SPECIAL THEME

VI

# 40 The Forest Sector in China: Towards a Market Economy

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## 40.1 Introduction

China covers an area of 9.6 mill. km$^2$, accounting for 7% of the total land area of the globe. The landmass consists of mountainous areas (33%), high plateau (26%), basins (19%), hills (10%) and flat lowlands (12%). The climate ranges from humid in the east to arid deserts in the west, and from boreal in the north to tropical in the south. China had more than 1.2 bill. people in 1995, with about 30% of the population living in urban areas. The natural growth rate of the population was 1.06% in 1995. The ”One child couple” policy is still used to ensure that the country’s population is held below 1.3 bill. by the end of this century.

China launched economic reforms in 1978. During the two subsequent decades, progress has occured in three phases:

- 1978–1984: Following the end of the decade-long Cultural Revolution in 1976, economic growth rates were 8% and 12% in 1977 and 1978, respectively. Initially, most people still trusted in the old system. It was assumed that economic problems lie in the “political-struggle” doctrine and the political upheavals rather than in the central planning system (Fan 1994). The reform was focused on the *micro-management system* and the main goal was to introduce *an incentive mechanism* to mobilize the initiative of workers and promote productivity. During this period, the people’s commune system was steadily replaced by a household responsibility system; the prices of agricultural products were raised considerably in order to stimulate agricultural production; reform in the urban areas was at an initial and pilot stage and four Special Economic Zones (Shengzhen, Zhuhai, Xiamen, Shantou) were established, and 14 coastal cities were opened to foreign investment.
- 1985–1991: At the beginning of this period, government officials, and even economists, still debated as to where China should go – towards a market economy or planned economy. The *planned market economy* was the official solution. During this period of time, *market mechanisms* were introduced and the centrally planned economy coexisted with the market economy. The emphasis of reform shifted from the rural areas to the urban areas. Specifically, the government delegated more authority to enterprises. This change was intended to make state-owned enterprises more independent in decision-making and responsive to market changes. Meanwhile, coastal areas, such as the delta areas of the Zhujiang River, Yangtze River and southern Fujian Province, were further opened to foreign investment. Hainan Island was separated from Guangdong province as an additional, and also the biggest, special economic zone in 1988.
- 1992–1998: After the experiences of previous periods, the market economy became the clear objective of China’s economic reform. The 14$^{th}$ Congress of the Party in 1992 came up with the concept of *socialist market economy*, which was inscribed in the Constitution the following year. During this period, the reform focused on improving the *macro socio-economic environment and the market mechanisms*. In 1993, most provinces removed all controls on food prices: prices that used to be the most tightly controlled of all. The dual rates for foreign exchange merged in 1994. Market mechanisms are now introduced into the com-

mercial banking system. In 1998, the market economy is playing a predominant role in resource allocation and price formation. The government is increasingly employing macroeconomic policies in place of the traditional planning policies.

The reforms have played a far-reaching role in reshaping China's economy. The annual average economic growth rate was about 9% from 1979 to 1992 and about 10% between 1993 and 1997. The World Bank (1980, 1997) estimates that China's GNP per capita increased from USD 260 in 1979 to USD 620 in 1995 and the PPP (Purchasing Power Parity) estimate of GNP per capita amounted to USD 2 920 in 1995.

Market liberalization, decentralization and privatization, as well as technology transfer and extension, are key elements contributing to Chinas's economic growth over the past two decades. Jin and Haynes (1997) viewed China's success as somehow based on the balance between the exogenous diffusion of neighboring capitalist ideas and the endogenous emergence of the economic institutions of capitalism.

As the reform advances, China is also facing serious challenges. Some of the challenges include the losses and low efficiency of most state-owned enterprises, growing unemployment (particularly the layoff from state-owned enterprises and governments), disparity of income, serious environmental problems, and widespread corruption.

To face these challenges, China began preparing a new stage of reform after the 15th Communist Party Congress held in 1997. The ambitious plan includes: (i) sale of or write-off of thousands of dying state enterprises through liquidation, mergers, a joint-stock system and outright privatization; and (ii) to lure foreign and domestic investors away from the coastal areas into the hinterland through incentive policies. To maintain foreign investment confidence at the current level may be the largest challenge in China's transition. A number of reforms still need to be implemented in the coming years.

This article presents and analyzes the updated status of China's forest sector and its progress towards the market economy. A general view of the status of forest resources, the environment, forest industries and trade is first outlined, followed by an introduction of the institutions and policy reform towards a market economy in the forest sector. Finally, a general discussion of the experience gained, problems encountered and anticipated future development is included.

## 40.2 Forests, Socio-economic Development and the Environment

### Forest Resources

Data on China's forest resources were first published in 1943 and on at least 10 other occasions before the first national forest inventory (1973–1976). All the data up to 1973, basically relied on the data of 1943 and stated that forest cover ranged from 5% to 9% (9% was more often used). These figures were erroneous, resulting from incorrect estimates and varying definitions. The 1949 forest cover rate can be reasonably estimated at 13–15% using today's definition. This also conforms to estimates by Jiang and Chou (1992).

The more reliable data are based on the four national forest inventories: 1973–1976, 1977–1981, 1984–1988 and 1989–1993 (Table 40.1). The recent FAO reports (1995a and 1995b), based on the third national forest resource inventory, also provide similar data. FAO (1995a) assumes that the reliability

**Table 40.1: China's forest resources, 1973–1993**

| Years of inventory | Forestry land | | Forest | | Forest cover |
|---|---|---|---|---|---|
| | Area mill. ha | Stock bill. m³ | Area mill. ha | Stock bill. m³ | % |
| **1973–1976** | 257.6 | 10.3 | 121.9 | 9.4 | 12.7 |
| **1977–1981** | 267.1 | 10.3 | 115.3 | 9.0 | 12.0 |
| **1984–1988** | 267.4 | 10.6 | 124.7 | 9.1 | 12.3 |
| **1989–1993** | 262.9 | 11.8 | 133.7 | 10.1 | 13.9 |

*Source: China's National Forest Resources Inventories (1973–1993)*

*Note: The data from the first inventory has been adjusted due to some technical problems.*

class is 1 on state estimates and 2 for change assessment (range from best = 1 to worst = 3).

Since 1996, the definition of forest in China has been changed to follow that common to the rest of the world, inasmuch as land with more than 20% canopy cover is termed forest land. In previous inventories, canopy cover was defined as 30%. It is quite possible that the proportion of land under forest will be higher in the coming inventory data.

The concept of *forestry land*, frequently used in China means all the land with a present or potential future forest cover, or the land that is allocated for forestry purposes. *Non-forested (forestry) land* denotes forestry land that has not been forested but can potentially be used for afforestation. *New planted land* denotes recently planted forest that still does not meet the definition of forest (Table 40.2).

China has the world's largest area of plantation forest. China had 32 mill. ha of plantation forests and 1 mill. ha of annual plantation rate, according to FAO (1995a). More recent national inventory data show that the plantation forest area was about 41 mill. ha in the early 1990's, with an additional 2.5 bill. trees beyond the forests, located by houses, in villages, roads and waterbodies. These trees beyond forest are important for farmland, particularly in northern China. Huang et al. (1997) estimated that the agroforestry systems cover 45 mill. ha in China.

Forests are classified into six types according to their purposes and functions: productive timber forests, economic forests (providing food and other non-wood goods), protection forests, fuelwood forests, bamboo forests and special purpose forests (Table 40.3).

Currently, therefore, China's forest land covers 14% of the total territory. Open forests, shrubs and new plantations cover a further 5% of total territory, while about 10% of the total territory has afforestation potential.

The forests are unevenly distributed and differ greatly from region to region (Map 33.3 and Table 40.4).

