the time set in the "Outline of 1989-2000 Afforestation and Land Greening Program". The percentage qualification should be about 90%. According to the provision in the program, up to 2000, the area of high-yield and fast-growing forests established will be 7.98 million ha. After the implementation of the program, it is expected that up to the end of this century the annual yield of commercial timber will be 22.5 million m³. The establishment of sand fixing forest and the "Three Norths" protection forests will be completed or completed ahead of the set time. So do the construction of protection forest systems at middle and upper of Yangtze River reaches, in the coastal areas and the shelter belt system in the great plains. 500 high-yield, high-quality and high-benefit economic forest bases will be built.

5.3.2 Further increasing the forest area, growing stock and forest cover

It is expected that in 2000 the forest area in China will be 147 million ha, with an increase of 13 million ha higher than that of 1992. The growing stock will increase to 11.71 billion m³, with an increase of 2.26 billion m³ over 1992. At that time the annual growth of forests will be 441 million m³, annual consumption of forest 314 million m³, and the annual net surplus of forest resources about 127 million m³.

It is expected that up to the end of this century, the forest coverage in China will be 15.3%, with an increase of 1.4% over 1992.

5.3.3 Focusing on the construction of a lot of priority forest industries

In the state forest areas, 20 new forest bureaus should be set up, with an annual capacity about 2.3 million m³. The target of annual production of industrial timber in 2000 will be 125 million m³*, among which the yield of fast-growing plantations will be 22.5 million m³.

As to forest product industry, in the period of the Eighth Five-Year Plan, the capacity of pulp production and paper making will be 400,000 t (not including the production of the light industry sector). The target to be achieved in 2000 will be 1 million t. In the same period, the panel industry will have a new increasing capacity of 580,000 m³, and it is expected that it will reach 5.1 million m³. The annual production in 2000 will amount to 6 million m³, among which the production of plywood will be about 2 million m³, that of fibreboard (including MDF) 1.9 million m³, and that of particleboard 2.1 million m³. The proportion of finished panels will increase from the current 20% to 30%. Up to the end period of Eighth Five-Year Plan, the planned sawnwood production in China will reach 15 million m³, among which the proportion of artificially dried timber will be 25%. In 2000, the expected production will amount to 20 million m³, among which the proportion of artificially dried timber will be 30%.

5.3.4 Promoting the economic returns of state forest enterprises, raised to the level of being comparatively well-off

In 1955, 138 forest industrial enterprises will pay off all the debts on behalf of forest regeneration, and fulfil the quota for production. In 1997, they will become enterprises without any financial loss. In 2000, more than 4,200 state forestry centres and more than 2,300 state run nurseries will be about the level of being comparatively well-off.

5.4 The main approaches and measures for realizing the equilibrium of timber demand and supply

What has been said above shows that up to the end of this century, a wide gap will exist between the demand and supply of industrial timber in China. It is a sharp contradiction, indeed. Calculated at a high consumption level, the timber deficit is about 95 million m³. Calculated at a medium consumption level, it will be about 55 million m³. At the same time, to protect ecologic environment, increase forest cover, and attain the objective of sustainable forest management, the consumption of forest resources must be strictly controlled, with overcutting limited. So, it is a difficult and complex problem to attain the equilibrium between industrial timber demand and supply in China in 2000.

As stated above, in the past decade some progress has been made in controlling the wood consumption, and in attaining an equilibrium between timber demand and supply, with some valuable experience acquired. After the fulfilling of the Sixth Five-Year Plan (1981-1985), although the GNP was more than twice higher, yet the total consumption level was roughly

Note: * This predicted figure is based on the maximum annual consumption (200-220 million m³ of timber forest resources converted into log production, among which the planned timber yield is about 65 million m³.
the same as that in the early stage of the period of the Sixth Five-Year Plan. And at the end of 1980s, the growth and consumption of forest resources largely reached an equilibrium of balance. In future, the past effective policies and measures will continue to be implemented. At the same time, the timber supply will increase through energetically developing the fast growing plantations and constructing new timber forest bases. In 1990s, the fundamental policy to resolve the problem of timber demand and supply was still these two approaches: broadening the timber sources and controlling wood consumption.

In the first aspect, in addition to opening new forest areas and establishing fast-growing timber forest bases, the following major measures are adopted:

5.4.1 Developing substitute production, by fully using wood residues and small dimension stock resources

Calculated at the current actual level of wood consumption in China, the capacity of residues is about 32-39.6 million m³, even calculated according to the planned wood consumption level, the annual capacity of residues is 13-14 million m³. Moreover, there is tremendous amount of slashes that can be used. Now the area of young and middle aged stands that need intermediate cutting is 35.07 million ha, being 56% of the total area of such stands. In recent time, the area of stands that need urgent intermediate cutting is about 13.2 million ha. If the annual area of intermediate cutting is 3 million ha, with a wood yield 9.6 m³/ha, the amount of small dimension stock produced annually will be 28.8 million m³. The chips made from these materials may be used in producing panels, and in paper making. Yet in 1992, the total amount of chips produced in China was only 1.192 million m³ (among which 1,077 million m³ was used in paper making), 1.302 million m³ in producing wood fibreboard, 1.159 million m³ in producing particleboard, indicating that only a small part of above-mentioned materials was utilized.

5.4.2 Energetically exploiting and utilizing the resources of bamboo and farm residues

Bamboo is an important component of forest resources in China. The current area of bamboo forest is 3.546 million ha, being 1/4 of the world total, with a gross growing stock about 80 million t, and an annual bamboo output of 8 million t, being about 1/3 of the world production. Bamboo not only can directly be used in construction industry, furniture industry, and manufacture of various sorts of art articles, but also is good materials in producing all sorts of panels (including plywood) and in paper making. It is also used to produce bamboo laminates, a sort of structural material. Especially, all sorts of plywood, having high strengths and being water-proofing, may be used as cement mould board, floor of truck bodies and bottom of containers. They are good substitutes for other wood panels. In the preliminary national program, up to the end of this century, the capacity for bamboo panel production will rise from the annual output of 150,000 m³ to 350,000 m³. At present time, the amount of bamboo used in paper making is also small, being about 2% of paper materials. To make up for the shortage of wood, it is necessary and feasible to increase the proportion of bamboo to be used in paper making in 1990s. In usual case, the production of 1 t of paper will need 2.5 t of bamboo, instead of 3 m³ of wood. In 2000, if 2 million t of bamboo is used in paper making, more than 2 million m³ of wood will be saved.

At present time, the annual amount of farm residues in China is about 400 million t. Except those used as fuels, fodders, fertilizers, and materials in paper making, it is estimated that at least there still remains 10% of them that can be well used. These are deemed as the third resources (bamboo as the second resources). In the period of the Ninth Five-Year Plan, if 5% of the better parts is used in producing particleboard and fibreboard, 20 million m³ of panels can be produced annually, to substitute for about 60 million m³ of wood.

5.4.3 Improving the technological process and product structure, promoting the rate of wood utilization and use value

Due to many factors such as technological process, equipment, materials and management system (mainly referring to decentralized processing), the current outturn of finished products and comprehensive utilization efficiency are still low. Especially the recovery of plywood with domestic materials is about 37%, that with imported materials is 50% only. The comprehensive utilization of the industrial timber is about 60%. The two indices are far lower than those of the advanced countries around the world.

At present time, most of the sawnwood produced in China are directly used without being artificially dried and antiseptically treated. It holds too with the building materials in medium and small cities, especially in the countryside. Of the lumber produced annually according to a plan, only about 15% is artificially dried. Lesser is the amount of timber antiseptically treated. The annual amount of timber so treated (the most of them are sleeper and electric poles) is only about 600,000 m³, being only 1% of the planned log production. In fact, most of the building materials (including urban timber consumption) and pit props largely not antiseptically treated are directly used. Henceforward, in order to increase the proportion of timber artificially dried and antiseptically treated, much work remains to be done. In addition to improving the technological process and equipment, economic and legal measures must be adopted. Much effort should be made to carry on propaganda and education, making people more conscious of the significance of the problem.

5.4.4 Increasing the utilization of waste paper resources, promoting the recovery and utilization of waste paper

The annual consumption of paper and paper board in China is about 20 million t (including the figure of import), yet the annual recovery of waste paper is low, being about 20%. Up to the end of this century, if the recovery and utilization rate is raised to 30-40%, it is equal to the increase of wood production
by 11-14.5 million m³ yearly.

In controlling the wood consumption, except continuing to strictly implement the cutting quota system, and control the consumption of timber resources, all effective substitute measures will be further extended, and to reduce fuel consumption.

1. As to substitution for wood, people are continuously encouraged to use all sorts of cement, metal and plastic products to substitute for wood. For example, concrete is used to make railway cross-ties, electric poles, stakes, small size motorboats and barges. All sorts of metals are used to make windows, doors, furniture and pit props. Ores, bamboo and paper board are used as packing materials. Steel tubes and bamboo are used to make scaffold and landing stage of scaffold. Steel mouldboards and man-made mouldboards are used to substitute for wood mouldboards. Plastics is used to make daily necessities, furniture, doors, windows and as packing materials. At the same time, regulations are imposed to prohibit the use of wood as raw materials in a series of industries such as construction, telecommunication, railway, mine and building material manufacture. Of course, when the above-mentioned substitutes are used, it implies not only high consumption of energy and increase of production cost, but also bringing about the fast exhaustion of unrenewable resources and the aggravated environmental pollution.

2. Reducing the fuelwood consumption up to now, the annual consumption of fuels in China is still about 1/3 of the total amount of consumption of forest resources, being 34% of the total rural consumption of energy. With the gradual increase of rural population and the development of township enterprises, if measures were not taken to reduce its consumption, the fuel demand will increase drastically. On the other hand, the thermal efficiency in the countryside is low, being about 12% at present time. The main approaches to solve the problem of fuel demand in the countryside are as follows:

a. Developing all types of energy resources according to local conditions to substitute for fuelwood

The countryside in China is extensive, and the conditions in various areas differ widely. The fundamental policy to resolve the problem of energy in the rural areas is to develop all types of energy resources according to local conditions, so as to reduce pressure on the forests. In mountainous areas rich in water resources, the chief approach is to develop hydroelectricity. In grass land and pastoral areas rich in wind resources, the main approach is to generate power by means of wind force. In flat land rich in hay and stalk, active effort should be made to exploit the methane. In the northwest dry areas, utilization of solar energy should be extended. In areas near the coal mines, coal should be used to substitute for wood.

b. Further extending the renovated stoves to reduce fuel consumption

In this field of work, successful experience has been acquired.

For example, in a certain county in Guizhou Province, before the renovated stoves are extended, the annual consumption of fuelwood in the whole county was 280 million kg, but after using them, it decreased to 165 million kg. This shows there is great potentiality in fuelwood economy. If the utilization rate of thermal energy can be raised from 12% to 20-25%, about half amount of fuelwood consumed will be saved. Now in the countryside of Guangdong Province and in that of Sanming City in Fujian Province, over 90% of old stoves have been remodelled into the renovated ones.

c. Energetically developing the fuelwood forests

Before 1980, no importance was attached to the development of fuelwood forests. From 1981 onwards, plans began to be made to establish fuelwood forests. Now the area of such forests has reached about 4.4 million ha, being about 3.7% of the total forest area in China. Due to small ratio in area of fuelwood forests, the amount of fuels provided is also small, being about 13% of the total amount of fuelwood consumed yearly. The rest is all taken from other forests (among which 40% is the result of excessive firewood gathering). In the countryside, the deplorable shortage of energy and excessive firewood gathering not only severely restrict the development of rural economy, affecting adversely the realization of the objective of being comparatively well-off in 2000, but also bringing high pressure on the already vulnerable ecological environment of the rural community. For this reason, the Ministry of Forestry has mapped out a program to establish 3 million ha of fuelwood forests in the period of the Ninth Five-Year Plan (1996-2000). It is estimated that in that period 6 million of peasants can have an annual increase of fuels to be used for three months.

After generalization of the statistic data, it is known that after adopting the above measures, at the end of 1990s, the expected increase of wood supply will be about 30 million m³. The rest will be made up by reducing the wood consumption, adopting substitutes for wood and importing foreign forest products. Therefore, it is necessary for continual import a part of forest products within this century, especially large dimension log and plywood.

5.5 China’s demand for tropical forest products in 2000, and the field and approach of possible cooperation with the tropical timber producing countries

In 1990s, with the gradual decrease of natural forest resources, and the increase of fast-growing plantations, conspicuous change will take place in the wood material structure and forest product structure in China. In material supply, the proportion of large dimension stock from natural forests will continue to dwindle, while small dimension stock from fast-growing plantations and intermediate cutting will tend to increase. In forest product structure, the amount of all sorts of non-veneer panels, paper board and paper products will increase drastically, while the proportion of sawnwood and plywood will decrease remarkably. In fact, in future the gap between wood
demand and supply in China will be due to shortage of large dimension stock. In other words, the shortage of wood resources in China will largely be shortage of large dimension stock. Therefore, henceforward China's demand for forest products in the world market is demand for large dimension stock and for plywood made of large dimension stock.

In the past more than 10 years, the large dimension log imported into China mainly was coniferous wood from USA, with Douglas fir and Tsuga as the main, being above 60%. Next was those from the former USSR, with Larix gmelinii and Pinus sylvestris var. mongolica as the main, being about 20%. In addition, a part of Pinus radiata was imported from Chile and New Zealand. It is expected that in 1990s the main log import will still be the temperate coniferous wood, but the source of export will be changed. Due to the long distance of shipping, high price, and the possible limitation of import from North America, it is supposed that more timber will be evidently imported from Russia. The Siberian and Far East forest areas in Russia are adjoining those of northeastern China. The trade between the two countries is highly complementary. The natural conditions, stand structure, and working conditions there are similar to those of forest areas in Heilongjiang Province and Inner Mongolia in China. The Russian areas are suitable for the Chinese equipment and experts to work there. The main mode of cooperation between these two nations will be joint exploitation of the natural coniferous forest in Russia, with China offering equipment and putting in labour. The potentialities of exploitation are tremendous. Moreover, in recent years, many Chinese companies crowd to New Zealand to purchase the forests there. It is anticipated that the import to China from that country will increase by a big margin, too.

Throughout the 1980s, the amount of tropical log imported to China was very small. Even in 1988-1990, it was only 8.8, 5.3 and 16.5% of the total import. However, in recent years, as the plywood factories established by foreign enterprisers were one by one put into operation*, leading to raising demand for log to produce plywood, the import of tropical log rose suddenly. The import in 1991 was 101.9% more than that in 1990, while that of 1992 was 21.5% more than that of 1991 (Table 8). Now the proportion of tropical log imported has risen to 38% of the total import. As more and more foreign enterprisers come to China with great favour to establish plywood mills, and less and less home produced wood is supplied for plywood production, domestic plywood mills will more and more rely on the world market to obtain materials needed. It is estimated that at the end of this century, the amount of tropical plywood demanded by domestic market will possibly reach 2-2.5 million m³. Such an amount plus that of sawnwood log and that needed for ship-building will total 2.5-3 million m³.

Due to the shortage and continual decline of large dimension stock resources in China, its demand for tropical log and plywood is an objective reality, and the quantity demanded is also considerable. Henceforward, the two major factors that restrict the import of tropical timber are: (1) the export policy of the tropical timber producing countries. (2) the log price and the capacity of acceptance of Chinese consumers. For the first factor, some tropical timber producing countries out of the need to conserve national resources and to develop national industry put the log export under a ban. Some countries adopt measures to limit log export. In fact, the countries that permit log export are becoming fewer. For the second factor, if the price of tropical log increases by a big margin, or redoubles, it will lead to the decline of consumption, and result in the substitution of non-veneer panels for its products (80% of them are plywood), and it will be even substituted by non-wood materials. The factors that influence the amount of tropical plywood imported are also diverse. The first factor is the speed of development of the Chinese plywood industry, especially that of foreign plywood enterprises. If the source of tropical timber is plentiful, and its price moderate, more foreign enterprise men will come to China to invest in such an industry. Otherwise, the plywood industry will stagnate, even the already formed capacity cannot be maintained by itself. The second factor is the price of the tropical plywood. Although the plywood is popular among the consumers, yet too high a price will render it uncompetitive on the market, and be substituted by other types of panels with improved designs, colour and variety. The third factor is the trade policy concerning plywood in China. To protect home plywood industry, now China adopts a high tariff policy (20%) on the import of plywood. However, due to the slow development of home plywood industry influenced by shortage of raw materials, and due to the urgent demand for plywood in the country, it is supposed, China will at a time later turn down the customs tariff after its position is rehabilitated by the GATT.

