

ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

WORKING PAPER SERIES

Working Paper No. APFSOS II/WP/2009/11

**PEOPLE'S REPUBLIC OF CHINA FORESTRY
OUTLOOK STUDY**

by

**The State Forestry Administration
People's Republic of China**



**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR ASIA AND THE PACIFIC**

Bangkok, 2009

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INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

Working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

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EXTRACTS

Factors influencing China's forestry development

China's sustainable forestry development is not only dependent on the distribution of forest resources and related natural conditions, but also influenced by various factors e.g. demographic change, socio-economic development, political and institutional context, technological advancement, globalization and so forth.

- Demographic change is one of the most important influencing factors of China's forestry development: changing demographics, including the total number of people, alters the demand for substantial forest products and ecological services and functions for socio-economic development. Meanwhile, changes in urban and rural population structures also have negative impacts on the management and maintenance of forests in collective forest areas
- The rapid economic development of China lays a sound economic foundation for the protection of forest resources and for ecological improvement. The government continues to increase inputs in the forestry sector. Especially, investments in the Six Key Forestry Programs are remarkably reinforced. Such movements fully demonstrate the state's strong support for forest ecological improvement
- Improvement in the public's awareness of ecology and the transformation of perceptions about consumption have advanced the development of community forestry and had positive and profound influences on forestry development in the new era. Voluntary tree-planting by the whole nation has been one of the highlights
- Continuous improvement of the political and institutional contexts has active effects on China's forestry development. The implementation of the "West Development" and the "Revitalization of the Old Industrial Bases" programs in Northeast China have provided excellent opportunities for sustainable forestry development in the ecologically vulnerable, western areas and in the northeastern areas with centralized distribution of forest resources. The alteration of the public financial system and the implementation of The Property Law of the People's Republic of China have provided institutional and legal guarantees for forestry development
- China's forest-related science and technology capacity has developed in leaps and bounds. However, the innovative capacity and a truly holistic approach to forestry science still falls short of those in developed countries, and does not yet meet the needs of China's forestry development objectives. Science and technology capacity is still one of the major restricting factors in China's forestry development
- The continuous development of globalization and regionalization has significant impacts on China's forestry development. Through involvement in international trade and economic organizations e.g. the WTO and Asian-Pacific Economic Cooperation Organization, China keeps strengthening its international contacts in the field of forestry. And, as China has decreased its import tariffs for timber and timber products and reduced non-tariff barriers, its export and import trade in wood

products has been more active

Status quo of China forestry

The Sixth National Inventory on Forest Resources (1998-2003) shows that China has a total forest area of 174.91 million ha, forest coverage of 18.21% of total land area, gross standing stock volume of 13.62 billion m³ and forest stock volume of 12.46 billion m³. China's forest area and stock volume are growing rapidly with the steady increase in forest coverage. The forest quality is improved to some extent and the forest structure is also improving. Forests that are not under public ownership are rapidly developing with their ownership being quite diverse

The guarantee system for the protection and development of forest resources has been preliminarily established and Chinese forestry is beginning to enter a new era of rapid development.

The forest industry maintains a trend of sound development, with rapid increases in production of various forest products, the further improvement of industrial structure and the gradual upgrading of China's status in the world's forest product market, but China does not yet perceive itself as a major power in the forest industry of the world.

In 2006, the total forestry production value reached 1.07 trillion RMB, the timber yield was 66.12 million m³, the volume of fiber wood increased and large-diameter timber decreased, and there was enormous potential for increased timber product consumption. The trade value of timber and wood products continues to grow. In 2006, the total trade value of forest product imports and exports reached US\$47.07 billion. Timber products were chief imports and exports of forest products and the Russian Federation maintained its position as the principal source for timber imports. Among forest product imports in 2006, the import volumes of logs, waste paper and wood pulp ranked first in the world, and those of paper and paperboard rose to second behind the United States.