## Forests and Socio-economic Development

The forest sector is important for socio-economic development as it not only brings income, but also

**Table 40.2: Forestry land-cover structure in China, 1993***

| Land cover | Area mill. ha | Ratio to forestry area % |
|---|---|---|
| **Forest** | 128.5 | 50.1 |
| **Open forest** | 18.0 | 7.0 |
| **Shrubs** | 29.7 | 11.6 |
| **New planted** | 7.1 | 2.8 |
| **Nursery** | 0.1 | 0.0 |
| **Non-forested** | 73.3 | 28.5 |
| **Forestry land total** | 256.7 | 100.0 |

*Source: China's National Forest Resources Inventory (1989–1993)*

*Note: * Does not include Taiwan and the part of Tibet that lies beyond the military control line.*

**Table 40.3: Forest typology in China, 1993***

| Forest Types | Area mill. ha | Percentage of forest land % | Inventory mill. $m^3$ |
|---|---|---|---|
| **Productive timber forest** | 84.9 | 66.0 | 6 743 |
| **Economic forest** | 16.1 | 12.5 | na |
| **Protection forest** | 16.1 | 12.5 | 1 778 |
| **Fuelwood forest** | 4.3 | 3.3 | 69 |
| **Bamboo forest** | 3.8 | 2.9 | na |
| **Special purpose forest** | 3.4 | 2.6 | 497 |

*Source: China's National Forest Resources Inventory (1989–1993)*

*Note: * Does not include Taiwan and the part of Tibet that lies beyond military control line.*

**Table 40.4: Four different forest regions in China**

| Region | Provinces | Characteristics | Major species |
|---|---|---|---|
| Northeast | Heilongjiang, Jilin, Liaoning, and the northeast of Inner-Mongolia | Important timber supplier, low population density, dominated by state-owned natural forests. | *Pinus Koraiensis, Abies fabri, Picea Koraiensis, Larix olegensis, L. gmelini, Quercus mongolica, Betula platyphylla*, Ash, etc. |
| North/ north-central/ northwest | Hebei, Henan, Shangdong, Beijing, Tianjin, part of Jiangsu, Anhui, Shanxi, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, and part of Inner-Mongolia | (i) The north/north-central China is a major timber consumption region and has the highest population density. Land use is dominated by agricultural land, and forestry land is dominated by plantation forests and agroforestry. The land is mostly owned by collective land ownership. (ii) Northwest China has dry climate and a very low forest cover and population. | *Populus tementosa, P. I-214, Paulownia* spp., *Pinus tabulaeformis, Platycladus orientalos, Quercus variabilis, Robinia psudoacasis*, etc. |
| South/ southeast | Shanghai, Zhejing, Fujian, Jiangxi, Hubei, Hunan, Guangdong, Guangxi, Hainan, Guizhou, and part of Anhui and Jiangsu. | Important timber supply and consumption region which is dominated by mountains and forests, and collective land ownership. Natural and plantation forests coexist. | *Pinus massoniana, Cunnighamin lanceolata, Cupressus funebris, Quercus* spp., *Cinnamomum camphora*, Eucalyptus, Bamboo, etc. |
| Southwest | Sichuan, Yunnan, and Tibet | Rich natural forest resources, mostly inaccessible. State-owned land is dominant. | *Picea asperata, Populus* spp., *Cupressus funebris, Pinus massoniana, Quercus* spp., *Schima superba, Cinnamomum camphora*, Arbor, Alpine, etc. |

*Sources: CAC (1985); MOF (1995c)*

provides employment opportunities, foods, and energy and promotes other economic development. The output value of forestry in China, excluding logging and wood processing, was about USD 7 bill. in 1995, accounting for about 5.3% of the value of agricultural output (including farming, forestry, animal husbandry, and fishery) (MOF 1996a).

The output value of the forest industries (mainly referring to logging in China) has been about USD 5 bill. annually since the 1980's, accounting for about one percent of industrial output by value. The correct share of the forest industries can be higher because some outputs are not included in the statistics. Forestry is particularly important in the local economies of northeastern and southwestern regions of China.

The forest sector employs over 2.5 mill. workers, engaged in silviculture, logging, wood processing and non-wood forest products processing. This figure only includes the state-owned section under the Ministry of Forestry, of which 138 big state-owned forestry bureaus are the most important part. Most of these forestry bureaus were established in the 1950's and 1960's for the purpose of harvesting the natural forests. After decades of development, they are becoming comprehensive forestry enterprises, including logging, silviculture, wood processing and even other industries. The number of employees in each bureau varies from 5 000 to 20 000. There are 150 000 rural collectively owned forest farms and a great number of forest-specialized households. In southern China, particularly in mountain areas, farmers are more or less involved in forest-related sectors. Of the total forest area of 128.5 mill. ha, the collectively owned forests account for 55%. However, of the total estimated inventory of 9 bill. $m^3$,

74% are accounted for by state-owned forests.

Forests are an important factor in ecotourism. Forest ecotourism is becoming an important industry in China, a result of the economic development and increasing living standards of the Chinese people. Nearly 2 000 forest locations have potential commercial value for ecotourism. Between 1982–1995, 701 forest parks were established, while 19 international hunting grounds and one forest recreation area were also created, covering 6 mill. ha in total.

Since 1994, forests have attracted between 50 and 60 mill. person visits annually and have brought a direct income of between USD 30 to 50 mill. (MOF 1996a). In addition, ecotourism promotes infrastructure development and creates employment opportunities for local people. For instance, 150 000 people are employed in forest ecotourism in the Zhangjiajie National Forest Park, Hunan Province.

It is expected that by the year 2000, the total number of forest parks in China will reach 1 000, covering 9 mill. ha. There will be about 100 mill. person visits. By the year 2010, it is expected that the number of forest parks all over China will reach 2 000, covering 19 mill. ha. The total annual visits are expected to reach 200 mill. person visits, of which 2.0 mill. will be by foreign tourists.

Forest energy is a traditional source of energy for the Chinese people. Forests designated for fuelwood account for about 3% of the forest area. Other types of forests also provide substantial amounts of fuelwood via logging and wood processing residuals. It is estimated that in recent decades, fuelwood consumption has been about 100 mill. $m^3$ per annum, accounting for 30% of total consumption of forest resources.

During the two most recent decades, a total of more than 7 mill. ha of fuelwood forests have been planted and have played a significant role in mitigating the shortage of rural energy. Expansion of the fuelwood resource is an important means of improving the rural energy situation. The Chinese government is aiming to plant some 3 mill. ha of fuelwood forests in 1996–2000 and 7 mill. ha in 2001–2010.

Forests are bases for non-wood forest products, which are important for the rural economy. The non-wood forest products include chemicals and other industrial raw materials from forests, fruits, edible oil, bamboo shoots, mushrooms and many other foods, beverages, traditional Chinese medicinal herbs, spices, etc.

Mountains account for 70% of the country's total land area. According to poverty standards in China, there are 80 mill. people in the 592 poorest counties (MOF 1995b). Of these, about 80% are located in the mountain areas. Forestry can therefore play a particularly important role in shaking off poverty in these areas (Shen 1995; Wang et al. 1995). The government is preparing to increase investment, and provide more favorable policy and training for extension of practical techniques and know-how (MOF 1995b).

The forest-based development includes commercial timber plantation, non-wood forest production, soil and water conservation, ecotourism, and wood and non-wood forest products processing industries. Two of the more ambitious targets and plans made by the Ministry of Forestry to eliminate poverty through forest-based development in those poor mountain areas are: (i) to increase the income per capita from USD 80 in 1992 to USD 150 in 2000, with half of the income coming from forestry; (ii) to create 15 mill. jobs within 5 years, accounting for about 15% of the total idle rural labor.

## Forests and the Environment

As in most countries, forests play a critical role in shaping and maintaining China's environment. Deforestation in China is also an important environmental issue and many environmental problems in China are related to deforestation (Box 40.1) (Murphey 1983; Smil 1983 and 1992; Ross 1988; Zhang). Environmental problems will be among the most challenging issues for China in the 21st century (Niu and Harries 1996).

Deserts and semi-desert land cover an estimated 150 mill. ha, while another 140 mill. ha of pastoral and crop lands are subject to threat by desertification. These areas are currently expanding at an estimated rate of 156 000 ha annually, mainly because of human activities such as deforestation and overgrazing (Fullen and Mitchell 1994). More than 170 mill. people suffer from this process and the annual economic loss is assessed to be USD 2–3 bill. (SPC 1994). One third of the desertification is attributed to the over-harvesting of forests (Liu 1993).

Several of the principal rivers, such as the Yangtze and Yellow rivers, are facing reduced flow, prolonged drought and the perils of recurrent fluctuations between droughts and floods. In rural areas, annual water shortfalls amount to 30 bill. $m^3$. Over 80 mill. rural people have insufficient drinking water, and 20 mill. ha of farmland suffer from inadequate water, resulting on crop losses of 2.5 mill. tonnes each year (Zhang and Zhang 1994). Water supply is particularly critical in the large northern cities, including Beijing and Tianjin. More than half

BOX 40.1

## DEFORESTATION IN CHINA

■ In ancient times, about half of the land in China was covered by forests. In 2700 B.C., there were 6 provinces with more than 90% forest cover and 14 provinces with more than 50% cover (Liu and Wang 1989). Significant deforestation in China began at least as early as 3000 B.C. and was promoted by the diffusion of first bronze and then iron tools, and accelerated more rapidly from the 17th century (A.D.) onwards. Accordingly, much of the land was already deforested several hundred years ago, when the forest cover rate was 26%. At that time, there were 2 provinces with 90% forest cover, 6 provinces with 50% cover and 7 provinces with 30% cover according to Liu and Wang (1989).

■ The temporal process of deforestation started from the heartland in the *Guangzhong* region (current Shaanxi Province), at the junction of the *Wei* and *Yellow* Rivers, spreading first towards east (current Henan and Shandong Provinces), and gradually towards both the south and the north. Deforestation in southern China was accelerated by the rapid population growth in the late *Song* Dynasty when northern China was occupied by the Mongolians and the capital was transferred to Hangzhou in 1127 A.D. Northeast and southwest China still had large amounts of forest in the late 19th century.