In the past ten and more years, due to the decrease of forest resources, and out of consideration for environmental protection and development of national economy, the export of tropical log in the world is tending to decrease. Taking the Southeast areas and the countries in West Africa as example, the amount of log export has decreased from 33.76 million m³ and 6.14 million m³ in 1980 to 22.477 million m³ and 4.115 million m³ in 1991, with a decrease of 33.4% and 33%, respectively. Only a few countries such as Papua New Guinea (it is said that the
country has decided to cut down the log export by 90% in the coming five years) where the forest is still at the initial stage of exploitation are the exception. But the general tendency is that the countries who permit log export will become fewer, while more and more countries will prohibit or limit the log export. This situation is irreversible.

In view of this situation, the more feasible and promising way for China to take is that except importing log and plywood directly from the countries rich in tropical timber, some large wood processing enterprises, especially those in coastal areas and big cities make direct investment in the countries with which cooperations have been contracted. The feasible and simple way of investment is to set up joint ventures in which China offers equipment and sends out technical experts (to put in labour when that country is short of labour), while the local cooperative partners offer capital and are responsible for civil engineering and necessary attachments. The other way is that China initiates a sole Chinese enterprise, not only provides the processing equipment, but also is responsible for civil engineering and the necessary attachments. In the countries in Southeast Asia and Latin America, there are many overseas Chinese and their progenies. Most of them are engaged in industrial and commercial business. It is relatively easy to find partners for a joint venture. As to products, primary products may be produced first. Then along with the development of production, one may proceed to produce deeply processed products, such as all sorts of finished panels, components of furniture and complete set of furniture, and the decorative materials. Part of the products may be locally marketed, and part may be exported to China or other countries and regions. This mode of cooperation is beneficial to both parties, and is, we suppose, welcome by the countries concerned.

Members of this Subject Group have made investigations in Papua New Guinea, Malaysia, Indonesia and Brazil. We think some areas in the above mentioned countries have good investment environment. Up to now, based on the introduction made by this Subject Group, the General Office of the Beijing Construction Materials Co., and the Beijing Guanghua Wood Mill have early or later sent delegations for inspections in Papua New Guinea, and Sarawak State in Malaysia, and have signed agreements to set up joint ventures, respectively. At the conclusion of this project, the Subject Group will through all channels (official, semiofficial and civil organizations) introduce this information to more manufacturers, let more factories and enterprises to go to those countries to open up new fields of development. We believe, our recommendations will be appreciated by more and more enterprises and companies, and be supported by the Government.

6 Conclusions

(1) Now China's reform and opening have entered a new stage. Taking advantage of the favourable turn of realizing the conversion of economic system and the setting up of a new system of socialist market economy, China encourages further mental liberation, hearty devotion, seizing the opportunity to speed up development and make the national economy keep a persistent fast growth. On the basis of the increase rate of 12.8% in 1992, the GDP in the first three quarters in 1993 gives an increase of 13.3% over the same period of last year. This rate of economic growth is far higher than the average of both the developed and developing countries. Now an all round multilevel open pattern has been formed, showing a large scale rise in the utilization of foreign capital, persistent growth of import and export, prosperity of urban and rural market, and further improvement of people's living level. However, although much progress has been made in recent years, yet in many aspects, China is still a developing country, belonging to the third world.

(2) The 1993's statistics show that the forest area in China has reached 133.733 million ha, with a growing stock of 11.785 billion m³, both ranking the seventh in the world. The forest coverage has risen to 13.92%. But due to high population density, the average forest area per capita and the average wood consumption level show that by and large China is still a country with severe shortage of forests or with scarce forest cover.

(3) The Chinese Government and Ministry of Forestry attach great importance to forest development. On the basis of summarizing the past experience and lessons in earnest, they readjust the forest development strategy, formulate relevant programs, regulations and plan outline. Definite policies are proclaimed to speed up the culture of forest resources, energetically develop the plantations, strengthen the management and protection of forest resources, control the consumption of forest resources, readjust the industry structure, promote the economic and social benefits of forest and import moderate amount of forest products. In recent years, the annual area of nation-wide afforestation is about 5-6 million ha, and the number of trees planted at "four sides" is over 4-6 billion. Up to the end of 1992, the total area of plantations in China was 33.79 million ha, ranking first in the world. The projects of "Three Norths" protection forests, protection forests at the middle and upper reaches of Yangtze River, protection forests in the coastal areas, the Taihang Mountain Greening, and the plains greening are all under way. Now, 420 forest types and wild life types nature reserves are set up, with a total area about 44 million ha, being 4.5% of the national territory. The forest survey in 1989-1993 shows that the annual growth of the forest resources in China is 400 million m³, and annual consumption 320 million m³, reaching an equilibrium of balance, with a little surplus. With the high rate of economic growth and the continual growth of population, the demand for forest products expands uninterruptedly. To ease the increasingly sharp contradiction between wood demand and supply, China adopts a dual policy in increasing the resource of forests and controlling the wood consumption, energetically carrying out wood economy and substitution. To make up for the inadequacy of home produced timber, a part of timber and forest products is imported.

(4) Before 1970s, the national economy of China was essentially of the nature of self-sustenance. The wood and forest products trade as other economic sectors is minimal.
After the implementation of the reform and open policy, the contradiction between demand and supply of wood and forest products becomes sharper and sharper. For this reason, the Chinese Government made important decisions, namely under the tight economic conditions and severe shortage of foreign exchange, a part of foreign exchange is appropriated to import wood and forest products. In 1981-1992, the cumulative import of forest products to China was 22.055 billion US dollars. Of the imported products, log was the staple goods, worth 7.04 billion US dollars; Paper and paper board worth 6.449 billion US dollars; Pulp and waste paper worth 4.099 billion US dollars; and plywood ranked the fourth, worth 3.972 billion US dollars. The coniferous log was mainly imported from USA. In recent years, the import of coniferous log from Russia and New Zealand gradually increases. Pulp, paper and paper board are mainly imported from Canada, USA, Sweden and Finland. Recently, the import from New Zealand and Chile evidently increases. Hardwood log was mainly imported from Malaysia. In addition, a small part of tropical wood was imported from Myanmar, Thailand and Laos. 60-70% of plywood was imported from Indonesia. Furthermore, a part of plywood was also imported from Malaysia and the Philippines. As to forest product export, due to shortage of timber resources, the export of log, sawnwood and plywood was minimal. Only in recent two years, chips from the Eucalyptus plantations in Guangdong and Hainan Provinces are exported.

(5) Since the implementation of the reform and open policy, the national economy developed rapidly. Now China is in the transition from the planned economy to socialist market economy, and is prepared to resume the membership of the GATT. In the forest product trade, she will continue to actively take part in the world trade, with incentive policies adopted: a). continue the policy of encouraging the import of raw materials and primary products; b). continue the policy of encouraging foreign enterprisers to invest in the construction of forest product processing bases; c). adopt a policy of encouraging the expanded export of forest products; d). and adopt a policy of increasing investment in foreign countries and setting up forest product production bases there. In a word, on the basis of economic development and home resources, she will rely on the principle of "keeping supply each other's needs, for mutual benefit standing on equality, in harmony and cooperation" to trade with other countries in the world. Consequently, the forest product trade will be more expanded in the future.

(6) The main objectives of forest development in China in 2000 are: a). to speed up afforestation, promote the quality of forests established, and early fulfil the program of afforestation and land greening. According to the program, in 2000 the area of fast-growing and high-yielding timber forests in China will reach 7.98 million ha, anticipating an annual supply of commercial timber of 22.5 million m\(^3\) at the end of this century; b). to further expand the forest area, stand stock and forest cover, anticipating the forest area to be 147 million ha, increased stand stock to be 11.71 billion m\(^3\), and a forest coverage to be 15.3% in 2000; c). to focus on construction of a lot of major forest industry projects, anticipating the annual production of industrial timber to be 125 million m\(^3\) in 2000, with 22.5 million m\(^3\) to be produced from plantations, and with the capacity of pulp, paper making, and plywood to be significantly improved; d). to promote the economic returns of state run forest enterprises, attaining the level of being comparatively well-off.

(7) In 1990s the import of tropical log increased, with an increase of 101.9% in 1991 over 1990, and an increase of 21.5% in 1992 over 1991. It is estimated that up to the end of this century, the Chinese market demand for tropical log will be 2-2.5 million m\(^3\). Plywood made of tropical timber is popular among the Chinese consumers. It is estimated that up to the end of this century, the amount of demand will reach 2 million m\(^3\). However, there is a variety of factors either domestic or external restricting the import of tropical timber. For this reason, henceforward except direct import of log and forest product from the tropical timber producing countries, China will adopt a policy to encourage home wood processing enterprises diverting forest industry to other countries. Of course, the fundamental approach to solve the problem of wood and forest product demand is to concentrate the efforts to develop home forest resources as soon as possible.

References

CHAPTER II

TROPICAL FOREST (INCLUDING BAMBOO FOREST) RESOURCES IN CHINA, PRESENT STATE OF UTILIZATION AND AN OUTLOOK OVER THE YEAR 2000

1 A General Picture of Forest (Including Bamboo Forest) Resources in China and Its Utilization

1.1 A general introduction to forest resources*

1.1.1 Forest area, growing stock and the principal tree species

The statistic data of the Third Nation-wide Forest Resources Inventory (1984-1988) show that the land area for forestry is 261.3144 million ha in China, among which the forested land is 119.4771 million ha, being 45.72% of the total. Of the area of the forested land that of stands is 102.187 million ha, that of economic forests 13.7438 million ha, and that of bamboo forests 3.5463 million ha.

The growing stock in the whole country is 9.5229 billion m³, among which the growing stock of forests is 8.0915 billion m³ (that of coniferous forests is 4.3923 billion m³, being 54.28% of the total; that of hardwood forests 3.6992 billion m³, being 45.72% of the total), that of open forests 545.8527 million m³, that of the scattered trees 694.5309 million m³ and that of trees grown at "four sides" 191.0386 million m³**.

According to forest category, the area of timber forests is 80.07 million ha, with a growing stock of 6.1732 billion m³, that of protection forests is 14.557 million ha with a growing stock of 1.3996 billion m³, that of fuelwood forests is 4.4438 million ha with a growing stock of 65.6204 million m³, and that of special forests 3.1163 million ha with a growing stock of 453.0805 million m³.


The area of plantations that have been established in China is 31.012 million ha, being 25.96% of the total forested land.

1.1.2 Area of various types of land for forestry classified according to ownership

Of the land for forestry the area of state forests is 98.61 million ha, being 38.86% of the total, that of collective forests (including private forests, samey refered in the following sections) is 155.13 million ha, being 61.14% of the total.

Of the area of forested land, that of state forests is 52.71 million ha, being 45.3% of the total, that of the collective forests is 63.65 million ha, being 54.7% of the total.

Of the area of timber forests the area of state forests is 40.94 million ha, being 52.02% of the total, that of collective forests is 37.47 million ha, being 47.98% of the total.

1.1.3 Quality of forest resources

The average growing stock in the land for forestry is 36.44 m³/ha, and the average growing stock in stands is 79.18 m³/ha.

1.1.4 Distribution of forest resources

Notes: * Forests in Taiwan Province and in the area outside the control line of the Tibet Autonomous Region are not included.

** Data of the Fourth Nation-wide Forest Resources Inventory (1989-1992) recently promulgated by Ministry of Forestry show that the land area for forestry is 262.89 million ha, area of forests is 133.7 million ha, with a forest coverage of 13.92%, and that the total growing stock is 11.785 billion m³ and that of forests is 10.137 billion m³.
The geographical distribution of forest resources in China is not even. The forest is mainly situated in Northeast China and Southwest China. The proportion of growing stock in the national total is as follows:

In Northeast China and Inner Mongolia (Heilongjiang, Jilin, and Inner Mongolia) it is 3.265 billion m³, being 34.28% of the total.

In Sichuan and Yunnan Provinces it is 2.759 billion m³, being 28.97% of the total.

In the collective forests in the 10 southern provinces (Guangdong, Hainan, Hubei, Jiangxi, Fujian, Guizhou, Zhejiang, Guangxi and Anhui) it is 1.71 billion m³, being 17.96% of the total.

In other provinces and cities (Gansu, Xinjiang, Shanxi, Liaoning, Henan, Hebei, Shandong, Ningxia, Shaanxi, Beijing, Tianjin, Jiangsu, Qinghai and Shanghai) it is 1.175 billion m³, being 12.34% of the total.

For the proportion of forest resources of various provinces and municipalities in the national total, see table 1.

1.1.5 Forest growth and consumption

In recent years the government is engaged in developing the forest resources to promote the forest growth on one hand, and in controlling the felling quota to reduce the forest consumption on the other hand.

A survey made in 1988-1990 shows that the annual growth of forest resources in China is 366 million m³, and the annual consumption is 327 million m³. The trend of greater consumption of forest resources than growth was reversed. The results of the Fourth Nation-wide Forest Resources Inventory recently promulgated show that the annual net growth of forests has reached 400 million m³, and the consumption of forest resources has decreased to 320 million m³. The annual average increment is about 70 million m³. During the second period (1977-1981) and third period (1984-1988) of nation-wide forest resources inventory, the annual growth of forest resources was 275.32 million and 329.46 million m³, respectively. The annual consumption was 294.1 million m³ and 344.83 million m³ with a deficit of 18.78 million m³ and 15.37 million m³, respectively. But the problem of deficit of timber forest resources has not been resolved.

1.1.6 Loss due to forest fire, disease and insect

As in recent years the government attaches much importance to prevention of disasters, the loss to forest resources due to disasters decreases annually. The prevention and control of forest disease and insect increases from 40.4% in 1987 to 48.8% in 1990, while the loss due to disasters has decreased from 8.01 million m³ in 1988 to 6.8 million m³ in 1989. From 1990 onwards, it decreased to 4.84 million m³.

1.2 Bamboo forest resources

The statistics of the Third Nation-wide Forest Resources Inventory show that the area of bamboo forests in China is 3.5463 million ha, with a growing stock of 80 million t. The annual yield of bamboo timber was 8 million t, and that of bamboo shoot was 1.25 million t. The bamboo forests are mainly distributed in Fujian, Jiangxi, Sichuan, Zhejiang, Hunan and Guangdong provinces (Table 2).

The bamboo resources in China is noted for numerosness in variety. There are over 400 species, belonging to 40 genera. The principal species are *Phyllostachys pubescens* Mazel ex H. de Lehaie, *Ph. glauca* McClure, *Chimonobambusa quadrangularis* (Kenzi) Makino, *Qionghuemia huminosa* Hsueh et Yi, *Bambusa umeinensis* Chia et et H. L. Fung, *Ph. bambusoides f. lacrimadeae* Keng f. et Wen, *Bambusa oldhami* Munro, *Dendrocalamus latiflorus* Munro, *Ph. bambusoides* Sieb et Zucc., and *Ph. praecox* C. D. Chu et C. S. Chao. The bamboo timber species are *Ph. pubescens*, *Bambusa umeinensis* and *Ph. bambusoides*. The area of *Ph. pubescens* forests in China is 2.5264 million ha, being 71.2% of the national total. The total of culms account for 7.9 billion and the annul yield of commercial culms is over 100 million. In recent years an incomplete statistical figure shows that in China the annual consumption of *Ph. pubescens* is 1.5-1.6 million t, among which 40-50% is used as construction materials, 20% is used in making wares and articles, 15-20% for pulping, and 10-15% for other uses.