■ China has a long forestry history. Over these thousands of years of history, there has been a cycle of deforestation, mild recovery, and more severe deforestation (Liao 1987). In general, intensified promotion of afforestation occurred at the beginning of each dynasty; however, rampant cutting and misuse were frequently found during conflicts among different interest groups and dynasties. Teng (1927) presented a good summary of the history of forests in China from the point of view of forest management and awareness. He divided the history into three distinct periods:

- The "ancient" period (from the earliest time to 1100 B.C.). Shennung (2737 B.C.) led the Chinese people to grow crops. His people, hitherto nomads, began to settle and agriculture began to develop. Very early the forests along river banks were cleared, and it is quite probable that this removal of the forest cover led to serious erosion and great floods.

- The "golden age" (1100 to 250 B.C., approximately coinciding with the *Zhou* Dynasty from 1122 to 256 B.C.). There is historical evidence of an active governmental interest in forest protection. There were well organized offices in the government giving thought and care to the management of the forests.

- The "dark age", from about 250 B.C. to 1911 A.D. indicated that many factors worked together to bring about the steady destruction of the forests.

■ Since 1949, the remaining forests were subject to additional pressure from economic development and population growth. Large populations were settled by the government in those regions with abundant forest resources, such as in northeast and southwest China. This population movement caused dramatic deforestation in those areas. However, misused institutions and policies were more important reasons for the forest destruction. For instance, there were three periods of serious forest destruction: (i) 1958–1961: the destruction was due to "The Great Leap Forward" ideology. For example, it is estimated that a total of 20 mill. $m^3$ of timber – more than one fourth of China's total inventory, was destroyed during this period in Anhui province (MOF 1987); in Hubei province, about one third of the forests were destroyed (Li and Li 1996); (ii) 1966–1976: the political unrest, "The Cultural Revolution", caused the forest cover to shrink from 12.7% to 12%; and (iii) 1981–1987: the uncertainty came from economic transition, together with market liberalization (timber price increase) and forest privatization, causing farmers to harvest their forests early.

of China's 200 large cities have difficulties with water supply and in about 50 of the these shortages are serious. Water shortages, particularly in rural areas, are partly caused by deforestation.

The area subject to soil erosion covers 180 mill. ha, accounting for nearly 20% of the total area of China. The most serious place is located in Loess Plateau area where 43 mill. ha are affected. In addition, 99 mill. ha of land is subject to salinization and alkalization (MOF 1995b). Soil erosion also results in heavy sediment loads and deposition on river beds. For instance, with higher erosion on the Loess Plateau, the rivers' silt loads have increased by at least 25% since the early 1950's. It is generally agreed that the increasing flood damage is partly caused by the soil erosion that clog drainage channels and reduce the holding capacity of many reservoirs.

Generally, it is difficult to combat environmental problems without the support of afforestation programs (Wang 1994; Liu 1995). Ten of the eleven recently implemented massive afforestation programs (Box 40.2) were initiated specifically to combat environmental problems. These programs have helped in preventing further environmental deterioration and improving the quality of environment.

## Forests and Biodiversity

China is a vast country covering many climatic zones, and possesses a rich flora and fauna. It is estimated that there are about 2 400 species of vertebrates living on land – mammals, birds, reptiles, and amphibians, accounting for more than 10% of the world's species (Table 40.5).

China has 32 800 species of higher plants, which can be divided into 470 families and 3 700 genera, including 200 types of gymnosperms, 25 000 types of angiosperms, 2 600 species of ferns, and 2 200 species of mosses. Of the higher plants, about 10 000 species are endemic, including 288 species of endangered plants, which have high scientific value. China ranks third in the world, only after Brazil and Indonesia, in terms of richness of plants species. About 3 000 species have economic and commercial value.

The growing population and economy, accompanied by increasing demand for natural resources, has caused deterioration in the natural environment, and threatens wildlife. Many species are on the verge of extinction. According to recent data, there are about 301 endangered vertebrate species, which account for 12.5% of the world total for this group. World Bank (1994) reported that about 200 species of plants have recently become extinct in China.

**Table 40.5: Endemic and endangered land vertebrates in China**

| | All species | Endemic species | Accounting for (%) | Endangered species | Accounting for (%) |
|---|---|---|---|---|---|
| **Mammals** | 499 | 72 | 14.4 | 94 | 18.8 |
| **Birds** | 1 244 | 99 | 8.0 | 183 | 14.7 |
| **Reptiles** | 391 | 26 | 6.6 | 17 | 4.3 |
| **Amphibians** | 280 | 30 | 10.7 | 7 | 2.5 |
| **Total** | 2 414 | 227 | 9.4 | 301 | 12.5 |

*Source: MOF (1996b)*

**Table 40.6: Commercial log production in China, 1988–1996 (mill. m³)**

| Regions | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|---|
| **NE** | 31.8 | 30.9 | 27.1 | 25.0 | 23.8 | 23.7 | 24.2 | 24.9 | 25.6 |
| **S & SE** | 19.7 | 17.5 | 18.0 | 20.0 | 24.4 | 25.7 | 26.9 | 27.7 | 26.0 |
| **SW** | 8.1 | 7.0 | 6.4 | 7.1 | 7.7 | 8.5 | 9.1 | 8.8 | 8.9 |
| **N & NW** | 2.6 | 2.6 | 4.2 | 6.0 | 5.9 | 6.0 | 6.0 | 6.4 | 6.6 |
| **Total** | 62.2 | 58.0 | 55.7 | 58.1 | 61.8 | 63.9 | 66.2 | 67.8 | 67.1 |

*Source: MOF (1996c)*
*Note: NE = Northeast SW = Southwest S & SE = South and Southeast N & NW = North and Northwest; for more details, see Table 40.4.*

BOX 40.2

## Massive Plantation and Afforestation Programs

■ Two decades ago it was recognized that China had the world's largest plantation area (Westoby 1975; FAO 1978), a position which China still holds. The most important afforestation programs that have been launched in China since the 1980's have been the following:

- *The Fast-Growing and High-Yielding Timber Plantation Program*: In 1990, China launched the program with a World Bank loan. About 1.37 mill. ha of land had been planted with a USD 0.3 bill. loan from the World Bank and USD 0.2 bill. of domestic loans during 1991–1995 (Lu and Tan 1996). The second phase, with a USD 0.2 bill. loan from the World Bank, has been planned.

- *The Three-North Shelterbelt Development Program*: This program has gone through two phases. During the first phase (1979–1985), more than 11.2 mill. ha had been planted with a survival area of over 6 mill. ha. During the second phase (1986–1995), about 10.6 mill. ha of land was planted, with 6.8 mill. ha becoming fully stocked forest. On the whole, 10% of the desert land has been controlled, 13 mill. ha of agricultural land has been protected by the planted forest, and 10 mill. ha of pasture land has been restored to forest by this project between 1978 and 1995. In the past, about USD 10 mill. from the central government budget and about USD 40 mill. from locally collected funds have been used annually to fund this program. The third phase (1995–2000) is to build on this achievement and to give priority to Liaoning, Jilin, Heilongjiang, Beijing, Hebei, the Kerqin Desert, the Mu Us Desert, the Loess Plateau to the north of Wei River, the southern part of Luliang Mountain and the Hexi Corridor, etc. The objective is to afforest 6.2 mill. ha.

- *The Program for Soil and Water Conservation in the Upper and Middle Reaches of the Yangtze River*: This program was initiated in 1989 and divided into two phases, covering 271 counties in 12 provinces and autonomous regions. The first phase to the year 2000 aimed to increase forested land by 6.7 mill. ha and the second phase was to forest 13.3 mill. ha within 20–30 years. From 1989–1995, the accumulated area afforestated amounted to 2.7 mill. ha (Lu and Tan 1996). (The Three Gorges Dam project is located in this area.) This program is given top priority by the Ministry of Forestry. From 1995 to 2000, the target is to complete the first phase plan, in which the total afforested area will reach 2.9 mill. ha. An even more ambitious target from 2001 to 2010 is to afforest an additional 6 mill. ha.

- *The Coastal Shelterbelt Program*: In 1988, the Government of China commenced the master plan for the Coastal Shelterbelt Program, aiming to establish 3.6 mill. ha of multiple use forest along the coast line by the year 2010. By the end of 1990, nearly 11 000 km of coastal shelterbelts had been established. From 1991 to 1995, about one million hectares of land had been planted. Of 18 000 km of coastline, 14 000 km of key shelterbelt had been established (Lu and Tan 1996). From 1996 to 2000, the priority will be given to the prevention and control of wind damage and soil erosion along the coast. The aim is to afforest one million hectares from 1996 to 2000 and a further million hectares from 2001 to 2010.

■ The other important programs are: (i) Northern and Central China Plain Afforestation Program; (ii) Taihang Mountains Afforestation Program; (iii) Combating Desertification Program; (iv) Shelterbelt Development Program for Huai River; (v) Shelterbelt Development Program for Tai Lake Basin Area; (vi) Shelterbelt Development Program in the Pearl River Valley; and (vii) Shelterbelt Development Program along the Middle Reaches of the Yellow River.