1.3 A brief description of forest industry in China

Since 1980s, much progress has been made in the forest industry. The total output value of forest industry rose from 8.67 billion yuan in 1980 to 33.849 billion yuan in 1992 (Table 3), (calculated at spot price in current year). The increase was almost 3 times higher. Of the increased output value, that of wood processing industry (including bamboo, liana, palm and straw articles) is more significant. During 1988-1992, it increased from 11.594 billion yuan to 18.244 billion yuan, with an increase of 57.4%. The output value of logging industry (including bamboo logging) slightly increased, with an increase over five years to be only 5.7%.

1.3.1 Wood production

Under the influence of organization system and tradition the wood production in China is mainly divided into three parts. (1) The first part is commercial timber controlled by the state guidance planning, supplied to priority state-run and urban industries, for capital construction and to meet the daily needs of urban inhabitants. This part of wood is supplied through the state goods and materials agencies. The channels and system of supply are relatively perfect, giving relatively accurate statistic data. (2) The second part of wood is not controlled by the state guidance planning. The wood production is regulated by...
market, and is supplied to local and township enterprises and private owners. The channels of supply are various without a fixed system. Therefore it is difficult to gather accurate statistic data. Since the opening of wood market, this part of wood production increases rapidly, gradually exceeding the amount of commercial timber production under the state guidance planning. The two parts of wood are largely industrial timber.

(3) The third part is fuelwood, supplied both to industries and to urban and rural inhabitants. This part of wood production is not controlled by state guidance planning. No organization is set up for organizing its production and for marketing. It is regulated by market, and no accurate statistic data can be obtained. The production can only be roughly estimated. It is estimated that now in China the agricultural and industrial

<table>
<thead>
<tr>
<th>Regions</th>
<th>Area of land for forestry</th>
<th>Total growing stock</th>
<th>Area of forested land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole country</td>
<td>261.33 million ha</td>
<td>9522.3 million m³</td>
<td>119.49 million ha</td>
</tr>
<tr>
<td>Beijin</td>
<td>1.06 million ha</td>
<td>5.25 million m³</td>
<td>0.22 million ha</td>
</tr>
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<td>Tianjin</td>
<td>0.10 million ha</td>
<td>1.58 million m³</td>
<td>0.06 million ha</td>
</tr>
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<td>Hebei</td>
<td>6.51 million ha</td>
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</tr>
<tr>
<td>Shanxi</td>
<td>6.63 million ha</td>
<td>44.83 million m³</td>
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</tr>
<tr>
<td>Inner Mongolia</td>
<td>32.69 million ha</td>
<td>1024.79 million m³</td>
<td>13.84 million ha</td>
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<td>Liaoning</td>
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<td>3.94 million ha</td>
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<td>Jilin</td>
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<td>Heilongjiang</td>
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<td>0.01 million ha</td>
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<td>0.39 million ha</td>
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<td>5.95 million ha</td>
<td>101.38 million m³</td>
<td>4.04 million ha</td>
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<td>Anhui</td>
<td>4.18 million ha</td>
<td>84.93 million m³</td>
<td>2.26 million ha</td>
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<td>8.98 million ha</td>
<td>378.88 million m³</td>
<td>5.00 million ha</td>
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<td>Jiangxi</td>
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<td>3.70 million ha</td>
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<td>4.86 million ha</td>
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<td>Xinjiang</td>
<td>4.86 million ha</td>
<td>232.32 million m³</td>
<td>1.50 million ha</td>
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</table>

Note: * Forest resources in Taiwan Province and in the area outside the control line of the Tibet Autonomous Region are not included in the total.
consumption of wood is about 2/3 of the national total and the fuel consumption is about 1/3 of the total.

Table 4 shows the commercial timber production during 1980-1992 under the state guidance planning, but it is estimated that during this period the actual annual wood production was about 187-203 million m³ and it was only about 1/3 of the actual wood production in the whole country.

Table 2 A Statistic table of bamboo forest resources in China *

(1000 ha, 1000 culms)

<table>
<thead>
<tr>
<th>Region</th>
<th>Total area</th>
<th>$Ph., pubescens$ (moso) area</th>
<th>Total of culms</th>
<th>Other bamboos area</th>
<th>culms</th>
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</thead>
<tbody>
<tr>
<td>National total</td>
<td>3546.3</td>
<td>2526.4</td>
<td>7957330</td>
<td>1019.9</td>
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<td></td>
</tr>
<tr>
<td>Shanghai</td>
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<td></td>
<td></td>
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<tr>
<td>Jiangsu</td>
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<td>14.0</td>
<td>42790</td>
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<td>442.7</td>
<td>671280</td>
<td>43.5</td>
<td>495800</td>
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<td>176.4</td>
<td>151.7</td>
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<td>24.7</td>
<td>709370</td>
</tr>
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<td>Fujian</td>
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<td>573.0</td>
<td>797490</td>
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<td>1050980</td>
</tr>
<tr>
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<td>529.1</td>
<td>957360</td>
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<td>Guangxi</td>
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<td>81.6</td>
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<tr>
<td>Hainan</td>
<td>7.2</td>
<td></td>
<td></td>
<td>7.2</td>
<td>10980</td>
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<td>Sichuan</td>
<td>342.1</td>
<td>19.2</td>
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<td>14.4</td>
<td>128580</td>
<td>129.5</td>
<td>812020</td>
</tr>
<tr>
<td>Shaanxi</td>
<td>38.4</td>
<td></td>
<td></td>
<td>38.4</td>
<td>152070</td>
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</tbody>
</table>

Notes: * Bamboo forest area and number of culms in Taiwan Province and in the area outside the Tibet Autonomous Region are not included in the total.

Table 3 The total output value of forest industry in China from 1980 to 1992 (billion RMB yuan)

<table>
<thead>
<tr>
<th>Item</th>
<th>1980</th>
<th>1988</th>
<th>1992</th>
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<tr>
<td>Total output value*</td>
<td>8.67</td>
<td>25.421</td>
<td>33.849</td>
</tr>
<tr>
<td>Logging industry (including bamboo logging)</td>
<td></td>
<td>11.566</td>
<td>12.224</td>
</tr>
<tr>
<td>Wood industry (including bamboo liana, palm and straw industry)</td>
<td></td>
<td>11.594</td>
<td>18.244</td>
</tr>
<tr>
<td>others</td>
<td></td>
<td>2.261</td>
<td>3.381</td>
</tr>
</tbody>
</table>

Note: * The value is calculated according to the spot price in current year.
From 1987 onwards, in order to control wood consumption, the Ministry of Forestry adopted a felling quota system which was ratified by the State Council. Meanwhile the state made a plan to reduce the amount of wood production and the amount of wood handed over to state, thus resolving the problem of excessive felling of forests. As a result, in the period from 1987 onwards the commercial timber production continued to decrease. In the major wood producing areas -- Northeast China and Inner Mongolia state forest areas the wood production decreased from 30.72 million m$^3$ in 1986 to 20.04 million m$^3$ in 1991, with a decrease of 1/3. These measures decreased the proportion of wood production under state guidance planning in the total wood production gradually. On the other hand this just conforms to the historical trend of transition from planning economy to market economy.

The general trend of wood production in China in a certain period would be that the commercial timber production under state guidance planning will continue to decrease or remain at a stable level, while the wood production regulated by market will be somewhat on the increase.

1.3.2 Lumber industry

The 1990 statistics show that in China there are 2166 sawmills (workshops), with a total production capacity of 23.6 million m$^3$, with an average outturn about 1,090 m$^3$/y. These mills belong to the departments of forestry, goods and materials, light industry, construction materials and agricultural reclamation. The production capacity of forest system is about half of the total.

The sawnwood production in China is shown in Table 5. The table shows that in 1980-1984 the sawnwood production in China showed a slowly increasing tendency, with an annual increase of 16.2% over 5 years. But from 1985 onwards, the sawnwood production continued to decrease. In 1992 it was 11.187 million m$^3$, being only 44.7% of its capacity. The main cause of this decrease is that the home produced log diameter becomes smaller, resulting in decrease of outturn.

Table 5 The sawnwood production in China in 1980-1992

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>13687</td>
</tr>
<tr>
<td>1981</td>
<td>13011</td>
</tr>
<tr>
<td>1982</td>
<td>13609</td>
</tr>
<tr>
<td>1983</td>
<td>13945</td>
</tr>
<tr>
<td>1984</td>
<td>15086</td>
</tr>
<tr>
<td>1985</td>
<td>15908</td>
</tr>
<tr>
<td>1986</td>
<td>15052</td>
</tr>
<tr>
<td>1987</td>
<td>14719</td>
</tr>
<tr>
<td>1988</td>
<td>14684</td>
</tr>
<tr>
<td>1989</td>
<td>13933</td>
</tr>
<tr>
<td>1990</td>
<td>12849</td>
</tr>
<tr>
<td>1991</td>
<td>11415</td>
</tr>
<tr>
<td>1992</td>
<td>11187</td>
</tr>
</tbody>
</table>


Among the ordinary sawnwood the coniferous wood is about 54.3%, and the hardwood is about 45.7%. Sawnwood production is the highest in Heilongjiang, being about 1/4 of the national total. Next comes Jilin, being about 12%. Liaoning, Inner Mongolia, Sichuan and Fujian are also major sawnwood processing areas.

1.3.3 Wood-based panel industry

Now in China there are over 1,100 wood-based panel factories, with a capacity about 5.4 million m$^3$. In 1992 the actual wood-based panel production was 4.169 million m$^3$ of which plywood was 1.565 million m$^3$, fiberboard 1.445 million m$^3$, and particleboard 1.159 million m$^3$. During the 13 years from 1980 to 1992 the wood-based panel industry in China developed at a highest speed (Table 6). Especially the annual production of particleboard rose from 78,000 m$^3$ to 1.159 million m$^3$, with an average annual increase of 25.2%.

Table 4 The 1980—1992 commercial timber production under state guidance planning in China

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>53593</td>
</tr>
<tr>
<td>1981</td>
<td>49423</td>
</tr>
<tr>
<td>1982</td>
<td>50413</td>
</tr>
<tr>
<td>1983</td>
<td>52323</td>
</tr>
<tr>
<td>1984</td>
<td>63848</td>
</tr>
<tr>
<td>1985</td>
<td>63234</td>
</tr>
<tr>
<td>1986</td>
<td>65024</td>
</tr>
<tr>
<td>1987</td>
<td>64079</td>
</tr>
<tr>
<td>1988</td>
<td>62176</td>
</tr>
<tr>
<td>1989</td>
<td>58018</td>
</tr>
<tr>
<td>1990</td>
<td>55710</td>
</tr>
<tr>
<td>1991</td>
<td>58073</td>
</tr>
<tr>
<td>1992</td>
<td>61736</td>
</tr>
</tbody>
</table>


(1) Plywood industry

Up to the end of 1990, in China there were 509 plywood mills.
with an annual capacity of 1.7013 million m³. The forest region in Northeast China (including east Inner Mongolia) with rich forest resources and the East China region where economy developed rapidly hold a large proportion of production capacity in the whole country. The former region has 191 plywood mills, with a capacity of 540,600 m³, being 31.78% of the national total. The latter region has 209 plywood mills, with a capacity of 587,900 m³, being 34.56% of the national total.

Of the 509 plywood enterprises those with the least economic scale of production are only 73 (with an annual capacity over 5,000 m³). The capacity of more than 85% of the plywood enterprises cannot reach the least economic scale of production. The annual capacity of the 73 above mentioned enterprises is 912,000 m³, being 53.61% of the total capacity in the nation. What is noteworthy is that since 1980s more than a dozen Sino-foreign ventures have an average annual capacity over 40,000 m³, which is the highest target of production in the nation. A survey made in June 1993 shows that now in China the joint ventures of plywood that have been put into operation number 16 with a capacity of 701,000 m³.

It is known from table 6 that during 1980s the plywood production in China was doubled, while in the short period from 1990 to 1992 the output was further doubled, far beyond expectation. The most important reason is that the foreign capital enterprises established in the late 1980s have played an important role.

In the forest region in China the materials supplied to plywood mills are largely home produced, while those supplied to factories in coastal areas and to foreign capital enterprises are mainly tropical wood imported. This is the reason why the import of tropical wood increases rapidly in recent years.

(2) Fibreboard industry

The 1990 statistics shows that in China there are more than 400 fibreboard plants, with a capacity about 1.7 million m³. In comparison with plywood and particleboard, through 1980s up to the early 1990s, the fibreboard production increased at a moderate speed. However, the fibreboard production in 1992 almost doubled that of 1980 (Table 6). Since 1980s the hard board production developed slowly, but the medium density fibreboard(MDF) developed rapidly. In 1989 the production of MDF was only 99,600 m³, In 1992 it reached 285,600 m³, with an annual increase of 42.1%. It is estimated that in the near future it will continue to develop rapidly.

(3) Particleboard industry

Now in China there are about 200 particleboard plants, with a capacity over 2 million m³. In 1992 the production of particleboard was 1.159 million m³. Since 1980s, in order to promote the comprehensive utilization of wood, the Chinese government energetically developed the particleboard production. Table 6 shows that the particleboard production in 1992 was almost 15 times that of 1980. The average annual increase rate was 25.2% in 12 years. But the per capita consumption of particleboard in China is still very low, being only 5-6% of the world average.

In China the defect of particleboard is its singleness of variety.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total amount</th>
<th>Plywood</th>
<th>Fiberboard</th>
<th>Particleboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>914</td>
<td>330</td>
<td>506</td>
<td>78</td>
</tr>
<tr>
<td>1981</td>
<td>996</td>
<td>351</td>
<td>568</td>
<td>77</td>
</tr>
<tr>
<td>1982</td>
<td>1167</td>
<td>394</td>
<td>670</td>
<td>103</td>
</tr>
<tr>
<td>1983</td>
<td>1317</td>
<td>455</td>
<td>735</td>
<td>127</td>
</tr>
<tr>
<td>1984</td>
<td>1391</td>
<td>490</td>
<td>736</td>
<td>165</td>
</tr>
<tr>
<td>1985</td>
<td>1616</td>
<td>539</td>
<td>895</td>
<td>182</td>
</tr>
<tr>
<td>1986</td>
<td>1848</td>
<td>611</td>
<td>1027</td>
<td>210</td>
</tr>
<tr>
<td>1987</td>
<td>2360</td>
<td>776</td>
<td>1207</td>
<td>377</td>
</tr>
<tr>
<td>1988</td>
<td>2794</td>
<td>827</td>
<td>1484</td>
<td>483</td>
</tr>
<tr>
<td>1989</td>
<td>2613</td>
<td>728</td>
<td>1443</td>
<td>442</td>
</tr>
<tr>
<td>1990</td>
<td>2359</td>
<td>759</td>
<td>1172</td>
<td>428</td>
</tr>
<tr>
<td>1991</td>
<td>2842</td>
<td>1054</td>
<td>1174</td>
<td>614</td>
</tr>
<tr>
<td>1992</td>
<td>4169</td>
<td>1565</td>
<td>1445</td>
<td>1159</td>
</tr>
</tbody>
</table>

Statistic Data of Forestry in China, 1997
Most of the adhesives are UF which has poor water proofness and antiaging ability. Particleboard made with this adhesive can only be used in room fittings, and cannot be applied to exteriors of buildings or for other uses. These drawbacks limit its further development. Now the consumption structure of particleboard is 87% in furniture making, 3% in construction and 10% in other uses. It is foreseen that its proportional consumption in furniture making will decrease, while in construction it will increase. For this reason the particleboard production will continue to develop, only the speed of development would be a little slower.

(4) Non-wood-based panel industry

China is relatively poor in forest resources, with short supply of wood. To make up for the serious shortage of wood, non-wood materials are used to make panel. Recently, much progress has been achieved in this industry. At present time, the chief non-wood materials used are bamboo, bagasse, cotton stalks, rice hulls and peanut shells. The principal products made of these materials are plybamboo, bamboo mat plywood, bamboo laminated board, bamboo-wood composite panel, cotton stalk board, rice hull board, peanut shell board and bagasse board, the varieties of which may be more than a score.

Now in China there are about 210 non-wood-based panel factories with an annual capacity about half a million m$^3$. Most of these factories are township enterprises with a designed annual production of 500-3000 m$^3$. Due to poor technical force, backward equipment and poor quality of products, the actual production is not up to the designed level. The incomplete statistics show that in 1991 the production of non-wood-based panel was 164,000 m$^3$ and 202,500 m$^3$ in 1992.

China is rich in non-wood fibre materials, which are numerous in variety. The utilization coefficient of these materials by the panel industry is only 0.2%. Hence the non-wood-based panel industry has great potentiality for further development.

2 A General Introduction to Tropical Forest Resources in China

The tropical forests in China are grown on the north border of tropical zone, where it is a transitory zone from dry and wet alternating belt to dry tropical belt. It may be roughly divided into three subzones: (1) the east transitory tropical monsoon rain forest and rain forest subzone, including southeast Fujian, south Guangdong, south Guangxi, and the central and north parts of Taiwan; (2) west transitory tropical forest, tropical monsoon rain forest and rain forest subzone, including southwest Yunnan and the south sides of Himalayas in southeast Tibet; (3) south tropical monsoon rain forest and rain forest subzone, including Hainan Island and other areas.

Historically, the people’s poor understanding of tropical forests and various social and economical reasons led to the gradual decrease of tropical natural forests. Up to now, the only tropical natural forests well preserved with a large area are those in Hainan Island and south Yunnan. In Hainan Island they are mainly distributed in the middle and south areas of the Jianfeng Mount; Bawang Mount, Wuzhi Mountain and Limu Mountain. In south Yunnan they are mainly distributed in Xishaingbanna Dai Autonomous Prefecture. A small number of them are distributed in Menglian County, Heyuan County, Dehong Dai, Jingpozui Autonomous Prefecture, Honghe Hanizu Autonomous Prefecture, Pingbian County, Luchun County and Simao district in areas bordering on Myanmar, Laos and Vietnam. Hence in this paper only the tropical forest resources in Hainan Island and south Yunnan are described.

2.1 Tropical forest resources in Hainan Island

2.1.1 Natural conditions

Hainan Island is situated in the north of the South Sea, 18°21' - 20°10' N, 108°37' - 111°03' E, with an area about 34,000 square kilometres, being 42.2% of the total tropical zone area of 80,000 square kilometres. In the island it is warm and hot all the year round, with plentiful precipitation, and distinct dry and wet seasons. It is always windy, with frequent storms and typhoon. The climate varies in all localities. The total annual solar radiation is about 110-140 K. cal./cm$^2$. The average annual precipitation is 1,639 mm, therefore, it is an area with typical tropical climate in China.

2.1.2 Forest area

In historical view Hainan Island may be called an island of backward equipment and poor quality of products, the actual production is not up to the designed level. The incomplete statistics show that in 1991 the production of non-wood-based panel was 164,000 m$^3$ and 202,500 m$^3$ in 1992.

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2.1.2 Forest area

In historical view Hainan Island may be called an island of forests. In the 1930s, the forest coverage was still above 50%. In 1956 the tropical forests preserved were 863,000 ha, being 25.46% of the total land in the island. In later years economic development demanded the tropical primitive forests to be exploited. The area of the natural forests to be cut and transformed into rubber forests or for planting cash crops was 360,000 ha. That destroyed by fire and slash-and-burn cultivation was 180,000 ha and that abusively felled was 31,000 ha, not to say the great volume of felling by forest industrial enterprises. Up to the end of 1979, the area of natural forests in Hainan Island was only 301,000 ha, being 8.8% of the total land with a growing stock below 20 million m$^3$. The change of area of tropical natural forests in Hainan Island in 1935-1990 is shown in table 7.

Since 1980s, due to high regard by the government, the natural forests were protected and developed. The area of natural regeneration continued to increase. Moreover a large scale planing drive was launched. The statistic data of forest resources in Hainan Province show that up to the end of 1990 the forest area did recover and rise to 770,300 ha of which the area of natural forests was 366,800 ha, and that of plantations was 403,500 ha, with a growing stock above 55.82 million m$^3$. The forest area in 1980-1990 in Hainan Province is shown in table 8 (The data of forest resources inventory recently promulgated by Ministry of Forestry show that in 1992 the forest area in Hainan Island is 1,0663 million ha, with a forest coverage of 31.27%. Of the total area, that of natural forests is 356,100 ha, and that of plantations is 710,200 ha.).
2.1.3 Types of natural forests and their distribution

The major forest types in Hainan Province are: evergreen monsoon rain forest, mixed monsoon rain forest (semievergreen or deciduous forest), tropical forest, low mountain rain forest, medium mountain rain forest, coppice on mountain tops, tropical coniferous forest, mangrove forest and tropical psammon in coastal area. Tropical natural forests are primarily distributed on mountains at an elevation above 500m, with distinct vertical distribution of forest vegetation, the salient features of which are species mixture, multi-storey, uneven age, evergreenness, tall trunk and wide crown. The tropical forests in Hainan are mainly distributed in the forest areas in Wuzhi Mountain, Jianfeng Mount, Bawang Mount, Diaolu Mountain and Limu Mountain. Of them those in Wuzhi Mountain are unexploited primitive forests.

2.1.4 Plant resources and tree species in natural forests

It is estimated that the vascular plants in Hainan Island number about 3,500, belonging to 1,347 genera of 259 families, about 83% of which belong to subtropical family of the pantropical family. The ecologic characteristics of vegetation in Hainan Island are those of the tropical zone, but are different from those of vegetation in the equatorial zone. They have the characteristics of the tropical monsoon vegetation.

Tropical forests in Hainan Island are noted for the rare and valuable tropical wood. The tree species are numerous. Among the 1,400 and more coniferous and broadleaf tree species, the arbors are of 800 species. Of these species 458 are listed as commercial timber species (for the names of species of commercial timber, see appendix 1). There are 85 sorts of wood suitable for ship building and luxury furniture making. The rare and valuable species number 45, of which Hopea hainanensis Merr. et Chun, Daldergia odorifera T. Cheng have been listed as the endangered rare and valuable species that should be protected in Hainan Island (Table 9).

2.1.5 Man-made forest resources

In Hainan Island the construction of man-made forest began in 1952, but large scale afforestation really began in 1982. Up to end of 1992, the area of plantations was 710,200 ha (excluding rubber forests), of which the area of timber forests was over 400,000 ha. Eucalyptus spp., Pinus elliottii and P. taeda are

Table 7 The change of tropical natural forests in Hainan island in 1935—1990

<table>
<thead>
<tr>
<th>Year</th>
<th>Forest coverage(%)</th>
<th>Duration (year)</th>
<th>Average annual change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1947</td>
<td>29.5</td>
<td>12</td>
<td>−1.708</td>
</tr>
<tr>
<td>1956</td>
<td>25.7</td>
<td>9</td>
<td>−0.422</td>
</tr>
<tr>
<td>1977</td>
<td>8.2</td>
<td>21</td>
<td>−0.833</td>
</tr>
<tr>
<td>1990</td>
<td>8.7</td>
<td>13</td>
<td>0.039</td>
</tr>
</tbody>
</table>

Source of data: Researches on the forest development policy in Hainan Province, in 1992.

Table 8 The forest area in Hainan Province in 1980—1990 (1000 ha)

<table>
<thead>
<tr>
<th>Type of forest</th>
<th>Year 1980</th>
<th>Year 1985</th>
<th>Year 1986</th>
<th>Year 1987</th>
<th>Year 1988</th>
<th>Year 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total forest area</td>
<td>509.9</td>
<td>563.3</td>
<td>583.7</td>
<td>625.4</td>
<td>656.2</td>
<td>770.3</td>
</tr>
<tr>
<td>natural forest</td>
<td>260.3</td>
<td>301.5</td>
<td>298.0</td>
<td>298.8</td>
<td>281.4</td>
<td>366.8</td>
</tr>
<tr>
<td>plantations</td>
<td>243.6</td>
<td>231.0</td>
<td>253.5</td>
<td>315.7</td>
<td>374.8</td>
<td>403.5</td>
</tr>
</tbody>
</table>

Classified according to use:
- timber forests | 371.9 | 365.0 | 381.8 | 413.1 | 436.5 | 525.5 |
- econ. forests | 20.2 | 17.1 | 17.6 | 18.7 | 19.7 | 26.0 |
- protec. forests | 116.2 | 120.2 | 123.2 | 132.7 | 138.7 | 145.6 |
- other forests | 1.6 | 61.0 | 61.1 | 61.0 | 61.2 | 73.2 |

the principal species in the plantations among which the *Eucalyptus* spp. share a large proportion. In 1991 the area of *Eucalyptus* plantations was 213,400 ha, being 41.77% of the total area. In Hainan Island the industrial timber forest base with short rotation and with *Eucalyptus* as the main species has been primarily established.

In addition, there are 347,000 ha of rubber forests (not included in table 8) and the annual output of natural rubber is 60% of the national total. In the past the rubber trees felled were used only as fuelwood. Now in Hainan Island researches and attempts are being made by the wood processing enterprises and research units on the rubber wood utilization, and some of furniture factories with rubber wood as materials have been set up.

### 2.2 Tropical forest resources in south Yunnan

The tropical natural forest resources in south Yunnan are mainly distributed in Xishuangbanna Dai Autonomous Prefecture, the rest in Menglian County, Cangyuan County, Dehong Dai, Jingpozu Autonomous Prefecture, Honghe Hani Autonomous Prefecture, Pingbian County and Luchun County in areas bordering on Myanmar, Laos and Vietnam. In addition, there are a few forests in Simao district in the hinterland. Except Xishuangbanna, the area of tropical natural forests in other areas is quite small, and is largely included in nature reserves. Therefore, in the following sections only those in south Yunnan are treated.

#### 2.2.1 Area of natural forests

In south Yunnan the area of tropical natural forests is over 600,000 ha, of which that in Xishuangbanna is about half million ha. Xishuangbanna is situated on the north border of tropical zone, 21°-23°30' N, 99°55' - 101°15' E, with an area of 19,690 km² and a population of 781,700 (1990 statistics).

In the early period in new China, the forest coverage of natural forests in Xishuangbanna was over 60%. After the late 1950s, multiplication of population, reckless reclamation and abusive felling led to drastic reduction of forest area. Statistic data show that in the past 30 years, the loss of all types of forests in Xishuangbanna was about 666,700 ha, with an annual average loss about 20,000 ha. Up to 1990, the forest area in Xishuangbanna was about 526,200 ha, with forest coverage reduced to 27.51%. Mengla is a county where the forests suffer less destruction and are noted for the most apparent features of the tropical and subtropical vegetation. Here the area of tropical forests is 379,600 ha being 72.1% of the total forest area in Xishuangbanna, with a forest coverage of 55.4%.

### Table 9 The catalogue of the endangered rare and valuable species that should be protected in Hainan Island

<table>
<thead>
<tr>
<th>Class of protection</th>
<th>Scientific name</th>
</tr>
</thead>
</table>
According to the division of vegetation in China, south Yunnan is a tropical monsoon rain forest and semievergreen monsoon rain forest zone, with vertical vegetation spectrum comprising seasonal rain forest, mountain rain forest and mountain evergreen hardwood forest.

Here in the tropical forests the plant species are numerous. For example, in Xishuangbanna the known higher plants are over 3,500 species, being about 12% of the national total. As Xishuangbanna is long under the influence of tropical monsoon, the biological and climatical conditions are excellent. Since the tertiary period in geological history, no big cataclysm occurred here, and a part of ancient tropical plants survived, thrived and developed. Its distribution is a continuation of those in relevant areas in Southeast Asia, with various transitory forms. Plant species in different geological ages and elements of different flora often congregate in one biozone, forming a rare distribution area of tropical plants containing rare and valuable species, relic species (living fossil) and endemic species.

An investigation shows that there are over 60 arbor species in each 100 m² of the tropical rain forests in Xishuangbanna. In each 150 m² of mountain rain forests in areas at an elevation of 1,400m, and in border areas of the tropical monsoon evergreen hardwood forests in South Asia, there are 30 arbor species in the first storey, and in other storeys there are 70 arbor and arbustum species. The principal species in tropical rain forests are *Parashorea chinensis* Wang Hsie., *Vatica fleuryana* Tard. -Blot, *Tetrameles nudiflora* R. Br., *Pometia tomentosa* (Bl.) Teysm. et Binn., *Nepheleium chryseum* Bl., *Terminalia myriocarpa* Huerc h et M. -A., *Knema furfuracea* (Hook. f. et Thomas.) Warb., *Horsfieldia pandurifolia* Hu., *Myristica yunnanensis* Y. H. Li, *Crypteronia paniculata* Bl., *Homalium laoticum* Gaga, *Gironniera yunnanensis* Hu, *Baccaurea ramiflora* Lour., and *Beilschmiedia yunnanensis* Hu. The principal species in monsoon rain forests are *Stereospermum tetragonum* DC, *Pauldopia ghorta* van Steenis, *Dolichandrone stipulata* (Wall) Bent h. et Hook f., *Mayodondron igneum Kurz., Chakrasia tabularis* A. Juss., *Gmelina arborea* Roxb., *Gossampinus malabarica* (DC) Merr., *Antocephalus chinensis*, *Dubaanga grandiflora* Walp., etc. Among the 316 commercial timber species known in Xishuangbanna Nature Reserve, 182 are valuable commercial timber species (for the name of species, see appendix II), of which the *Parashorea Chinensis*, *Gmelina arborea* and *Vatica fleuryana* have been listed in the first group of the Catalogue of the Endangered Rare and Valuable Plants that Should be Protected in China. Table 10 shows the total number of 54 endangered rare and valuable plants in Xishuangbanna Nature Reserve, that is 15% of the plants which should be protected in the whole country, and 36% of in

<table>
<thead>
<tr>
<th>Class of protection</th>
<th>Scientific name</th>
</tr>
</thead>
<tbody>
<tr>
<td>First class</td>
<td><em>Cyathea spinulosa</em>, <em>Parashorea chinensis</em></td>
</tr>
<tr>
<td>Second class</td>
<td><em>Amentotaxus yunnanensis</em>, <em>Camellia sinensis</em>, <em>Caryota urens</em>, <em>Cephalotaxus oliveri</em>, <em>Cephalotaxus hainanensis</em>, <em>Felu tharhena macrocarpa</em>, <em>Gmelina arborea</em>, <em>Litchi chinensis</em>, <em>Mesua ferrea</em>, <em>Oryza granulata</em>, <em>Oryza officinalis</em>, <em>Tetrameles nudiflora</em>, <em>Trigenobalanus doichangensis</em>, <em>Vatica fleuryana</em></td>
</tr>
</tbody>
</table>

Source: Natures Reserves in Yunnan, 1989
2.2.3 Man-made forest resources

The man-made forests in tropical areas in south Yunnan are mainly rubber plantations (the area of which is not included in the area of tropical forests) and largely distributed in Xishuangbanna, with an area about 90,000 ha. In addition, a few fast-growing and high-yield timber forests, fuelwood forests and headwater conservation forests are constructed.

3 Protection Policies and Measures for Tropical Forests in China

Tropical forests are the largest treasure house of plant and animal resources in the world. The closed tropical forests with an area of only 8.8% of the land area of the earth accommodate more than 2.5-5 million species, being about half of the world total. The ecosystem of tropical forests is very delicate and vulnerable. Once destroyed, it can never be restored to original state. Tropical natural forests are noted for their structural traits of numerous species and genera, multistorey, evergreenness and species mixture, playing an important role in keeping ecological equilibrium, preventing soil and water erosion and in headwater conserving. The destruction of tropical forests not only brings about the drastic decrease of biological diversity, but also causes the hydrological and environmental deterioration, even a warmer climate. Since 1980s, the area of tropical forests in the world decreased surprisingly at an annual rate of 16.78 million ha, producing ill effect on the climate and environment of some areas or even the whole world. So the protection and rational exploitation of tropical forests have become a hot topic in the world circles of forestry and environmental protection, and draw close attention of all countries.