■ With the exception of the Fast-Growing and High-Yielding Timber Plantation Program, all these programs are designed to improve China's environment. It is expected that the environment will be greatly improved if these programs are successfully implemented.

## 40.3 Forest Industries and Trade

### Roundwood and Sawnwood

*Roundwood*

Since there are no official annual figures for total roundwood production, commercial log production serves as a good proxy to view year to year changes. Commercial log production usually excludes fuelwood and logs that are produced and used by farmers themselves. Southern China has become an increasingly important source of timber supply, challenging northeast China during the 1990's. During the last ten years, commercial log production ranged from 55 to 70 mill. $m^3$ (Table 40.6).

According to FAO (1997), the total roundwood production ranged from 280 to 300 mill. $m^3$ from 1991 to 1995, of which 90 to 96 mill. $m^3$ was industrial roundwood. The estimates by FAO seem to be higher than China's official figures, even accounting for Taiwan which usually is not included in the figures from official China's statistical sources.

According to China's Forestry Law, annual forest resources consumption in China should not exceed the nationwide annual increment of the forests. The level of the annual allowable cut implies an annual growth of about 2.2% of the estimated total inventory of 11.8 bill. $m^3$ on forestry land, and an annual growth of about 1 $m^3$ per ha on the forestry land. According to the Ministry of Forestry's plan for 1996–2000, the annual allowable cut will be 266 mill. $m^3$, of which 135 mill. $m^3$ of standing stock are planned to be used as a resource to produce 80 mill. $m^3$ of commercial logs (MOF 1995a).

*Sawnwood*

In the mid 1980's, sawmill production capacity reached its highest ever level. It is estimated there were more than 2 200 mills, with a total production capacity of more than 30 mill. $m^3$. However, the actual production was only 16 mill. $m^3$ in 1985 (Figure 40.1). The most important reason for the increased sawmill capacity was the large difference between log and sawnwood prices, which were both fixed by the government. About 50% of the sawmills were located in northeast China, 20% in northern China and the Shanghai area, 20% in southern China, and 10% in southeast and southwest China. The most important cities for sawmill industries were Harbin, Jiamushi, Mudanjian, Shanghai, Beijing, Chendu, and Guangzhou.

Since 1985, the gap between log and sawnwood prices has narrowed. The government lowered the annual removal quota for timber harvesting to increase log prices, and consequently the output of sawnwood decreased (Figure 40.1). According to FAO (1997), the total sawnwood production ranged from 20 to 25 mill. $m^3$ during 1991–1995.

Currently, it is estimated that China has about 2 000 sawmills, with a total annual production capacity of 24 mill. $m^3$, although annual sawnwood production is less than 15 mill. $m^3$. The sawmill industry has been declining in recent years. Consequently, few firms are willing to update equipment and technology. It is estimated that about 70% of the

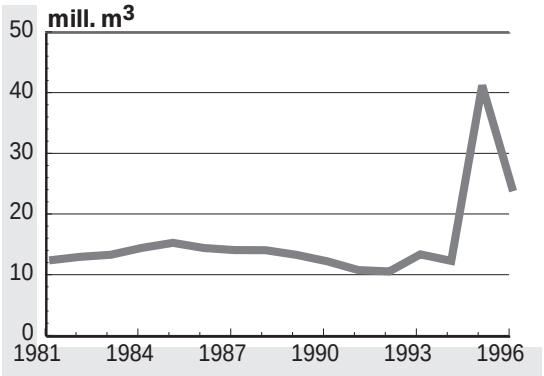


**Figure 40.1: Sawnwood production in China, 1981–1996 (China's National Forestry Statistical Materials 1996)**

*Note: The sudden change since 1995 comes from a change in data coverage.*

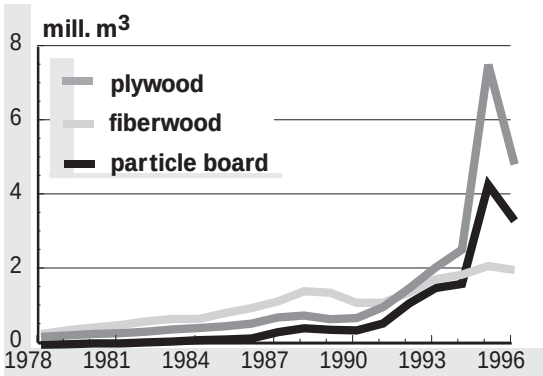


**Figure 40.2: Production of wood-based panels in China, 1978–1996 (China's National Forestry Statistical Materials 1996)**

*Note: The sudden change since 1995 comes from a change in data coverage.*

equipment used by the sawmills dates from the 1950's. Most sawmills, usually branches of big state-owned "integrated" wood-processing factories, no longer produce sawnwood. This is especially true for those sawmills located in big cities but far away from the source of raw materials.

## Wood-based Panels

The wood-based panel industries have been developing rapidly during the last two decades. In 1996, plywood, fiberboard and particleboard stood at 4.9, 2.1 and 3.4 mill. $m^3$, respectively (Figure 40.2), but according to FAO (1997), were respectively 3.0, 2.0 and 1.7 mill. $m^3$. These latter figures include Taiwan, however, so the estimates by FAO are lower than China's official figures.

During this decade, agriculture, including forestry and other primary industries, have been given priority by the government. For instance, between 1981–1990, 26 large and medium-sized wood-based panels factories had been built by the Ministry of Forestry, with a total production capacity of one million cubic meters. Meanwhile, other sectors and some local governments have also built a large number of new factories and renovated many old ones. Between 1986 and 1990, the total capital investment in forest sector amounted to USD 3 bill., half of which was invested in forest industries. The investment resulted in a 394 000 $m^3$ increase in the production capacity of particle board, and for plywood, including bamboo panels, the capacity increase was 280 000 $m^3$.

Foreign capital, advanced technology and equipment have also each contributed to the increased production capacity and to new products, such as medium density fiberboard (MDF), oriented strand panel (OSP) and other specific-use panels. As the technology and materials for surfacing have improved, the end-use opportunities for wood-based panels have increased rapidly. There was about USD 30 mill. worth of foreign investment in China's wood-based panel industry between 1978 and 1993, accounting for 40% of total foreign investment in the forest sector (Li 1996).

## Non-wood Forest Products

Non-wood forest products are particularly important for the Chinese rural economy. They include bamboo products, chemicals and other industrial raw materials from forests, fruits, edible oil, mushrooms and other foods, beverages, traditional Chinese medicinal herbs, spices, etc. The concept of *economic forest* in China is used to mean forests which are used to produce non-wood forest products. Currently, the economic forest accounts for some 13% of total forest area.

### *Bamboo*

Bamboo is an important non-wood forest resource in China. As "the Kingdom of Bamboo", China contains one third of the total number of bamboo species, area, and production of the world. China has more than 40 genera and 400 species of bamboo, covering 7 mill. ha; *Phyllostachys pubescans*, the most important species, covers 3.5 mill. ha. During the early 1990's, the total growing stock amounted to 100 mill. tonnes, producing about 10 mill. tonnes of bamboo poles and nearly 2 mill. tonnes of bamboo shoot, with a total value of USD 700 mill. annually. Bamboo poles are not only used for traditional purposes, but also in construction, light-fitting industry, paper making, food processing, packaging, transportation, and furniture.

The production of bamboo-based panels began in the middle of 1970's and has been developing rapidly. China was estimated to have only 100 bamboo-based panel factories in 1988 and the total production was about 100 000 $m^3$. In 1994, more than 200 factories were mostly located in Hunan, Zhejiang, Sichuan, Jiangxi and Fujian provinces, with an annual output of 225 000 $m^3$ and a consumption of about 550 000 tonnes of bamboo. The annual output value was about USD 100 mill. based on the 1994 prices (Zhong 1996).

### *Industrial Materials*

The most important chemical raw materials from forests are turpentine oil, resin, rosin, tannin and shellac (Figure 40.3). In southern China, the annual resin production was over 580 000 tonnes in 1996, providing part-time employment opportunities for 300 000 people. Rosin output is nearly 40% of the total output of the world, accounting for half of the world trade. In recent years, annual exporst have been more than 200 000 tonnes, with a value of USD 100 mill.

Some other raw materials from forests include tung oil, Chinese tallow oil, insect wax, raw lacquer, and other types of oil products from trees. The tung tree is unique to China, covering a total area of 1.8 mill. ha. Its main product is industrial oil, the annual production of which is over 400 000 tonnes, with 2 000 tonnes for export. Chinese tallow, a major economic tree, covers 200 000 ha with a production of 40 000 tonnes of tallow seeds (MOF 1996a).