Tropical forests in China are located on the northernmost border of tropical mixed forests in the Asia and Pacific Region. In other regions in the world there are no forests of such nature. So they are the treasures donated by Nature. As the two existing tropical forest areas are situated at the north border of tropical zone and at the dry and wet alternating tropical climatic transitory section, heat and water are at marginal state and the forest ecosystem is also at the marginal state of tropical rain forests. If the forests are not rationally used or even destroyed, the vegetation will soon be subject to a downward succession, resulting in sharp decrease of biological diversity, with forest ecosystem becoming pure and heliophilous.

The tropical species resources in China are only next in number to those in Brazil and Malaysia. The tropical natural forests in China play a critical role not only in keeping the local natural ecological equilibrium, contributing to social economic development and coordinated development of environmental protection, but also in deeply influencing the protection of species resources and the climatic change and water cycling of the earth. So the protection of the tropical forests here is of worldwide importance.

Being similar to the causes of destruction of tropical forests in other regions in the world, the serious destruction of tropical forests in China in past several decades was mainly due to reclamation by destroying the forests, excessive fuel gathering, reckless felling, natural disasters and inappropriate state policies. The inhabitants in the tropical forest areas in Hainan Island and Xishuangbanna are mostly minorities. Their life depends on simple farming with grain as the major crop. With backward production tools, they still adhere to the traditional custom of slash-and-burn cultivation. Owing to this tradition, the area of forests destroyed annually is 2,700 ha in Hainan, and 23% of the population in Xishuangbanna depend on this mode of cultivation for existence.

Moreover, the rural energy needed by the processing of farm crops and by-products, the processing of tropical crops, and the making of bricks, tiles and limes in the tropical forest areas is largely fuelwood. In 1989, the consumption of growing stock for farm crop and by-product production and daily life in Hainan Island was 1.558 million m³, being 62.5% of the provincial total. In recent years the average annual consumption of fuelwood in Xishuangbanna is about 800,000-900,000 m³. Calculated according to growing stock, 2,500-3,300 ha of forests must be felled each year to meet the demand for fuelwood in the prefecture.

In 1950s and 1960s, large scale transformation of forests into rubber forests, forest fires and excessive felling by the forest industrial enterprises are also the main cause of the disappearance of large area of tropical natural forests in China.

The decrease of natural forests in a wide range leads to the deterioration of the local ecological environment and the frequency of natural disasters. For example, in 1956 and 1980 the area of tropical natural forests in Hainan Island decreased by over 2/3, resulting in abnormal change of climate. Before 1960s, a spring drought occurred every four years and a summer drought occurred every three years, while in the 10 years after 1970s there were 8 years with spring drought and 6 years with summer drought. Moreover, in rainstorms serious soil and water loss occurred. Now as most of tropical natural forests are grown in the neighbourhood of minorities, the quality of stands has decreased drastically.

China began to protect the tropical forests in 1950s, but only after 1980s attention was really paid to their protection. In 1980 the State Council adopted a policy that the construction of tropical forests must observe the rule of "protection, restoration and development". On basis of this policy, the central and local governments adopt a series of new policies and measures to protect and develop the tropical forest resources to the maximum extent.

3.1 Establishment of nature reserves for tropical forests

The first tropical forest nature reserve in China was the nature reserve in Xishuangbanna established in 1950. Later the establishment of tropical forest nature reserves was interrupted. Since 1980s, due to conscientious understanding of the
important role of tropical forests and the urgency to energetically protect the tropical forests, the Chinese government sped up the establishment of tropical nature reserves. For example, a lot of tropical forest nature reserves such as those in Jianfeng Mount, Wuzhi Mountain and Bawang Mount were sooner or later established. In Yunnan a new program was made to establish the nature reserves in Xishuangbanna, and 8 more nature reserves such as those at Tongbiguan, Fengshuiling and Daweishan were set up with the protection of the tropical forest ecosystem as the main role. In other tropical areas, the rest scattered tropical natural forests small in size have been primarily included in the local nature reserves.

3.1.1 Tropical forest nature reserve system in Hainan Island

Statistic data show that up to 1990, 14 tropical forest nature reserves have been established in Hainan Province (Table 11), with a total area of 76,932 ha, being about 21% of the area of all the tropical natural forests in Hainan Island. With the area of those tropical natural forests for protection off wildlife and plants added, the total area of tropical natural forests included in nature reserves is about 81,300 ha.

The nature reserves consist of tropical mountain rain forests, tropical secondary monsoon rain forests and the mixed mountain forests with the evergreen monsoon rain forests as the basic belt, and form various tropical forest ecosystems,

<table>
<thead>
<tr>
<th>NR or management</th>
<th>Area (ha)</th>
<th>Locality</th>
<th>Major objects of prot.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jianfeng Mount NR</td>
<td>1,600</td>
<td>Ledong</td>
<td>mixed mountain forest ecosystem with evergreen monsoon rain forest as the basic belt</td>
</tr>
<tr>
<td>Diaoluo Mountain NR</td>
<td>4,000</td>
<td>Lingshui</td>
<td>tropical mountain rain forest system</td>
</tr>
<tr>
<td>Wuzhi Mountain NR</td>
<td>18,667</td>
<td>Qionghai</td>
<td>ditto</td>
</tr>
<tr>
<td>Nanlin Forest Management Office</td>
<td>4,400</td>
<td>Wanning</td>
<td>tropical second. monsoon rainforestry</td>
</tr>
<tr>
<td>Jiaxin Forest Management Office</td>
<td>2,667</td>
<td>ditto</td>
<td>ditto</td>
</tr>
<tr>
<td>Jianfeng Mount Forest Management Office</td>
<td>2,600</td>
<td>ditto</td>
<td>ditto</td>
</tr>
<tr>
<td>Shangxi Forest Management Office</td>
<td>2,133</td>
<td>ditto</td>
<td>ditto</td>
</tr>
<tr>
<td>Huishan Forest Management Office</td>
<td>5,333</td>
<td>Qionghai</td>
<td>ditto</td>
</tr>
<tr>
<td>Fanjia Forest Management Office</td>
<td>5,333</td>
<td>Danxian</td>
<td>ditto</td>
</tr>
<tr>
<td>Jiaxi Tropical Coniferous NR</td>
<td>8,333</td>
<td>Ledong</td>
<td>tropical mountain coniferous forests of Pinus strobus in Hainan Island</td>
</tr>
<tr>
<td>Tonggu Mount Natural landscape NR</td>
<td>1,000</td>
<td>Wenchang</td>
<td>natural landscape of tropical secondary monsoon rain forests</td>
</tr>
<tr>
<td>Nanxi Tropical Forest NR</td>
<td>15,333</td>
<td>Baisha</td>
<td>tropical second. monsoon rain forests</td>
</tr>
<tr>
<td>Qizhi Mountain NR</td>
<td>3,000</td>
<td>Baoting</td>
<td>headwater conservation forests</td>
</tr>
<tr>
<td>Qinzun NR</td>
<td>2,533</td>
<td>ditto</td>
<td>ditto</td>
</tr>
<tr>
<td>Total</td>
<td>76,932</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source of data: Nature Reserves in Hainan, 1990
facilitating species protection in tropical forests and being important sites for researches on these forests.

But to be viewed in light of proportion, the proportional protected area of tropical forests in Hainan Island is still low. In the period of the Eighth Five-year Plan, the priority on nature reserves was that set on protection of tropical natural forests, and a plan was made for all the tropical primitive forests to be included in nature reserves at different stages.

3.1.2 Tropical forest nature reserve system in Yunnan Province

<table>
<thead>
<tr>
<th>Nature reserve</th>
<th>Area (ha)</th>
<th>Major objects of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xishuangbanna</td>
<td>241,776</td>
<td>tropical rain forest, monsoon rain forest and rare animal population</td>
</tr>
<tr>
<td>Guishan</td>
<td>54</td>
<td>valuable medical plants</td>
</tr>
<tr>
<td>Nangunhe</td>
<td>6,983</td>
<td>Asiatic elephant and the ecologic environment of its habitat in the tropical forests</td>
</tr>
<tr>
<td>Tongbiguan</td>
<td>34,158</td>
<td>tropical seasonal rain forests</td>
</tr>
<tr>
<td>Fenshan Mount</td>
<td>10,761</td>
<td>natural landscape and valuable animal and plant resources in the mountain moss evergreen hardwood forests</td>
</tr>
<tr>
<td>Dawei Mountain</td>
<td>15,365</td>
<td>natural landscape and rare and valuable plant and animal species</td>
</tr>
<tr>
<td>Laojun Mountain</td>
<td>4,509</td>
<td>ditto</td>
</tr>
<tr>
<td>Huanglian Mountain</td>
<td>13,935</td>
<td>ecosystem of evergreen hardwood forests</td>
</tr>
<tr>
<td>Caiyanghe</td>
<td>7,035</td>
<td>natural landscape and rare and valuable animals in tropical rain forests, and tropical forests in South Asia</td>
</tr>
</tbody>
</table>

Source of data: Nature Reserve in Yunnan, the China Forestry Publishing House, 1989

<table>
<thead>
<tr>
<th>Xishuangbanna NR</th>
<th>Total area</th>
<th>Natural forests</th>
<th>Bamboo forests</th>
<th>shrubbery</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole NR</td>
<td>241776</td>
<td>197819</td>
<td>14316</td>
<td>2724</td>
<td>26917</td>
</tr>
<tr>
<td>Mengla Office</td>
<td>92932</td>
<td>74409</td>
<td>727</td>
<td>1618</td>
<td>16178</td>
</tr>
<tr>
<td>Shangyong Office</td>
<td>30538</td>
<td>25234</td>
<td>2095</td>
<td>612</td>
<td>2597</td>
</tr>
<tr>
<td>Mengcang Office</td>
<td>11242</td>
<td>10115</td>
<td>251</td>
<td>271</td>
<td>605</td>
</tr>
<tr>
<td>Mengyang Office</td>
<td>99760</td>
<td>81086</td>
<td>11243</td>
<td>57</td>
<td>7374</td>
</tr>
<tr>
<td>Mangao Office</td>
<td>7304</td>
<td>6975</td>
<td></td>
<td>166</td>
<td>163</td>
</tr>
</tbody>
</table>

Source of data: Comprehensive Investigation Reports on Nature Reserves in Xishuangbanna, 1987
area of hardwood forests is 197,417.4 ha, being 99.8% of the total, and that of coniferous forests 401.7 ha, being 0.2% of the total. The total growing stock is 39.6 million m³, with an average growing stock of 200 m³/ha. The highest growing stock per unit area is that of the Parashorea chinensis Wang Hsie forests, to be approximately 1,000 m³/ha.

In the nature reserve of Xishuangbanna, the area of primitive tropical rain forests and monsoon rain forests is 17,000 ha, being about 7% of the nature reserve area. These are the only well preserved primitive tropical forests in China, being deemed very valuable. The growing stock of them is 3.54 million m³, being about 8.9% of the total growing stock of natural forests in the area.

3.2 Implementation of the economic support policies and improvement of people's life step by step

The protection of tropical forests is closely related with the inhabitants' living standard and mode of production. Poverty and slash-and-burn cultivation are the main causes of the destruction of tropical forests by the inhabitants, also the cause of rapid disappearance of tropical forests.

The principal tropical forest areas are inhabited by minorities. Due to backward production tools and technique, they have to practise slash-and-burn cultivation with fuelwood as the chief source of energy. Over 60% of growing stock consumed each year are fuelwood. How to bring the advantages of the mountain areas into full play and to promote the living standard of the minorities have become problems with which are concerned all the people who take interest in tropical forests. It is also the focal point relevant to whether the tropical natural forests can be really protected.

The Chinese government adopts a series of policies to help the poverty stricken areas, supporting the local inhabitants to develop production and to establish residential areas. Each year tens of millions of yuan are allocated to them gratis, or long-term interest-free and low interest credits are given for economic development of these areas. Since 1981 the state allocated subsidies of 20 million yuan each year to the undeveloped areas in Hainan Island.

The program and immediate objective of Hainan Province are: (1) resolving the contradiction between agriculture and forestry in struggle for land, continuing to make more financial allocations, strengthening the capital construction of farms, and maintaining the fixed arable land. The first step is to let the more than forty thousand minority people to settle down in fixed localities, to change the custom of slash-and-burn cultivation, to promote the grain yield and to solve the problem of food; (2) implementing economic and technical support policies to bring the advantages of natural resources in mountain areas into play, implementing a dual-purpose policy of fully using resources and protecting the natural ecologic environment, to make a comprehensive utilization of the forest products and by-product resources to increase economic returns and to accelerate the economic development in the mountain areas.

The local government is prepared to build up forest villages, edifying and instructing them and giving financial aids to the minorities who practise slash-and-burn cultivation and lead a normal life in the forest areas to remove to neighbourhood to settle down, to till fixed arable land, to develop agricultural production and to construct and protect forests. The concrete measures are: (1) Support is given to build houses, schools and roads, to establish utilities to promote the living standard; (2) Farmland is well transformed and agricultural technical training course is held to promote the development of agricultural production; (3) Farmers are encouraged to manage the state forests by contract, to do afforestation and take charge of forest protection with subsidies given by government; and (4) Farmers are helped to develop cash crops of the collectives, to improve the natural ecology by planting trees and to increase personal income.

The general purpose is to turn the negative factors into positive factors, and to turn the destroyers of tropical forests into protectors and foresters. In this way not only the tropical natural forests can be protected, but also the inhabitants in the forest areas can earn a life.

Since 1982, the government of Yunnan Province formulated and implemented sooner or later some special policies in the shifting cultivation areas: farmers are exempt from payment of public and surplus grain, and from agricultural tax; grain is allocated or sold to them as a token of reward for the cash crops handed in or sold to the state; under the guidance of the central government policy, the local governments allocate the farmers in the mountain areas small private lots of forests. These efforts made by the local governments at all levels have achieved good results. Consequently the pressure of shifting cultivation on tropical forests has been significantly reduced and the tension in destroying forest for farmland has been eased.

3.3 Gradual reduction of felling in natural forests and carrying out sustainable management of tropical forests

Wood production is also a cause of large scale destruction of tropical natural forests. For example, in Hainan Island more than 10 state forest industrial enterprises managed over 100,000 ha of tropical natural forests which are basically in primitive state. In the past 30 and more years, wood was the single object of management, with felling as the chief means. In the past the highest planned annual production of wood was 360,000 m³. Excessive felling led to great destruction of the natural forests here, with sharp decrease of stand quality.

Although in south Yunnan there are no large state forest industrial enterprises in the tropical forest area, yet with the local economic development and the rapid growth of population, the volume of wood needed by local industries also increases rapidly.
With gradual understanding of the role of tropical forests, the local governments and the wood production units began to decrease the wood production in the tropical natural forests and changed the mode of production with wood as the single object. From 1980 onwards, the state forest industrial enterprises in Hainan Island began to change the mode of production and carried out a policy of "with silviculture as the base, forest felling is combined with culture for sustainable utilization of forest". After 1984 the felling of natural forests was limited to 60,000-70,000 m$^3$/yr. The government gave to the forest industrial enterprises which had changed the mode of production with silviculture as the main role, subsidy to make up for the deficit incurred in a certain period. According to the forest felling quota in 1991-1995 reported by Hainan Province and ratified by higher authority, the consumption of forest resources in the whole province was 1.25 million m$^3$/yr, the decrease being almost half of the consumption in 1989. Moreover, gradual reduction of felling in the natural forests was specially emphasized. In August 1993, a forest industry conference was held in the province, with a decision made for forestry to make a strategical shift from the industrial mode to ecologic mode. One of the measure was from January 1 1994 onwards, all felling in the natural forest in the province was prohibited. The felling volume in Xishuangbanna in 1991-1994 will be rigidly limited.