Raw lacquer covers a total of 500 000 ha, with an annual production of more than 3 000 tonnes in

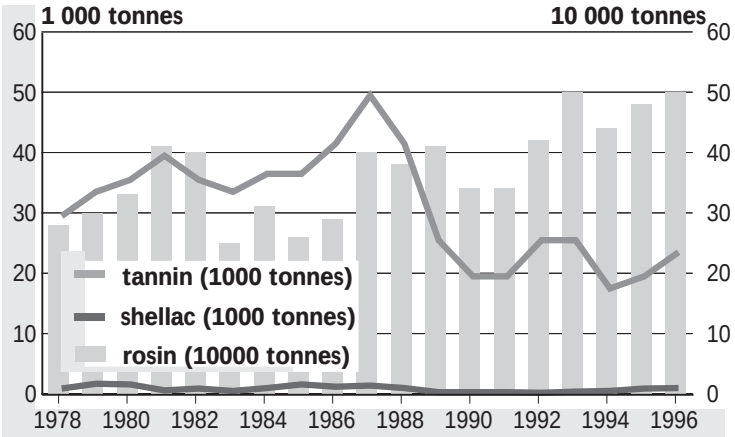


**Figure 40.3: Production of non-wood forest products in China, 1978–1996 (China's National Forestry Statistical Materials 1996)**

recent years. Essential oils and other fragrant materials are also important NWFPs, including *litsea cubeba*, eucalyptus leaf oil, etc. Eucalyptus plantations have reached more than 6 mill. ha and produce about 3 000 tonnes of oil, of which 1 000 tonnes are exported.

### *Foods, Beverages and Medicines*

Forests are a traditional source of food and beverages for the Chinese. Apart from the bamboo shoot discussed above, there are many other products, such as chestnut, Chinese date, birch sap, seabuckthorn, etc. The annual production of chestnut is more than 200 000 tonnes, of which around 25 000 tonnes are exported. There are over one million hectares of walnut forests, producing over 200 000 tonnes, with 50 000 tonnes for export. There are 240 000 ha under Chinese dates, producing 400 000 tonnes of fresh dates.

Ginkgo is distributed widely with an annual production of over 5 000 tonnes, mostly for export. *Camellia* spp. is endemic to China, with a total area of over 4 mill. ha, producing 500 tonnes of tea oil. China has rich resources for soft drink materials, such as birch sap, seabuckthorn, kiwi fruits, bureji gooseberry, blackberry, amur grape, wild rose, cowberry, siberian nitraria, pine pollen, etc.

The traditional Chinese medicinal herbs are well-known in the world. Most of the products are from forests. They include ginseng, American ginseng, pilose antler, tall gastrodia, bezoar, cocos poria, eucommia, roots of common baphicacanthus, Ural licorice, flower of lily Magnolia, and Chinese thorowax. Their production is becoming a promising industry as the biotechnolgy develops.

## Pulp and Paper

By the end of 1995, there were more than 6 000 paper mills, excluding 15 000 small factories that belong to local villages. Between 1991–1995, the output of paper and paperboard increased by 15% annually. In 1995, about 28 mill. tonnes of paper and paperboard was produced (Figure 40.4). These figures are close to the estimates by FAO (1997), which, however, included Taiwan.

Although the paper industry in China is developing rapidly, it still cannot meet the growing demand.

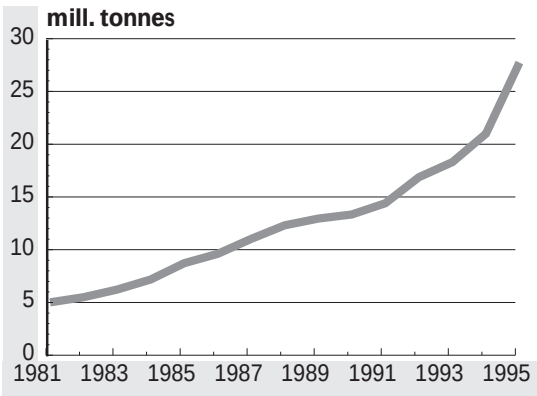


**Figure 40.4: Paper and paperboard production in China, 1981–1995 (China's National Forestry Statistical Materials 1996)**

The annual consumption per capita was only 20–25 kg in the early 1990's. Total consumption of paper and paperboard was 30.6 mill. tonnes in 1995. A great quantity of pulp, paper and paperboard has to be imported. Annual pulp imports account for approximately 10% of total domestic pulp output.

China has the biggest non-wood paper industry in the world. Its capacity for non-wood fiber pulp and paper production accounts for about 62% of the total capacity of world. Currently, about 60% of the raw material for China's paper industry is non-wood fiber (Table 40.7). The share of wood fiber pulp to total pulp has decreased from 14.6% in 1990 to 13.7% in 1992 and to 13% in 1995. China's paper production is the third largest in the world after the United States and Japan.

Because most of the raw materials are non-wood fiber and the products are mostly used locally, the production scale of the mills is very small. As these small factories generally are not equipped for alkali and wastewater treatment, they are large sources of water pollution. The total wastewater discharge from the paper industry was 3 bill. tonnes and represented 12% of total industrial wastewater in 1992.

In recent years, the central government has made efforts to improve and renovate these factories and decided to close down all pulp and paper factories whose capacity was lower than 5 000 tonnes per year from 1st September 1996. But, according to some media reports, it seems that they have not been closed down completely.

### Forest Products Imports and Exports

Since the 1980's, China has become an important importer of wood products (Table 40.8). The change in the structure of imports is due to changes in the international wood product market and in domestic demand. For instance, log imports have declined while imports of plywood, veneer, paper and paperboard have increased.

While China is a net wood importing country, it also exports some wood products, as well as some non-wood forest products, charcoal, etc. The export of wood chips have been growing fast during recent years following the development of eucalyptus plantation forestry in southern China. In 1995, nearly 2 mill. tonnes of dry wood chip was exported from China. In Hainan province, wood chip exports have become an important foreign currency earner, amounting to about USD 20 mill. annually in recent years.

Non-wood forest products are China's traditional export products. For instance, in 1995 the exports of rosin and charcoal amounted to 287 000 and 26 000 tonnes, earning USD 2 mill. and USD 0.2 mill., respectively. The exports of bamboo products have been USD 250 mill. annually in recent years.

## 40.4 Institutions and Policy Reforms

### Property Right Clarification and Decollectivization

Since 1949, forest related institutions and policies have experienced frequent changes (Table 40.9). At the very beginning of the reforms in the late 1970's, China did not change the property right because at that time most people had not yet completely lost their trust in the old system. Particularly in the forest sector, it was believed that public ownership was superior to private. But it was obvious that inconsistent and over-centralized property rights were harmful to both forest protection and investments. The reform in forestry came nonetheless much later than in the agricultural sector.

"The Decisions on the Issues of Forest Conservation and Forestry Development", issued by the central government in 1981, was a landmark in forestry reforms. This document was intended to *stabilize* the forest and forest land ownership, to *specify* private forest land and to *set up* the system of management responsibility (so-called "3-S"). The "3-S" declared that: (i) for all the forest stands and forest land with clear ownership, the government, at or above the county level, should issue a property certificate to the owner to recognize the property right and guarantee its stability; (ii) in accordance with the needs of the local forest farmers, plots of forest land, including waste hills, river sites or beaches, should be allocated to the farmers for the purpose of long-term planting of trees and grass; and (iii) the trees, planted by the farmers around their houses, on allocated land and on the land designated by the village committee, shall be everlasting property of the farmers and can be inherited.

The "3-S" strategy was implemented during the following four years. With the exception of Shanghai and Tibet, 1 781 counties, or 77.5% of all the counties which participated in implementing "3-S", had accomplished the work. About 100 mill. ha of forest land were issued certificates and some 1.3 mill. disputes on forest and forest land were settled (90% of all disputes). A total area of 31 mill. ha were allocated to about 56 mill. households, averaging

**Table 40.7: Pulp production from various raw materials in China, 1992**

| Materials | 1 000 tonnes | % |
|---|---|---|
| Rice and cereal straw | 7 200 | 43.9 |
| Wastepaper* | 4 480 | 27.3 |
| Domestic wood fiber pulp | 1 630 | 10.0 |
| Reed, cotton, and grass | 800 | 4.9 |
| Imported wood fiber pulp | 610 | 3.7 |
| Bagasse | 520 | 3.2 |
| Bamboo fiber | 300 | 1.8 |
| Other non-wood fiber | 860 | 5.2 |
| Total | 16 400 | 100 |

*Source:* Pulp and Paper Research Report *(1993)*
*Note: * Includes imported wastepaper.*

**Table 40.8: Forest products imports in China, 1981–1994**

| Year | Log 1 000 m³ | Sawnwood 1 000 m³ | Plywood 1 000 m³ | Veneer 1 000 m³ | Pulp and wastepaper 1 000 tonnes | Paper and paperboard 1 000 tonnes |
|---|---|---|---|---|---|---|
| 1981 | 1 871 | 75 | 259 | 0.3 | 710 | 766 |
| 1982 | 4 652 | 132 | 5 140 | 8.4 | 584 | 459 |
| 1983 | 6 613 | 162 | 304 | 4.9 | 977 | 517 |
| 1984 | 7 956 | 600 | 573 | 1.2 | 824 | 608 |
| 1985 | 9 820 | 148 | 824 | 2.3 | 779 | 863 |
| 1986 | 7 818 | 165 | 621 | 0.9 | 737 | 1 095 |
| 1987 | 7 189 | 98 | 1 406 | 30.2 | 979 | 1 336 |
| 1988 | 10 675 | 392 | 1 352 | 24.6 | 788 | 852 |
| 1989 | 6 410 | 125 | 1 073 | 13.5 | 465 | 858 |
| 1990 | 4 193 | 252 | 1 377 | 5.8 | 765 | 952 |
| 1991 | 4 097 | 306 | 1 463 | 27.9 | 1 291 | 1 339 |
| 1992 | 4 670 | 974 | 1 585 | 241.4 | 1 343 | 2 443 |
| 1993 | 3 467 | 1 318 | 1 513 | 350.0 | 1 300 | 2 500 |
| 1994 | 3 335 | 955 | 2 177 | 239.0 | 1 410 | 3 180 |

*Source: China's Customs Statistics Yearbooks (1981–1994)*

0.56 ha per household.

During the implementation of the "3-S", the government had intended to expand the private section. For instance, in 1983 it stipulated that: (i) the plots of land allocated to the farmers should be enlarged; (ii) the acreage of wasteland under a contract should not be limited and the contract duration could be for 30 to 50 years; and (iii) the contracts can be transferred to other people.

Presently, there are about 4 500 state-owned forestry enterprises, including 138 state forest bureaus, 443 wood processing enterprises, 148 forest chemical processing enterprises, 72 forest machinery factories, and 1 461 small-scale local enterprises (MOF 1995a). Since 1990, four forestry enterprise groups (Heilongjiang, Jilin, Daxinganling, and Inner Mongolia) have been established. In addition, there were more than 4 200 state-owned forest farms, managing 46 mill. ha of land, with 26 mill. ha of plantation and secondary natural forests, accounting for 20% of the forest land area. These farms are becoming more independent of government control.

There are several kinds of collectively owned forestry properties, including: (i) township or village forest farms; (ii) joint-forest farms; and (iii) the share-holding system. By 1992, there were about

**Table 40.9: Forest-related policy changes in China**

| Period | Institutional changes | Tenure system | Stumpage and timber market | Notes |
|---|---|---|---|---|
| Before 1949 | | Landlords, bureaucrats, merchants, self-sufficiency farmers, common and open access | Free market, but some degree of monopoly | The P.R. of China was founded on 1st October 1949; The Communist Party came to power |
| 1950–1956 | Land reform and economic recovery | Government confiscated all forest lands owned by landlords and bureaucrats and evenly distributed to the farmer within the community, or as state-owned land | Free market | 1949–1952: Land reform and economic recovery<br>1955–1956: Primary collectivization: mutual aid teams, and elementary agricultural production cooperatives |
| 1956–1958 | Towards socialism | Transition to collectively owned, state-owned | From free market to central distribution system | 1957–1958: Advanced collectivization-stage 2: Advanced Agricultural Production Cooperatives and People's Commune;<br>1958: Great Leap Forward |
| 1958–1981 | People's commune system | Collectively owned, state-owned | Centrally planned prices, production and distribution | 1961–1963: Economic adjustment due to the food crisis in 1959 and 1960<br>1966–1976: Cultural revolution<br>1978: Economic reform launched<br>1979: Provisional Forest Law adopted |
| 1981–1984 | Stabilization and consolidation of ownership | Contracted timberland; collective timberland (shareholding system), state-owned | Dual system: compulsory delivery and free market | 1981: Some important forest policy changes enacted |
| 1985–1992 | Early privatization and decentralization | Private timberland; contracted timberland; collective timberland (including shareholding system), state-owned | Price controls lifted in the part of free market, but tax and fees increased, government retained monopoly on procurement | 1985: Timber markets opened and central government pricing abolished in the south<br>1986: Forestry Law enacted;<br>Timber markets in the south under temporary government control<br>1991: Four large State-owned Forestry Corporations were established in northeast China and Inner-Mongolia |
| 1993–1998 | Towards market economy | Longer-term contract for forest and forest land, auction of non-forest land for long-term (up to 100 years) holding, state-owned | All price controls lifted (dual prices convergence) and free competition in collective forest area; bigger share of timer traded by market (90%) for state-owned forest | 1998: The Ministry of Forestry was degraded into the National General Bureau of Forestry |

*Sources: Combined and modified from Ross (1988), Sun (1992), Yin (1994) and Zhang (1997)*

130 000 township or village forest farms in the whole country, managing about 12 mill. ha of forest. Under this form of tenure, the land use right belongs to the collective, and the farmers are paid in accordance with their contributions. The net profit is used to develop the collective welfare services or divided among the farm staff. The farms are run by the forest farmers themselves, usually with reputable and responsible persons as managers. The township economic or village economic organizations supervise the forest farms. The joint forest farms are operated by a few households. The ownership of the forest land does not change, but the user right belongs to the farms. The share-holding system was initiated in the middle of the 1980's in a few places, such as in Fujian Province. This system is now widely practiced in Fujian, Hunan and Guizhou provinces, among others, but the procedure varies from region to region.

By the end of 1986, there were over 4 mill. specialized forest households, each being independent management and decision-making units. Most households manage the allocated forest land and the contracted forest land. They usually specialize in nursery production, planting, forest conservation, harvesting, forest by-product processing and timber transportation. However, some of them have developed into cooperative forest farms or joint-stock farms.

The clarification of ownership of the trees and land laid the ground for legally protecting the rights of the owners. Total afforestation area of the country amounted to 6 mill. ha in 1983 and exceeded 8 mill. ha in 1984.

## Property Transactions and Management Reform

### *Collectively Owned Forests*

Along with property right clarification in the collective forest areas, more flexible management organizations have been adopted in the last two decades. The main idea is to diversify, decentralize and liberalize forest management. Land could not be privately held or traded in China after the *socialist transformation* in 1956, but the reforms begun in 1978 brought about a change in the land management system in which the management authority was separated from ownership. This led to the land categories of "state-owned, collectively managed" or "collectively owned, privately managed". The 1982 Constitution and the National Land Administration Law both declare that the administrative villages that succeed the ownership of the land may allocate the land to smaller units or households for management.

A main impact of the reform, after implementing the "3-S", was to allow forest and forest land to be transferable. By 1988, the transaction had become widely used, especially in the provinces of Guizhou, Fujian, Guangdong, Hunan, and Sichuan. The young and middle-aged forests are traded in market, while the mature forests are open to bidders and enterprises, such as the paper mills. Some of the wood-based panels factories also buy forests and establish their own raw material bases.

The introduction of sale by auction has also been an important development. Although wasteland was allocated, the four types of wasteland, i.e., the waste mountains, waste hills, waste slope areas, and the waste beach areas, remained unattractive to farmers. Farmers often saw little benefit from planting trees on the allocated wasteland with no guarantees if government policy changed. To promote afforestation on the wasteland, the government tried selling land-use rights for a long-term, ranging from 50 to 100 years. The rationale behind this was very simple: there were no incentives to invest capital and labor when the land ownership was unclear.

The auctions seem to have been successful. More than 10 provinces have used auctions, and over 730 000 ha have come under a new management authority (Ai 1995). In Shaanxi Province, utilization rights for over 267 000 ha of the bareland were transferred by auctions between 1992 and 1995 (Wang and Jian 1996). In the Lulian Prefecture of Shanxi Province, about 200 000 ha of wasteland were transferred by auctions during the same period (Yao 1996).

The decolletivization of forest land was often accompanied by forest destruction because of the farmers' uncertainty about future policy. The shareholding system was introduced to preserve the scale economies by integrating forest areas and to prevent forest destruction in the process of privatization. In this system, rather than dividing the physical forests, it is the nominal shares that are divided among the villagers.

A common procedure is to establish monetary shares in certain forests within the community, which are then evenly redistributed between households in relation to family size. These shares were defined as *basic shares* or *initial shares*, which could be inherited or transferred but could not be withdrawn by any holder. Later, a new type of share was issued in return for investment of labor or capital. It was known as an *additional share* or *investment share*,

and was permitted to be withdrawn. A shareholding committee was then formed, and an executive was elected to take charge of the company. The various forest management responsibilities were contracted to holding members. Yin (1994) and Song et al. (1997), among others, have discussed this system extensively.

### *State-owned Forests*

Reform of the state-owned forests started in the middle of the 1980's. Between 1985–1987, an old system in which all profits were paid to (or all losses were compensated by) the government was replaced by a partial profit submission (or losses compensation), and finally by a tax submission system. These reforms changed the forestry bureaus from being simply part of government into more independent economic enterprises.

An important change has been the adoption of a stumpage price system since 1990, in which the stumpage price becomes a cost component in forest harvesting. Those sources collected from the stumpage price are proposed to be used for silviculture and infrastructure investments, and administration. In this case, the Ministry of Forestry can reallocate some resources across different forestry bureaus. The stumpage prices were determined by the Ministry of Forestry together with the State Bureau of Pricing, and they differ by species and by location. Currently, the stumpage price accounts for about 30–40% of the local timber price.