3.4 Great effort devoted to establishment of plantations and mitigation of pressure on natural forests

Another important measure taken by the Chinese government to protect the tropical forests is to actively establish plantations and to set up fast-growing and high-yield forest bases to meet the local demand for wood.

In the tropical areas there are high solar radiation, long duration of sunshine and rich water resources, which favour the fast growth of trees. So here are the ideal areas for development of plantations. Environmental protection and the modern ideology in line with economic development are demanding that in the tropical areas great effort must be made to establish plantations, for Hainan, Guangdong and Fujian provinces are coastal areas where economy develops faster.

The establishment of plantations began in 1952 in Hainan, but the 1979 forest resource investigation shows that in the island the area of forests retained was only 213,000 ha. However, the successful establishment of protection forests in coastal plains with an area approximating 70,000 ha remarkably changed the distribution of forests in the island and effectively avoid the threats of wind and sand disasters, laying a good foundation for production and living environment in the coastal plainbelt.

After a contractual production responsibility system was implemented, tree planting by contract was deemed as commercial production and the establishment of man-made forests entered into a new stage in Hainan. Especially after 1982, during the period when high yield forests were being built, a large scale afforestation drive was launched with the quality of forest greatly improved. In the 12 years from 1980 to 1992, the area of plantations was 551,000 ha, with the forest coverage to be increased from 15% in 1980 to 31.27% in 1992. Especially in recent 3 years, forest construction was accelerated. In 3 years, the forests established was 96,700 ha, being 141% of the planned target. Up to the end of 1992, the area of plantations reached 710,200 ha in Hainan Province.

In Xishuangbanna located in a border area to hinterland and in other tropical areas in China, man-made forests are also being developed. The local governments also encourage the masses of people to plant trees, and permit them to grow farm crops or cash crops in the forests. State farms and township enterprises are allowed to build timber forests and fuelwood forests on which they should mainly depend to produce timber or to gather fuelwood for own use, so as to mitigate the pressure on the natural forests.

The development of plantations also infuse vitality into the local social and economic development. For example, the fast-growing and high-yield plantations established since 1982 began to be felled in succession with significant economic returns obtained in Hainan Province. In 1988, the foreign exchange earned by export of Eucalyptus timber and chips was 1.3 million US dollars, that in 1989 was 2.6 million US dollars, in 1990 7.81 million US dollars, and in 1991 14.69 million US dollars. They stood in the foremost ranks in the commercial goods to earn foreign exchange in the whole province. This fact shows that the management of plantations is not only the most effective way to protect the natural forests, but also the most promising means to promote the economic development in the tropical border areas in China because of the high benefits and high income to the inhabitants.

4 A Brief Description of Tropical Wood Production and Forest Products in Recent Five Years

4.1 Tropical wood production and consumption

Since 1980s, due to the adoption of a policy to protect, restore and develop the tropical natural forests, the felling volume in natural forests in China gradually decreased. From 1984 onwards, the felling volume in natural forests in Hainan Island was limited to about 60,000 m$^3$. From January 1 1994 onwards, all felling in natural forests will be prohibited. Consequently, since the late 1980s, the wood production in Hainan Province was shifted to plantations. In 1988-1992, the increased wood production in Hainan Province was mainly due to the fast-growing timber plantations of Eucalyptus spp. established in the early 1980s. Table 14 shows that the wood production in Hainan Island in 1988-1992 the proportion of log increased rapidly, from 47.2% in 1988 to 80.3% in 1992. This indicates that in recent years the wood consumption structure in Hainan Island prescribed by the state guidance planning has remarkably improved.

Except in Xishuangbanna all tropical forests in South Yunnan
are small in size and are mostly included in nature reserves, so they give less wood yield. The tropical forests in Xishuangbanna are also the priority forests to be protected by state. No demand for wood production is assigned them by state, and the wood produced is mainly used locally. Therefore the annual wood production is largely kept at 80,000-100,000 m$^3$ (Table 14). In 1991-2000 the annual felling quota in Xishuangbanna is 200,000 m$^3$. When converted into commercial timber it is 95,000 m$^3$.

Due to economic backwardness of the area, the traditional wood consumption was mainly non-production consumption, namely with wood as the source of energy. For example, in 1989 the consumption of growing stock was 2,488 million m$^3$. in Hainan, of which the consumption for production was only 748,000 m$^3$, being 30.1% of the total growing stock while the non-production consumption was 1,588 million m$^3$, being 62.5% of the total consumption (Table 15). Of the wood produced in Xishuangbanna, that consumed as source of energy was above 2/3, while the wood used in production was less than 1/3.

4.2 Processed products of tropical timber

<table>
<thead>
<tr>
<th>Item</th>
<th>Hainan Province</th>
<th>Xishuangbanna Autonomous Prefecture</th>
<th>Yunnan Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood production * log</td>
<td>202.9</td>
<td>238.2</td>
<td>225.0</td>
</tr>
<tr>
<td>Sawnwood</td>
<td>45.8</td>
<td>25.0</td>
<td>50.3</td>
</tr>
<tr>
<td>Chips</td>
<td>—</td>
<td>6.0</td>
<td>59.3</td>
</tr>
<tr>
<td>Wood-based panel</td>
<td>4.1</td>
<td>5.0</td>
<td>12.3</td>
</tr>
<tr>
<td>plywood</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>fiberboard</td>
<td>—</td>
<td>—</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Note: * the wood production refers to that included in the state guidance planning.


China is not rich in tropical forest resources. Moreover, these resources are distributed in the area of ethnic minorities where economy is not developed due to lack of transport facilities. Hence over a long time wood is mainly used as fuels, while industrial utilization is limited. Of the small part of wood industrially utilized, most are primary products (with sawnwood as the main), and the wood-based panel industry is still in the initial stage. For instance, before 1988, in Hainan Island and Xishuangbanna the wood products were simple in variety. Only sawnwood and a small amount of plywood were produced, with a low utilization coefficient in processing.

In 1988 the Hainan Province was formally inaugurated and became the largest special economic zone in China. The economy developed rapidly, and the wood processing industry also boosted a tremendous development. Table 14 shows that the output of sawnwood increased from 45,800 m$^3$ to 115,800 m$^3$ in 1988-1992. The increase was over 2 times, and the variety was not limited to plywood. Two more varieties were added: particleboard and veneer.

Chip is a wood product produced only after the fast-growing and high-yield plantations established in 1980s entered the stage of felling. Due to the considerable demand for chips in the
world market, the chip production in Hainan Province began to develop with a surprising momentum. In 1989 the initial output of chips was 6,000 m³. In 1992 it was 218,000 m³, with an average annual increase of 231%. In 1991 the foreign exchange earned by export of *Eucalyptus* wood and chips was 14.69 million US dollars. They become the major products that can earn foreign exchange in Hainan Province. It is expected that in the several coming years as the *Eucalyptus* plantations enter the final stage of felling, the chip production will be further greatly developed.

In recent years in Hainan Province remarkable progress has been made in the furniture making industry. Through introduction of modern equipment, technical innovation and mill expansion, the quality of furniture is improved with variety increased. A complete series of products are produced, including furniture made of solid wood, boards or of composite wood. The enterprises engaged in furniture making are more than 20, with an output value over 8.5133 million yuan.

In Xishuangbanna except sawmills, there is only one small plywood mill, established in 1980s, and the annual plywood production in 1990 was 1,100 m³. In 1990, 25,600 pieces of wooden furniture were produced in Xishuangbanna, with an output value of 1.1247 million yuan.

In a word, the utilization and processing of tropical wood in China are at a low level. Neither the production or the structure of the products is desirable. Hence under the principle of sustainable management, how to rationally utilize the tropical resources to accelerate economic development in the coming years is a problem worthy of research in the tropical forest areas in China.

5 An Outlook over Tropical Forest Resources in China in the Year 2000

5.1 An outlook over the development of forest resources in China

In the early 1990s both the area and growing stock of forest in China increased, with a slight increase of forest coverage. This indicated that a new breakthrough was made in the development of forest resources in China. But in light of the high population density in China the forest resources are still in adequate. The relation between forests, territory and environment remains in tension. The demand for wood and wood products due to economic development and for people’s life exceeds the capacity of acceptance of forest resources. Now the problems existing are the continual decrease of available timber forest resources, the continual dwindling of the area of the mature and overmature timber forests, and the serious loss of the forested land. The crisis in forest resources has not been thoroughly

| Table 15 Consumption of growing stock and consumption structure in Hainan Province in 1989 |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Consumption**                 | **Amount and proportion** | **Handed over to state** | **Sold to other provinces** | **Used in localities** | **Used by collectives below county level** | **Used by farmers** | **Loss due to transport in the felling area** | **Other uses** | **Total** |
| **Consumption for production**  | **Amount (1000m³)** | 111 | 151 | 48 | 313 | 21 | 104 | 748 |
| **proportion (%)**              | **4.5** | **6.0** | **2.0** | **12.6** | **0.88** | **4.2** | **30.1** | **-** |
| **Non-production consumption**  | **For construction in the forest area** | **For industrial and sideline production** | **For urban life** | **For rural life** | **Used in farming** | **Total** |
| **Amount (1000m³)**             | **1** | **148** | **660** | **747** | **2** | **1558** |
| **proportion (%)**              | **6.0** | **26.5** | **30.0** | **0.1** | **-** | **62.6** |
| **Loss due to disasters**       | **Forest fire** | **Disease and insect** | **Other loss** | **Used in other ways** | **Total** |
| **Amount (1000m³)**             | **1** | **79** | **112** | **182** |
| **proportion (%)**              | **2.8** | **4.5** | **7.3** | **-** |
| **Total**                       | **2488** | **-** | **-** | **-** |

Source of data: Forest Bureau, Hainan Province; A Report on Consumption of Forestry Resources in the whole province, 1990
To proceed from the present real situation of forest resources, China is prepared to adopt comprehensive management measures. On one hand, measures are taken to strengthen the management of forest resources and the forest administration. First priority is set on controlling the consumption of the forest resources as the main work with active effort made to adopt new technology and new methods to provide accurate figures and to grasp dynamic consumption of forest resources in time. Regulations and systems should be perfected with the forests managed according to the strict regulations of a law. Great effort should be made to strengthen the rational and scientific management of the existing forests to promote the productivity of forest land. On the other hand, tree planting is sped up to develop the forest resources. With the existing forest areas and priority forest counties as the base, and with priority set on reproduction and remodelling of the low yield stands and on improvement of their quality, forest land is divided in accordance with an unified program and all-round arrangement, and timber forest production bases are established under intensive management. Fast-growing and high-yield plantation production bases are established in areas with better heat and water conditions. The proportion of fuelwood forests is increased, and efforts are made to develop the economic forest production bases to produce famous, special and excellent commodities. The seven projects of protection forest systems, such as the "Three North" (northeast, northwest, and north China) protection forest system, the protection forest systems at the middle and upper reaches of the Yangtze River, the protection forest system in coastal areas, the greening project in Taihang Mountain, the protection forest system along the Huai River (Tai Lake), the protection forest system in the Zhu River valley and the greening project in the plains, prescribed in the Seventh Five-year Plan are continually carried out. The purpose is to protect, restore and expand the forest vegetation to check the soil and water loss as the main task, and to establish stable, multifunctional artificial ecological project systems.

According to the Ninth Five-year Plan formulated by the Ministry of Forestry and the major development objectives set in the 15 year program, the area of forested land in China in 1995, 2000 and 2010 will reach 138 million, 147 million and 160 million ha, respectively, with the forest coverage increasing to 14.4%, 15.3% and 16.7% respectively, and the stand stock amounting to 11.16 billion, 11.71 billion and 13 billion m³, respectively (Table 16).

### 5.2 Management objectives of tropical forest resources in China and the development in the future

In recent years significant achievements have been made in the management of tropical forest resources in China. The latest forest inventory data show that the forest area in Hainan Province has been restored and amounts to 1.0633 million ha and the forest coverage has increased to 31.27%, both of which has doubled the figures of 1980.

Hence-forward in the whole tropical forest area the general policy formulated in 1980s of forest restoration and development with its protection as the main role will be continually carried out. Sustainable management and utilization of tropical forests will be realized step by step through classified forest management and the concrete measures of establishing three systems: nature reserve system, tropical natural forest system and protection forest system, and of setting up a fast-growing and high-yield timber forest production base.

#### 5.2.1 Establishment of a perfect system of nature reserves

The establishment of nature reserves is an important measure to protect the tropical natural forests and species resources. Hence-forward the area of nature reserves will be enlarged by either broadening the old ones or adding new ones with the management work strengthened. Efforts are being made to set up a tropical nature reserve system in the year 2000, with the outlay as rational as possible and the objects of protection as complete as possible. The Chinese government has a plan to have all the tropical primitive forests to be included in the nature reserves, and expects to increase the total area from 500,000 and more ha now to 400,000 ha of which those in Hainan Province will be 120,000 ha, and those in South Yunnan 250,000 ha. These nature reserves are not only the core of tropical forest ecosystem, but also the tropical forest research base.

#### 5.2.2 Restoration and development of tropical forest system

The tropical natural forest system plays the principal role in

| **Table 16 The major development objectives of forest resources in China in 1995—2010** |
|---------------------------------|-------|-------|-------|
| **Item**                        | 1995  | 2000  | 2010  |
| Area of forested land (million ha) | 133   | 147   | 160   |
| Forest cover percent (%)         | 14.4  | 15.3  | 16.7  |
| Total stand stock (billion m³)   | 11.16 | 11.71 | 13.0  |
| Total forest growth (million m³) | 396   | 441   | 494   |
| Growth of timber forests (million m³) | 250   | 276   | 287   |
maintaining the ecologic environment of the tropical forest areas. The Chinese government's management policy for this system is to let it first give ecologic benefits and to bring into full play its function in headwater conservation, soil and water conservation and gene preservation. At the same time on the basis of maintaining the natural regeneration and natural development of forests, proper management measures should be taken to improve the mode of felling, to culture the invaluable hardwood species and to produce medium and large dimension tropical stock. The policy of "sustainable utilization" must be carried out in the management of natural forests with forest felling combined with culture and with clear cutting prohibited at all. The secondary forests should be cultured by hill closure. In areas with serious soil erosion, the farming on steep slopes should be stopped with the fields restored to forest land. The tropical natural forest system forms the largest proportion of forests in the tropical areas and plays a multiple function. Hence it is also the multi-functional forest system in the tropical areas. In order to give the natural forests in Hainan Province a chance of recuperation, the State Planning Commission plans to grant a credit of 100 million yuan to help the local forest logging enterprises to develop diversified management so as to reduce felling of the natural forests.

5.2.3 Further expansion of the protection forest system

The coast-line of Fujian, Guangdong, Guangxi and Hainan provinces is long, and they suffer much from the assault of typhoon. The desertification in the coastal areas is also serious. The protection forest system is the important protective screen for agricultural production and people's life. As above mentioned, the protection forests in the coastal plains with an area approximating 70,000 ha established in 1970s remarkable improved the distribution of forests in Hainan Island and effectively reduced the threats of wind and sand disasters, greatly benefiting the production and improving the living environment. This is a good example of protection forests. In the coming years the central government will grant the province each year a fund of 4.8 million yuan for agricultural development, ordering it to establish protection forests with an annual area of 5,500 ha.

Now there are about 400,000 ha of protection forests in the tropical coastal areas in China. They include bank protective forest, wind-breaking and dune-fixing forest, shelter belt, soil and water conserving forest and headwater conserving forest. It is planned that in the year 2000 the area of tropical protection forests in China will increase to about 1.2 million ha (620,000 ha in Guangdong, 150,000 ha in Guangxi and 400,000 ha in Hainan). In the hinterland in the tropical areas, protection forests are also being built. The establishment of these protection forests should be in accordance with the characteristics of local natural circumstances, be well planned, taking into account the diversity of species and functions. Emphasis should be placed on forest protection in combination with management.

5.2.4 Speeding up the construction of tropical timber plantation system

The construction of such forest base can mitigate the pressure on natural forests due to short supply of timber. Therefore on it depends the success of the other three forest systems. The establishment of tropical timber forests in China has given primary results, and they begin to substitute for the natural forests to bear the load of timber production.