In 1991, the 84 forestry bureaus in northeast China and Inner Mongolia were incorporated into four large state-owned forestry corporations. This approach, perhaps learned from South Korean models, was designed to establish a modern forestry enterprise system and new economic operational mechanisms. Property right transactions take place through selling, renting or contracting. The transaction is intended to undergo a stock system transition.

As the economic situation and the forest resources deteriorated in the late 1980's, a series of policies were designed to further support the forest enterprises. These policies included reducing the quotas delivered to the state with a below-market price. Other measures included tax exemptions, increasing the proportion of the forestation fund and providing low interest loans to help the shift from logging to silviculture. All these policies helped mitigate the crisis for the state-owned forestry enterprises.

However, like the state-owned enterprises in other sectors, the transition has been difficult for forestry, both because of the decreasing forest resources and increasing economic burden of the growing population. The bureaucratic administration, the poor market mechanism, and corruption all hinder the economy's progression from going towards a market economy.

## Forest Legislation

The Forestry Law adopted in 1984 is the basic law concerning forestry. The law covers tree planting, cultivation, protection, utilization, and management of forest resources. There are also several hundreds of other legistativedocuments and regulations at the national and provincial levels. The Forestry Law is currently under revision.

### *Laws and Regulations on Forest Plantation*

The Fifth National People's Congress affirmed in 1982 the *Resolution on Conducting the National Compulsory Campaign for Tree Planting*. It stipulates that each Chinese citizen aged over 11 years, except for old, weak, sick or disabled people, should plant 3–5 trees or contribute the equivalent work in growing seedlings, protection or other activities each year. March 12th is the National Tree Planting Day.

*The Implementation Guideline of the Forestry Law* sets the overall goal of national forest coverage at 30%, while the goal for mountainous counties is over 70%, hilly land 40% or more, and plains about 10%. The Forestry Law further stipulates that all forestry land owners with available land for afforestation should afforest that land.

The Forestry Law indicates that all the organizations or individuals that have conducted logging should reforest the logged sites. The area, number of trees, species and duration should be pre-defined in the logging permit document. In general, the reforested area should be larger than that harvested.

### *Laws and Regulations on the Utilization and Protection of Forest Resources*

Several measures have been applied to protect forest resources, including: (i) an annual logging quota, which sets the maximum forest consumption during a given year. The quota is calculated and approved by relevant authorities; (ii) a logging license system that is designed to ensure that annual logging does not exceed the logging quota and that reforestation follows the logging; (iii) a timber transportation license system that is designed to control timber transportation; and (iv) controls on the number and scale of the wood processing enterprises that are determined according to the current situation of

forest resources and the annual logging quota in a given area.

The Forestry Law and the Regulations on Forest Fire Control stipulate that the local government must be well prepared to prevent and extinguish forest fires. Enhanced forest fire control has considerably decreased the number and the seriousness of forest fires. The guiding principle of forest disease and pest control in China emphasizes the importance of prevention combined with integrated control. First, a forest disease and a pest monitoring and control system has been established throughout the country to enhance control at an early stage of their appearance. Second, a pest and disease quarantine system for forest products and plants has been set up. The transporters of forest plants and other products for import or export in a special area must hold a quarantine certificate. Wherever pests or diseases are found in forest products or plants at either the place of origin or destination, they must be immediately treated or burned *in situ*. Third, species and seedlings should be selected for plantation in order to match the site (both the soil and climate). Fourth, forest disease and pest prevention and control should be generally tackled by owners; however, in the case of a large-scale outbreak of dangerous pests or diseases, the control will be organized by the government, and the duties and the costs will be shared by forest owners and governmental organizations.

### *Laws and Regulations on Biodiversity Conservation*

The nationally protected key wildlife species are classified by the Ministry of Forestry and the Ministry of Agriculture, and regulations are approved and issued by the State Council. The National Protected Animal Category issued in 1989 includes 355 species. Furthermore, there are regional or locally protected wildlife species that are not included in the national category.

The hunting of nationally protected wildlife is forbidden by the Wildlife Protection Law. A special hunting permit is required if some wild animals are needed for scientific research, domestication and breeding, exhibition or other purposes. The hunting of unprotected animals also requires a Normal Hunting License or Special Hunting Permit. Hunters must strictly adhere to the animal species, numbers, locations and durations of hunting stipulated by the license.

Trading in wild animals and their products is controlled by the trade and industry administrative organization. Generally, trading of nationally protected wild animals is not allowed.

In 1985, the state issued Management Regulations on the Natural Reserves for protecting Forests and Wildlife. Based on these regulations, 518 natural reserves have been established, covering about 5% of the total territory of China. These are for the protection of natural forest ecosystems, wetland ecosystems, wildlife and plants.

### *Laws and Regulations Enforcement*

To increase the awareness and ease the implementation of the laws and regulations, a series of law awareness campaigns, training, education and dissemination have been widely carried out. Supervisory and inspection systems have also been established to monitor law enforcement. A forestry security department, Procuratorate and court have been established in every forest region. Some 50 000 employees are involved in law enforcement and related activities.

## Other Forest Policy Reforms

### *Forest Taxation*

The forest taxation system was introduced at the very beginning of forest economic reforms and has changed frequently. The relation between the state-owned forest bureaus and the government was also changed from being a profit remittance system to a taxation system, in order to promote market mechanisms. Currently, the taxation system is still very complicated and varies from province to province. The major taxes and fees in Fujian Province, an important timber producing province in southern China, are listed in Table 40.10. The taxes and fees listed are set by the provincial government. In fact, there are several other local taxes and fees that are additionally used at county and village levels. The heavy tax burden and complexity of the tax system are a major impediment to the operation of free market in the forest sector.

### *Forestation Fund and Subsides for Silviculture*

To increase afforestation and ensure the reforestation of logged sites, a forestation fund was established two decades ago. Finances for the fund partly come from taxes and fees charged in timber harvesting and trading. For instance, the buyers pay 12% of the timber price to the local forestry administrative agency at county level in most provinces of the southern China. In general, 10%, 20% and 70% of the fees and taxes are allocated to the provincial, prefecture and county administrative agencies, respectively.

**Table 40.10: Timber taxes and fees in Fujian Province in China, 1997**

| No. | Item | % or amount (yuan/m³) | Purposes |
|---|---|---|---|
| 1 | Special products tax 1* | 8.8% of the timber procurement price** | Used as government budget source |
| 2 | Special products tax 2 | 8.8% of timber procurement price + silviculture fee + forest services and development fee | Used as government budget source |
| 3 | Value-added tax (VAT) | 13% of the sale price | Used as government budget source |
| 4 | Silviculture fee | 12% of the sale price | Afforestation, reforestation, forest protection, technological extension, inventory, etc. |
| 5 | Forest services and development fee | 8% of the sale price | Used for road extension, renewed fixed assets, small water damage protection projects, etc. |
| 6 | Forest resources compensation fee | 5% (3%) of the price sold to outside provinces for fir and pine (and for other species) | Used for forest resource development and related projects |
| 7 | Others† | about 10% of the timber price | Miscellaneous |

*Source: Fujian Provincial Government (1997)*
*Notes:*
* *No.1 tax is paid by the forest owner, the others are paid by the timber trading companies.*
** *The timber procurement price refers to the government purchasing price from farmers.*
† *Including township development fee, education fee, infrastructure development fee, social development fee, plant quarantine fee, forestry development fee, etc.*

It is claimed that the use of the fund is restricted according to its source, i.e., for the state-owned forest, the fund is used to plant trees on the logged sites, and on bare mountains that are state-owned; the fees collected from collectively owned forest products are used for the reforestation of logged sites, the rehabilitation of bamboo forests and subsidies to purchase seedlings, etc.

In addition, the Forestry Law stipulates that enterprises which consume large amounts of wood, such as the paper and coal mining industries, must use a certain amount of income for the afforestation of special purpose forests producing pulpwood and mining-wood. Since this policy was introduced in the early 1980's, the coal mining sector has planted about 40 000 ha of forests.

Other economic measures are also used by the government to support collective and private silviculture and forest management, such as providing free seedlings, technological support, planning, and long-term low interest or even interest-free loans.

### *Market Liberalization and Development*

In 1950, timber trading for collective forest enterprises had been monopolized by the central government, which controlled timber production, price and allocation. Ten Policy Issues for Promoting Rural Economic Development of 1985, abolished the state monopoly for timber trade in southern China. Unfortunately, due to this overnight market liberalization, the intended market instrument incentive caused disorder in the market and led to the biggest episodes of deforestation since 1949. As a result, in 1987 the government reactivated the traditional government timber procurement agencies and again imposed its monopoly on the timber market in major timber production counties. But as the market mechanism and the socio-economic environment improved, all price controls were finally lifted and free competition has been practiced since 1993.

The timber market was opened much later for the state-owned forests. Initially, the approach was to gradually increase the timber price, making the set price closer to the market price. For instance, the price was increased four times from 1981 to 1990. Then the state-owned forest bureaus were gradually allowed to sell their timber in the free market upon delivering a fixed quota of their products to the state. The proportion of timber sold in the free market has been gradually increasing. Now, only 10% of the timber production is still controlled. In fact, the controlled part only concerns wood for the military, disaster relief, the coal industry and railway construction.

China's wood markets are also becoming more open to the rest of the world. In 1996 and 1997, China twice implemented tariff reductions, including most wood and wood product items. The only items for which tariffs were not reduced were plywood and laminated wood. Tariffs on the remaining items were cut by 12 to 57% in 1996. But the value-added tax (VAT), while not discriminatory in principle because it is also applied to domestic production, does add significantly to the price of imported goods.

Presently, the wood products markets are quite competitive. It is estimated that about 20 000 companies are involved in timber trading in the Shanghai region alone. The private and small companies are obtaining an increasing stronghold of the markets because they are often more competitive than state-owned big trading companies. To further promote competition, a number of different forest products fairs are organized either annually or otherwise. The most significant of these are the Annual Timber Products Trade Fair and some company-sponsored local timber products fairs held occasionally in major cities.

## 40.5 Discussion

About 80% of the world's forests are in public ownership. Since the early 1980's, the trend towards reducing the size of the public sector in favor of private ownership and management has recast the development strategies and policy assumptions of past decades. Privatization is widely applied as the main strategy to reduce government participation and control (Laarman 1996). However, the implementation of privatization has been a failure in numerous cases. The problem has not come from privatization itself, but the failure of both the market and government functions. The optimal combination of private and public sectors in forest policy obviously depends on economic and social conditions (Hofstad 1997).

China's forestry reforms since the late 1970's have generally been succesful when measured by the growth of forest resources and timber production. This view is also supported by several empirical studies, such as Yin (1994), Ruiz-Peres et al. (1996) and Song et al. (1997). In this context and considering the comprehensiveness of its reforms, China provides a unique example for other developing countries and countries with economies in transition. China's experiences include decentralization, property rights transformation and stabilization, management reforms (separating the ownership from management, contract responsibility systems, and share-holding systems), timber market and price liberalization, as well as the promotion of afforestation and the protection of natural forest resources.

The success of China's policy to plan and control births is well-known, from a total fertility rate of about six per couple in the 1960's to less than two per couple in recent years. Although this is close to what demographers call "replacement level fertility", China's population will continue to grow for some time because of its young age structure. China will, most likely, have over 1.3 bill. people by the end of the century, and, even if fertility remains low, the ultimate population is likely to exceed 1.5 bill. (Heilig 1996). China still has half of its forestry land unforested. The extent of further conversion of forestry land to agricultural land will depend, among other things, on progress in the intensification of farming. Fuelwood production and consumption continue to be stable and have slightly decreased in recent years, from 110 mill. $m^3$ in the late 1980's to 90 mill. $m^3$ in the mid-1990's, as other energy sources have replaced fuelwood.

Based on reasonable forecasts, the forest cover rate in China should reach 15% within 5 years and 20% within 25 years. However, China will still be short of domestically produced timber in the foreseeable future and will still be a significant wood products importer in the world markets, but the increasing trend in imports will eventually slow down. As the market economy develops and policy changes continue, forest management will become more efficient and China's forest sector (especially plantations for timber production) will become more competitive. In addition, housing starts (both in urban and rural areas) may well experience a downturn from their recent levels.

China's forest development will greatly depend on institutional and policy reforms. In the regions dominated by state-owned forests, such as the northeast and southwest China, the transition continues to be painful as the accessible forest resources are being exhausted and the large and still growing populations have to rely on the natural forest resources; investments in other sectors (including reforestation) have been very limited in the past decades. The strict allowable cutting quotas and the reduced government investments may worsen the situation in the coming years. Unemployment is also becoming a serious problem in these regions.

In the regions of the south and southeast, where collectively owned forests dominate, property right issues remain problematic, as the farmers continue to be uncomfortable with the often inconsistent and volatile policy changes. Another issue is that the

heavy taxes and fees charged on timber production discourage long-term forest investments. The central government has attempted to reduce farmers' tax burdens, but to maintain lower taxes seems very difficult in practice since forestry plays a key role in supporting local governments in rural areas. As long as the costly, bureaucratic, administrative system exists, it will be difficult to relieve the tax burden on farmers.

The heavy and complex taxation applied in the forest sector greatly discourages further forest development in China. Farmers' net income from timber sales may be as low as 6% according to Yin (1994). Production and yield taxes are the types of forest taxes mostly used in China. These taxes may be helpful to sustain the existing forest resources in the short run, but in fact they are cumbersome and expensive to implement. They also discourage forest investments in the long run. A preferable tax type would be the site productivity tax (*lump sum* tax) which is inexpensive and easy to implement. A *lump sum* tax in agriculture has been practiced for many decades and has proved to be very workable in China. This may be one of the reasons why reforms have been more successful in agriculture than in forestry.

Subsidies for silviculture from the forestation fund are usually based on how extensive an area is planted. Even if these subsidies are beneficial in increasing the forest cover in the short run by encouraging people to plant by area, the applied principle is likely to discourage follow-up efforts and intensive silviculture. The long administrative chain from collecting the fund to distributing it not only squanders resources, but also provides incentives for the corruption of officials. This in turn discourages fair competition, an important principle for market economy.

Authorities in China encourage wood consumers to shift to alternative materials, such as cement, metal and plastic. This policy is intended to discourage the use of forests and save the remaining forest resources. But in fact it discourages long-term forest investments and may lead to depreciation of the forest resources in the long run. Higher demand with resulting higher prices for wood products could generate more investments in forestry. This would require both fully consistent property rights, and a relaxation of the complex and heavy taxation and fee system within the forest sector, where currently the net price of wood received by the seller may be only a fraction of the price paid by the buyer.

China still likes to set various kinds of "afforestation targets" and campaigns, to mobilize ambitious afforestation programs and to design poorly implemented forest regulations. This approach is not always in line with market economy principles. The market economy requires positive market-oriented signals from the government and well-designed macroeconomic policies, rather than government-set plans, targets and poorly implemented regulations.

In sum, institutional and policy reforms that foster the market mechanism, reduce the burden of taxes and fees, and create more consistent property rights are critical for China's forest sector in its transition to market economy. In line with the economic reform, science and technology development, including training and extension, is also important for the future of the forest sector. Compared with other developing countries, the human capacity of forest management in China is strong after decades of efforts (Box 40.3). A more important issue is how to use the potential capacity and to apply the technologies in practice. More investment in training and extension is one approach, but an efficient, transparent and responsible administration system is probably more important. Political reforms will therefore become increasingly important as the economic reform advances.

BOX 40.3

## Forestry Education and Research in China

■ There have been significant developments in Chinese forestry education during the past two decades. Forestry education is organized at various levels, taking on different forms and standards as appropriate. The status of forestry education in 1996–1997 is listed in following (Table 40.11).

■ The Chinese Academy of Forestry, the largest national forestry research institute in the world, has 14 research institutes and a staff of academically qualified researchers of nearly 2 000. Since 1978, the forestry research capacity has been strengthened. In 1994, there were 248 independent forestry research institutions at or over the prefecture level with a total staff of some 20 000, of which 10 000 were specialists and technicians. There are 48 institutions at the provincial level with a total staff of 6 300, of which 4 100 are specialists and technicians, and 182 institutions at the prefecture level with 7 000 staff members, of whom 4 000 are specialists or technicians. There are 2 100 extension units with 20 000 staff members in the whole country, and 185 technical supervision institutions in the country. In other words, the primary network of forestry research, extension and technical supervision has been established. In addition, forestry technological information institutions are gradually being completed.

■ Currently, there are 29 ministerial level laboratories that are located in different research institutions and universities, colleges or vocational schools. The two national technical centers facilitate the application of research results. Forestry technical development is organized into five experimental or demonstration regions at the prefecture level, 35 experimental or demonstration regions at the county level, and 1 000 experimental forest plots. The aggregate initial value of the special equipment amounted to USD 20 mill. in 1994.

■ The research facilities of the forestry educational units have been improved, while the forestry technology research investments in 1994 amounted to nearly USD 40 mill., which accounted for 0.7% to 0.9% of the total national investment in technology. The state accounted for 63% of all R&D budget in forestry technological services, self-funding from institutes (income from business operations), bank loans and other sources of finance accounted for the rest.

**Table 40.11: Forestry education in China, 1996–1997**

| Items | No. | Graduates | New students enrolled | Students enrolled | Teachers and staff | Full-time teachers | Professors | Associate professors |
|---|---|---|---|---|---|---|---|---|
| **Forestry universities and colleges** | 10 | 6 248 | 7 718 | 24 510 | 10 185 | 3 832 | 430 | 1 116 |
| **Forestry dept. in other universities** | 61 | 3 676 | 3 677 | 11 950 | na | na | na | na |
| **Vocational schools** | 133 | 14 237 | 24 284 | 68 024 | 9 248 | 4 400 | na | na |
| **Total** | 204 | 24 161 | 35 679 | 104 484 | | | | |

*Source: MOF (1996c)*

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