Henceforward in the well qualified tropical areas a lot of timber plantation bases with medium rotation and with valuable species such as Tectona grandis will be established so as to improve the species structure in the tropical plantations. In areas with better conditions large scale timber forest bases with short rotation and directive culture will be constructed, with funds raised through various channels such as the World Bank credit, state investment and the fund raised by the masses of people. At the same time when the timber forest bases are constructed as quickly as possible, efforts by the local forestry agencies will be devoted to promoting the manage-level of the tropical plantations.

In 2010 the Chinese government will establish 8 million ha of fast-growing and high-yield timber forests, among which 20-25% will be in the tropical and subtropical areas. Hence the forests of such a nature will have a broad prospect of development.

5.3 The prospect of tropical wood processing and utilization in China

In 2300 major part of the tropical wood will be produced in the plantations. Due to small diameter of log, the wood processing and utilization will be diverted to panel making, pulping and paper making.

The strategical objective of development of the plantations in 2000 in Hainan Province is to expand the area of the Eucalyptus plantations to 366,700 ha with the annual volume of felling reaching 3.85 million m³. According to such as objective, the government of Hainan Province has mapped out a plan to set up two paper mills, one with a capacity of 100,000 t, one with a capacity of 50,000 t, 1 MDF factory with an annual capacity of 50,000 m³ and 1 particleboard plant with an annual capacity of 30,000 m³.

In addition, a MDF factory will be built in Xishuangbanna. Using the man-made forest resources, large MDF factories, pulping factories and paper mills will be built in Fujian, Guangdong and Guangxi provinces.

In Hainan province and Xishuangbanna, efforts will be devoted to the utilization of the modified rubber wood.

References


Appendix I

The Catalogue of Species of Commercial Timber in Hainan Province

I. Coniferous Timber

1. CYCADACEAE
   Cycas taiwaniana Carruth

2. ARAUCARIACEAE
   Araucaria cunninghamii Sweet

3. PINACEAE
   Keteleeria hainanensis Chun et Tsiang
   Pinus caribaca Morelet
   P. elliottii Engelm
   P. fenzeliana Hand-Mazz
   P. kesiya var. langbianensis (A. Chev) Ganssen
   P. kwangtungensis Chun et Tsiang
   P. latteri Mason
   P. massonian var. hainanensis Cheng et L. K. Fu
   Pinus taeda Linn.
   P. thunbergii Pay!.

4. TAXODIACEAE
   Cunninghamia lanceolata (Lamb) Hook.
   Taxodium distichum (Linn) Rich.

5. CUPRESSACEAE
   Calocedrus hainanensis G. A. Fu

6. PODOCARPACEAE
   Dacrydium pierrei Hickel
   Podocarpus annamensis N.E.Gray
   Podocarpus brevifolius (Stapf) Forxw
   P. fleuryi Hickel
   P. imbricatus Bl
   P. nagi (Thunb.) Zoll et Moritz ex Zoll
   P. neriifolius D. Don.

7. CEPHALOTAXACEAE
   Cephalotaxus mannii Hook. f.

II. Hardwood

1. MAGNOLIACEAE
   Magnolia albosericea Chun & C. Tsoong
   Parakmeria lotungensis (Chun et C. Tsoong) Law.
   Manglietia hainanensis Dandy
   Michelia balansae (A. DC) Dandy
   M. mediocris Dandy
   M. shiluensis Chun et Y. Wu
   M. hedyasperma Law
   Tsoongiodendron odoratum Chun

2. ILLICIACEAE
   Illicium oligandrum Merr & Chun
   Illicium ternstroemiioides A. C. Smith.

3. ANNONACEAE
   Alphonsea hainanensis Merr et Chun
   A. mollis Dunn
   A. monogyna Merr et Chun
   Dasysmacalcan trichophorum Merr
   Polyalthia cerasoides (Roxb) Benlih et Hook

4. LAURACEAE
   Actinodaphne glauca Allen
   Alseodaphne hainanensis Merr
   A. rugosa Merr et Chun
   Beilschmiedia appendiculata (Allen) Chun et S. Lee
   B. glauca S. Lee et L. F. Lau
   E. intermedia Allen
   E. laevis Allen
   E. longipetiolata Allen
   E. tungfangensis S. Lee et L. F. Lau
   Beilschmiedia tsangii Merr
   E. wangii Allen
   Cinnamomum burmanni (Nees) Bl
   C. camphora (L.) Presl
   C. liangii Allen
   C. obtusifolium Nees
   C. parthenoxylum (Jack) Nees
   C. rigidiss
   C. subavenium Miq
   C. tsai Allen
   C. validinerve Hance
   Cryptocarya chinensis (Hance) Hemsl
   C. chinii Cheng
   C. concinna Hance
   C. densiflora Bl
   Cryptocarya hainanensis Merr
   C. maclurei Merr
   C. metcaliana Allen
   C. obtusifolia Merr
   Dehaasia hainanensis Kosterm
   Lindera kwangtungensis (Liou) Allen
   L. robusta (Allen) Yang et Huang
   L. metcaliana Allen
   L. nacusa (D. Don) Merr
   Litsea acutivena Hayata
   L. baviensis Lee
   L. elongata (Wall ex Nees) Benth et Hook. f.
   L. glutinosa (Lour.) C. B. Rob
   L. litseaefolia (Allen) Yang et P. H. Huang
   L. lancilimba Merr
   Litsea monopetala (Roxb) Pars
   L. rotundifolia var. oblongifolia (Nees) Allen
   L. variabilis Hemsl.
   L. variabilis f. chinensis (Allen) Yang et P.H.Huang
   Machilus breviflora (Benth) Hemsl.
   M. chinensis (Champ.) Hemsl.
   M. cicatricosa S. Lee
22. GUTTIFERAEE
Calophyllum inophyllum L.
Garcinia multiflora Champ
G. oblongifolia Champ.

23. TILIACEAE
Grewia eriocarpa Juss
Haiania taichosperma Merr
Microcos chungii (Merr) Chun
M. paniculata L.

24. ELAEOCARPACEAE
Elaeocarpus apiculatus Mast
E. dubius A. DC
Elaeocarpus hainanensis Oliver
E. howii Merr & Chun
E. limitaneas Hand - Mazza
E. japonicus Sieb et Zucc
E. nitifolius Merr & Chun
E. petiolatus (Jack) Wall ex Kurz
E. ganitrus Roxb.
E. poilanei Gagnep.
Sloanea chungii Hu
S. chingiana var. integrifolia Chang
S. hainanensis Merr et Chun
S. sinensis (Hance) Hemsl.

25. STELICULIACEAE
Commersonia bartramia (L) Merr
Firmiana hainanensis Kosterm
F. pulcherrima Chun et Msue
Heritiera angustata Pierre
H. parvifolia Merr.
Kleinhovia hospita L.
Pterospermum heterophyllum Hance
P. lanceaefolium Roxb.
Reevesia longipetiolata Merr et Chun
R. pubescens Mast
R. thyroideas Lindl.
Sterculia alata Roxb
S. lanceolata Cav

26. BOMBACACEAE
Ceiba pentandra (L.) Gaertn
Gossampinus malabarica (DC.) Merr

27. MALVACEAE
Hibiscus tiliaceus L.

28. LINACEAE
Ixonanthes chinensis Champ

29. EUPHORBIACEAE
Aleurites moluccana (L.) Wild
A. montana (Lour.) Wils
Antidesma bunius (L.) Spreng
A. macuarei Merr
Aporosa dioica (Roxb) Muell-Arg
Baccaraea ramiflora Lour.
Bischofia trifoliata (Roxb) Hook.
Bridelia insulana Hance
B. tomentosa Bl
Clausoxylon indicum (Beinw ex Bl) Hassk
C. hainanensis Pax & Hoffm
Cleistanthus sumatranus (Miq) Muell
C. tomentosus Hance
Coelodanthes hainanensis (Merr) Croiz.
Croton laevigatus Vall
C. laui Merr et Metc
Drypetes confertiflora Merr et Chun
D. hainanensis Merr
D. indica (Muell-Arg) Pax et Hoffm
D. perretticulata Gagn
Endospermum chinensis Benth
Erismanthus sinensis Oliv
Glocidion sphaerogynum (Muell-Arg) Kurz
G. macrophylla Bentham
G. puberum (L.) Hutch
G. wrightii Bentham.
Hevea brasiliensis (Wild ex Adr. Jass) Meull-Arg
Homonoia pseudoverticillata (Merr) Merr
Macaranga bacteata Merr
M. denticulata (Bl) Meull-Arg.
M. hemsleyana Pax et Hoffm
Mallotus fureitanus (Baill) Muell-Arg
M. hainanensis S. H. Huang
M. hookerianus (Semi) Muell-Arg.
M. paniculatus (Lam) Muell-Arg.
M. philippinenis (Lam) Muell-Arg
Microdesmis caseariaefolia Pl.
Ostodes paniculatus Bl.
Phyllanthus emblica L.
Sapium discolor (Champ ex Bentham) Muell-Arg
S. laui Croiz
Sapium sebiferum (L) Roxb
Suregata glomerulata (Bl) Baill.

30. DAPHNIPHILLACEAE
Daphniphyllum paxianum Rosenth.

31. ESCALLONIACEAE
Itea macrophylla Wall.
Polyosma cambodiana Gagn.

32. ROSACEAE
Eriobotrya deflexa (Hems) Nakai
Photinia prunifolia (Hook et Arn)
P. benthamiana var. salicifolia Card.
Laurocerasus phaeosticta (Hce) Schneid.
Pyguem topengii Merr
Raphiolepis ferruginea Metc
R. indica (L.) Lindl.
Sorbus granulosa (Bert) Rehd

33. MIMOSACEAE
Acacia auriculiformis A. Cunn ex Bentham
A. confusa Merr
A. catechu (Linn. f.) Wild
Adenanthera pavonina var. microsperma Nielsen
Albizia attoeueens (Pierre) Nielsen
A. chinensis (Osb) Merr
A. odoratissima (L. f) Bentham
A. lebbeck (L.) Bentham.
A. procera (Wild) Bentham
Pithecellobium clypearia (Jack) Bentham
P. dulce (Roxb) Bentham
P. lucidum Benth
Leucaena leucocephala (Lam.) de Wit.
Enterolobium cyclocarpum (Jacq)
Samanea saman (Jacq) Merr
34. CAESALPINIACEAE
Delonix regia (Boj) Baf
Gleditsia australis Hemsl
G. fera (Lour) Merr
Peltophorum tonkinense (Pierre) Gagnep
Erythrophleum fordii Oliv
Cassia siamea Lam
Bauhinia purpurea Linn.
B. variegata Linn.
Sindora glabra Merr ex de Wit.
Tamarindus indica Linn.
15. PAPILIONACEAE
Dalbergia balansae Prain
D. odorifera T. Chen
D. hainanensis Chun et Merr
Erythrina variegata var. orientalis (L) Merr
Ormosia balansae Drake
O. emarginata (Hook. et Arn.) Benth.
O. fordiana Oliv
O. glaberrima Y. C. Wu
Ormosia howii Merr et Chun ex L. Chen
O. pinnata (Lour) Merr
O. semicastastra f. litchifolia How
O. xylocarpa Chun ex L. Chen
Pongamia pinnata (L) Merr
Pterocarpus indicus Willd
16. HAMAMELIDACEAE
Altingia obovata Merr et Chun
Chunia bucklandioides H. T. Chang
Eustigma oblongifolia Gardn et Champ
Liquidambar formosana Hance
Rhodoleia stenopetala H. T. Chang
R. latiovarifolia G. A. Fu
Semiliquidambar cathayensis H. T. Chang
Sycopsis tutcheri Hemsl
7. SALICACEAE
Populus giongdaensis T. Hong et P. Luo
8. MYRICACEAE
Myrica adaphophora Hance
9. BETULACEAE
Betula alnoides Buch-Ham
0. CORYLACEAE
Carpinus londonica var. lanceolata (H-M) P. C. Li
1. FAGACEAE
Castanopsis carlesii (Hems!) Hay
C. fissa (Champ) Rehd et Mils
C. fabri Hance
C. jucunda Hance
C. hystrix A. DC
C. indica (Roxb) A. DC
C. jiangfenglingensis Duanmu
C. wenchangensis G. A. Fu et Huang
Castanopsis tonkinensis Seem.
Litocarpus chiuangchungensis Chun et Tam
L. elaegniifolius (Seem) Chun
L. hancei (Benth) Rehd
L. pseudovostitus A. Cam
L. silvicolorum (Hance) Chun
L. caudatilimbus (Hance) Chun
L. irwini (Hance) Rehd
Lithocarpus amygdalifolius (Skau) Hay.
L. brachystachys Chun
L. elmerrii Chun
L. fenzelianus A. Cam.
L. handelianus A. Camus
L. howii Chun
Quercus acutissima Carr
Q. albicaulis Chun et Ko
Q. bambusaefolia (Hance) Chun
Q. champini Benth.
Q. blakei Skan
Q. disciformis Chun et Tsiang
Q. editiae Skan
Q. fleuryi Hick et A. Camus
Q. hui Chun
Q. hainanica Huang et Y. T. Chang
Q. patelliformis Chun
Q. subhincidea Chun et Ko
Q. tiolooshanica Chun et Ko
42. CASUARINACEAE
Casuina equisetifolia L. ex Forst.
C. cunninghamiana Miq
C. glauca Sieb ex Spreng
43. OLMACEAE
Celtis cinnamonea Lindl et Planch
C. colinsae Craib
C. tetrandra subsp sinensis (Pers) Y. C. Tang
Gironniera cuspidata (Bl) Kurz
Gironniera subaequalis Pfl
Trema orientalis (L.) Bl.
Ulmus tonkinensis Gagn
44. MORACEAE
Antiaris toxicaria Lesch
Artocarpus heterophyllus Lam
A. hypcegyreus Hance
A. nitidus ssp lingnanensis (Merr) Jarr
A. styracifolius Pierre
A. tonkinensis A. Chev ex Gagn
Ficus alissima Bl
F. auriculata Lour
F. benjamina L.
F. fulva Reinw
F. glaberrima Bl
Ficus fistulosa Reinw ex Bl.
F. langkokensis Drake
F. microcarpa Linn. f.
F. nervosa Heyne
F. oligader. Miq
F. tinctoria var. gibbosa (Bl) Corner
F. tufahapess Drake
F. variegata var. chlorocarpa (Benth) King
F. variolosa Lindl.
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F. vasculosa Wall.
F. virens Ait
F. virens var. sublanceolata (Miq) Corner
Morus of wittinum Hand-Mazz
Pseudostreblus indica Bur
Streblus asper Lour.
Taxotrophis iliofciatus Vidal

45. URTICACEAE
Oreocnide rubescens (Bl) Miq

46. AQUIFOLIACEAE
Ilex chingiana Hu et Tang
I. cochin chinensis (Lour) Loes
I. chapanaensis Merr.
I. ficoides Hay.
I. godajam Wall. ex Hook. f.
I. goshiensi!i Hay.
I. hainanensis Merr
I. kobuskiana S. Y. Hu
I. kwangtungensis Merr
I. nuculicava S. Y. Hu
I. purpurea Hassk.
I. rotunda var. microcarpa (Lindl ex Part) S. Y. Hu
I. sterrophylla Merr et Chun

47. CELASTRACEAE
Pleurostylia opposita (Wall) Merr et Metc.

48. ICACINACEAE
Apodytes cambodiana Pierre
Gonocaryum lobbinum (Miers) Kurz
Platea hainanensis Howard
P. parvifolia Merr & Chun
Gomphandra tetrandra (Wall et Roxb) Sleum

49. OLACACEAE
Schoepjia chinensis Gardn et Champ

50. SANTALACEAE
Sclerophrum wallichianum Am

51. RHAMNACEAE
Alphitonia philippinensis Braid
Rhamnus longipes Merr et Chun
Ziziphus fungii Merr

52. RUTACEAE
Acronychia oligophlebia Merr
A. pedunculata (L.) Miq
Euodia lepta (Spreng) Merr
E. lepta var. chunii (Merr) Huang
E. meliaefolia (Hance) Benth
Fortunella margarita (Lour) Swingle
Zanthoxylum avicennae (Lam.) DC

53. BURSERACEAE
Canarium album (Lour) Raeusch.
C. pimela Koenig
Garug apinnata Roxb

54. MELIACEAE
Aглаia roxburghiana Miq
A. tsangii Merr
Ailanthus altissima (Mill) Swingle
Amoora dasyclada (How et T. Chen) C. Y. Wu
Aphanamixis grandifolia Bl
A. polystachya (Wall) R. N. Park
Cheukrasia tabularis A. Juss
Dysoxylum biearti (Roxb) Hook. f ex Bedd
D. hainanensis Merr
D. hainanensis var. glutinum How et T. Chen
D. hongkongensis (Tutch) Merr
Dysoxylum lukii Merr
Heynea trijuga var. microcarpa Pierre
Khaya senegalensis A. juss
Lansium dubium Merr
Melia azedarach L.
Swietenia macrophylla King
S. mahagoni Jacq
Toona sureni (Bl) Merr
Walsura robusta Roxb

55. SAPINDACEAE
Arytera literalis Bl.
Amesodendron chinensis (Merr) Hu
Dimocarpus longan Lour.
Harpullia cupanioides Roxb
Lepisanthes rubiginosa (Roxb) Leenh
Litchi chinensis Sonn
L. chinensis var. euspon tari Hsue
Mischocarpus fiscescens Bl
Otophora unilocularis (Leenh) H. S. Lo
Nephelium chrysemum Radlk.
Paranephelium hainanensis H. S. Lo
Aphania oligophylla (Merr et Chun) H. S. Lo
Sapindus mukorossi Gaertn.

56. ACERACEAE
Acer decandrum Merr
Acer fabri Hance
A. hainanensis Chun et Fang

57. SABIACEAE
Meliosma angustifolia Merr
M. dumicola W. W. Sm.
Meliosma fordii Hemscl
M. laui Merr
M. rigida Sieb et Zucc
M. squamulata Hance
M. thorelli Lecomte

58. STAPHYLEACEAE
Turpinia glaberrima Merr.
T. montana (bl) Kurz

59. ANACARDIACEAE
Allospondias lakonensis (Pierre) Stapf
Anacardium occidentale L.
Buchanania latifolia Roxb
B. microphylla Engl
Choerospondias australis (Roxb) Burtt et Hill
Lannea grandis (Pennst) Engl
Mangifera indica L.
Pistacia chinensis Bunge
Toxiconodendron succedaneum (L.) O. Kuntze
Spondias pinnata (L.) Kurz

60. CONNARACEAE
Ellipanthus glabrifolius Merr

1. JUGLANDACEAE
   Engelhardtia colebrookiana Lindl ex Wall
   E. hainanensis P. Y. Chen
   E. roxburghiana Wall
   E. unyuga Chun

2. CORNACEAE
   Mastixia pentandra subsp cambodiana (Pierre) Matthews

3. ALANGIACEAE
   Alangium chinensis (Lour.) Harms.
   Alangium kurzii Craib
   A. salviifolium (L. f.) Wanger

4. NYSSACEAE
   Nyssa javanica (Bl.) Wanger

5. ARALIACEAE
   Dendropanax hainanensis (Merr & Chun) Chun
   Heteropanax fragrans (Roxb) Seem.
   Macropanax decandrus Hoo
   Schefflera octophylla (Lour) Harms

6. ERICACEAE
   Craibiodendron kwangtungense S. Y. Hu
   Rhododendron moulinmainense (W. & Z.) Sprag
   R. simiarum Hance

7. EBENACEAE
   Diospyros corallina Chun et Chen
   Diospyros chunii Mtc
   D. eriantha Cham.
   D. hainanensis Merr
   D. howii Merr et Chun
   D. inflata merr & Chun
   D. kaki L.
   D. longibracteata H. Lec
   D. macularei Merr
   D. morrisiana Hance
   D. nitida Merr.
   D. rubra H. Lec
   D. strigosa Hemsl.
   D. susarticulata H. Lec

8. SAPOTACEAE
   Chrysophyllum roxburghii G. Don
   Chrysophyllum caimito Linn.
   Madhuca hainanensis Chun & How
   Manilkara hexandra (Roxb) Dubard
   Pouteria annanensis (Pierre) Baehni
   P. clemensi H. Lec
   Xantolis bonia var. rostrata (Merr.) Royen.
   Xantolis longispinos (Merr.) H. S. Lo

9. SARCOSPERMACEAE
   Sarcospermum laurinum (Benth) Hock.f.

10. MYRSINACEAE
    Ardisia densilepidotula Merr
    A. ordinata Walk
    A. obisus Mez
    Rapanea nerifolia (Sieb et Zucc) Mez.

11. STYRACACEAE
    Alniphyllum fortunet (Hems.) Perk.
    Styrax agrestis (Lour.) G. Don
    S. grandiflorus Grifff.

S. hainanensis How
S. serrularis Roxb.

72. SYMPLOCACEAE
   Symplocos adenophylla Wall
   S. atriolivacea Merr. et Chun ex Li
   S. anomala Brand
   S. chunii Merr
   S. cochinchiensis (Lour.) Morre
   S. confusa Brand
   S. crassilimba Merr
   S. congesta Benth
   S. glauca (Thunb) Koidz
   S. lancifolia Sieb et Zucc
   S. lamiilimba Merr.
   S. laurina (Retz.) Wall.
   S. ovatiflora Noot
   S. poianaet Guill
   S. sumunitia Buch (S. Caudata Merr.)
   S. wikstroemiifolia Mayata

73. APOCYNACEAE
    Hunteria zeylanica (Retz) Gard. ex Thw.
    Kopsia lacinibracteolata Merr
    Winchia calophylla A. DC
    Wrightia laevis Hook. f.
    W. pubescens R. Br.

74. RUBIACEAE
    Adina hainanensis How
    A. pilulifera (Lam) Franch. ex Drake
    A. racemosa (Sieb et Zucc) Miq
    Canthium dicoccum (Gaertn) Merr
    C. simile Merr et Chun
    C. dicoccum var. obovatifolium G. A. Fu
    Cardenia hainanensis Merr.
    Guettardella sinensis Champ
    Nauclea officinalis Pierre
    Randia canthioides Champ.
    R. merrillii Chun
    R. acuminaattissima Merr.
    Tarenna atenuata Hutch.
    T. wallichii Hook.f.
    Tricalycia dubia (Lindl) Ohwi
    Wendlandic uvarifolia Hance

75. CAPRIFOLIACEAE
    Viburnum lutescens Bl.
    V. punctatum Buch-Ham.

76. BORAGINACEAE
    Cordia dichotoma Forst. f.
    Ehretia laevis Roxb
Appendix II
The Catalogue of Species of Valuable Commercial Timber in Xishuangbanna Nature Reserve

Podocarpus imbricatus Bl.
Parashorea chinensis Wang Hsie.
Catina fleuryana Tard. -Blot.
Syzygium szemaoense Merr. et Perry.
Mesua nagassarium (Burm.f.) Koster. et Mert.
Acacia catheiu (Linn.) Wild.
Adenanthera pavonina Linn.
Albizia odoratissima (Linn. f.) Benth.
Dalbergia fusca Pierre.
D. obusifolia Prain.
Garuga floribunda var. gamblei (King et Sm.) Kalkm.
Chukrasia tabularis A. Juss.
C. tabularis var. velutina (Wall.) King.
Pistacia weimannifolia Poiss. ex Fr.
Mitrargyne brunonis (Wall.) Craib.
Cordia furcata Johnst.
Stereospermum tetagotum (Wall.) DC.
Gmelina arborea Roxb.
Premona szemaoensis Pei.
Podocarpus walllichii Presl.
Manglietia microsperma Liu.
Michelia hedysperma Low.
Paramichelia bailloni (Pierre) Hu.
Cinnamomum glanduliferum Meissn.
C. porrectum (Roxb.) Koster.
Litsea glutinosa C. B. Rob.
Duabanga grandiflora (Roxb. et DC) Walp.
Homalium laoticum Gagn.
H. laoticum Gagn. var. gabretum C. Y. Wu.
Schima wallichii Choisy.
Sladenia celastrifolia Kurz.
Terminalia bellirica (Gaertn.) Roxb.
T. myriocarpa Heurck et M. -A.
Crataxylon cochinichensis (Lour.) Bl.
C. taiwanianus (Jack) Dyer.

Ehretia longiflora Champ.
E. thyrsiflora (S. et Z.) Nakai

77. BIGNONIACEAE
Dolichandrone canda -jelina (Hance) Benth
D. spathacea Sch
Oroxylum indicum (L.) Vent.
Radermachera frondosa Chun et How
R. hainanensis Merr

78. VERBENACEAE
Gmelina hainanensis Oliv
G. arborea Roxb
Premona corymbosa (Burm.f.) Rottl et Willd
P. octonervia Merr et Metc
Tectona grandis L.f.

Vitex tripinnata (Lour) Merr
Vitex canescens Kurz.
V. pierreana Dop
V. quinata (Lour.) F.N.Will

79. LILIACEAE
Dracaena cambodiana Pierre ex Gagnep

80. PALMAE
Chuniophoenix hainanensis Burret
C. humilis C. Z. Fang et T. L. Wu
Liristona fengkaiensis X. W. Wu et M. Y. Xiao
Nipa fruticata Wurmb.


Heritiera angustata Pierre.
Prerospermum lanceaefolium Roxb.
P. acerifolium (Linn.) Willd.
P. menglenense Hsue.
Pterygota alata (Roxb.) R. Br.
Bischofia javanica Bl.
Adenanthera microsperma Tejsm. et Binn.
Milletia lepioboytia Dunn.
M. pachycarpa Benth.
Altingia excelsa Noron.
Betula alnoides Buch. -Ham. ex D. Don.
Castanopsis hystrix A. DC.
C. mekongensis A. Camus.
Celtis wightii Planch.
Morus laevigata Wall.
Canarium album Raesch.
C. pimela Leenh.
Aphanamixis grandifolia Bl.
A. polystachys (Wall.) R. N. Parker.
Dyssoxylum binecteriferum (Roxb.) Hook. et. Bedd.
D. gobarra (Buch. -Ham.) Merr.
D. hongkongensis (Tutch.) Merr.
Toona ciliata Roem.
C. microcarpa (C. DC.) Harms.
C. sinensis (A. Juss.) Roem.
Nepheleum chryseum Bl.
Pometia tomentosa (Bl.) Teysm. et Binn.
Dracontomelon macrocarpum H. L. Li.
Mangifera siamensis Warb. ex Craib.
Camptotheca acuminata Decne.
 Diospyros kaki Linn. f. var. sylvestris Mak.
Metadina trichotoma (Zoll. et Mor.) Bakh. f.
Cordia dichotoma Forst. f.
Vitex xiquintata (Lour.) Will.
V. quinata Will. var. puberula Moldenke.
Podocarpus nerrifolia Wight.
Pseudolarix amabilis (A. Chev.) Hems.
Pinus kesia var. langbianensis (A. Chev.) Gaussen.
Manglietia fordiana (Hems.) Oliv.
M. wangii Hu.
Alphonsea mollis Dunn.
A. monogyna Merr. et Chun.
Polyalthia chelensis Hu.
Actinodaphne henryi Gamble.
Cinnamomum austro-yunnanensis H. W. Li.
C. chartophyllum H. W. Li.
C. bejolghota (Buch. -Ham.) Sweet.
Cryptocarya densiflora Bl.
C. impressivaria H. W. Li.
Lindera communis Hems.
Litsea liyuyingi Liou.
Machilus shwelenensis W. W. Sm.
Phoebe macrocarpa C. Y. Wu.
P. puwenensis Cheng.
Horsfieldia pandurifolia Hu.
H. tetratepala C. Y. Wu.
Knema furfuracea (Hook. f. et Thoms.) Warb.
Myristica yunnanensis Y. H. Li
Helicia nilagirica Bedd.
Tetrameles nudiflora R. Br.
Anneslea fragrans Wall.
Syzygium polypetaloides Merr. et Perry.
Anogeissus acuminata var. lanceolata Wall
Garcinia xanthochymus Hook. f. ex T. Anders.
Microcos paniculata Linn.
Elaeocarpus austro-yunnanensis Hu.
E. japonicus Sieb. et Zucc.
Sloanea chelensis Hu.
S. tomentosa (Benth.) Rehnd. et Wils.
Gossampinus malabarica (DC.) Merr.
Macaranga benticulata (Bl.) M. -A.
Mallotus philippinensis (Lam.) Muell. -Arg.
Sapium baccatum Roxb.
Bauhinia variegata Linn.
Acrocarpus fraxinifolius Arn. ex Wight.
Albizia bracteata Dunn
A. chinensis (Osb.) Merr.
A. procera (Wild.) Benth.
A. yunnanensis (Kosterm.) Y. H. Huang.
Derris robusta Benth.
Erythrina lithosperma Bl. ex Miq.
Alnus nepalensis D. Don.
Carpinus londoniae H. Winkl.
Castanopsis argyrophylla King ex Hook.
C. calathiformis (Skan) Rehnd. et Wils.
C. indica (Roxb.) A. DC.
C. tribuloides (Sm.) A. DC.
Cryptocalanopsis (Hemsil.) Schott.
Lithocarpus grandifolius var. brevipetiolata (A. DC.) S. N.
L. truncatus (King ex Hook. f.) Rehnd. et Wils.
Quercus altissima Carr.
Q. cocciferoides H. -M.
Celtis bodinieri Levil.
C. cinnamomea Lindl. et Planch.
Gironniera subaegalis Planch.
Trema angustifolia Bl.
T. orientalis (Linn.) Bl.
Ulmus lanceaefolia Roxb. ex Wall.
Broussonetia papyrifera (Linn.) Vent.
Ficus altissima Bl.
F. callosa Wild.
Strybus asper Lour.
Apodytes dimidiata E. Meyer.
Hovenia acerba var. kiukiangensis C. Y. Wu.
Zizyphus mauritiana Lam.
Z. oenoplia (Linn.) Mill.
Z. rugosa Lam.
Z. yunnanensis Schneid.
Ailanthus fordii Booten.
A. triphysa (Dennst.) Alston.
Garuga pinnata Roxb.
Amoora tetrapetala (Pierre) C. Y. Wu.
Chisocheton siamensis Craib.
Dysoxylum hainanensis Merr.
Melia azederach Linn.
M. toosenden Sieb. et Zucc.
Harpullia cynapioides Roxb.
Acer longicarpum Hu et Cheng.
A. oblongum Wall.
Choerospondias axillaris Burtt. et Hill.
Engelhardtia serrata Bl.
E. spicata Bl.
Alangium ciienesis (Lour.) Harms.
Nyssa yunnanensis W. C. Yin.
Pouteria grandifolia (Wall.) Pierre.
Sarcoceperma arboreum Hook.
Alniophyllus fortrunel (Hemsil.) Mak.
Styrax subriffolia Hook. et Zucc.
S. tonkinensis (Pierre) Craib.
Fraxinus floribundus Wall.
Alstonia scholaris (Linn.) R. Br.
Wincia calophylla A. DC.
Wrightia pubescens R. R. Br.
Anisopterophy uncinifera (Rich. ex Walp.
Cephalanthus naucleoides DC.
Neonauclea sapphir (Hook.) Merr.
N. sessilifolia (Roxb.) Merr.
Tarenna incerta Koord. ex Vale.
T. sylvistris Hutch.
Ehetria acuminata var. obovata Johnst.
E. sangii Johnst.
Dolichandrae stipulata (Wall.) Benth. et Hook. f.
Premna latifolia Roxb.
P. latifolia Roxb. var. cuneata C. B. Clarke.
Caryota ureus Linn.

Source: The Comprehensive Survey Reports in Xishuangbanna Nature Reserve