Forests have mighty service functions. Forest recreation in China is developing in leaps and bounds. In 2006, all the forest parks across China received a total number of 213 million visitors and the direct tourism income, most of which comes from entrance tickets, reached 11.83 billion RMB. China has also witnessed significant progress in the development of urban forestry. In 2006, the urban green coverage rate reached 32.54% and, in 2007, the State Forestry Administration (SFA) issued appraisal indicators of national forest cities. The interrelationship between forests and water resources has increasingly become a hotspot issue arousing people's attention. The Research of Chinese Sustainable Forestry Development Strategies puts forward strategic goals related to forest vegetation development and water protection. The Chinese government attaches great importance to the conservation of biological diversity. By the end of 2006, China had established 1,737 nature reserves of various types and levels with a total area of 120.13 million ha, accounting for 12.51 percent of the total land area of the state. The Chinese government also highlights the efforts of forestry

development to respond to climate change and actively advances the CDM (Clean Development Mechanism) project on carbon sequestration by afforestation and reforestation under the Kyoto Protocol. In July of 2007, the China Green Carbon Fund was founded.

The framework of Chinese forestry policies, legislation and law enforcement is continuously improving and forest-related policy-making, legislation and law enforcement have become more scientific and democratic. Policy changes — e.g. the historic transition of forestry development strategies, the implementation of a classified forest management system, the establishment of compensation systems for ecological forest benefits, the reform of the collective forest property right system, and the advancement of modern forestry development in a holistic way have had significant and profound impacts on forestry development.

Forestry status to 2020

According to the Eleventh Five-Year Forest Plan and the National Plan for Long- and Medium- Term Forestry Development issued by the SFA, by 2020, China's forestry will have basically achieved the strategic goals of establishing an improved forest ecology system, a developed forest industry system, and a flourishing ecological culture system, thereby entering a new era of sustainable development. The major development indicators include a newly afforested area of 29.60 million ha, the forest coverage rate reaching 23.46% of the total land area; an area of nature reserves throughout China of 161.2 million ha, accounting for 16.80% of the total land area of the state, with the total number of nature reserves of various types (e.g. forests and wildlife) reaching 2,300, thereby providing a good standard of protection to 95% of the wildlife species of national protection importance, and all typical bio-systems; the number of wetland reserves across the country reaching over 600, including around 80 wetlands of international importance, and the effective protection of over 60% of the natural wetlands; an area of desertification control of 20 million ha; urban tree coverage reaching 35% in 70% of cities throughout China; the rate of quality seeds in plantations reaching 65%, the unit stock volume per hectare of existing timber plantations reaching approximately 100 m³, and the contribution rate of science and technology advancements to forest economic growth reaching 50%.

Forecasts of timber supply and demand to 2020

In line with the improvement of people's standard of living, increases in demands for housing, furniture and paper, increases in overseas demands for Chinese forest products, and mutual substitutions among wood and other materials e.g. steel, plastic and concrete, it is pre-estimated that the whole country's timber demands in 2020 will be 450-470 million m³, the supply of commercial timber will be approximately 304 million m³, and the gap between timber supply and demand in China will be around 150-170 m³. So a shortfall between supply and demand will still exist.

China has formulated policies to encourage the development of timber forests. It is expected that the whole country's forest area will reach over 220 million ha, the forest stock volume

will be 14.5 billion m³, the area of fast-growing and high-yield forests will be 13.33 million ha and the average annual forest increment will reach 20 m³ per ha in 2020. Increases in timber yield will come from the improvement of forest quality. The improvement of annual increment and the gross stock volume provides possibilities for increasing the sustainable forest harvest. In addition, thanks to the amelioration of quality seeds and intensive management in the timber forests, the unit yield will be increased and more timber can be produced based on a constant forest area. China will relatively reduce demands for roundwood in the future, by developing processing and utilization technology, improving the integrated utilization of wood, through economical utilization of wood, recycling utilization, and adopting other measures to significantly ease the shortfall in timber supply in China.

Prospect and outlook for the forest industry

China's forest product processing industry will maintain and extend its processing scale, improve production efficiency, the utilization of wood and the industry's profitability, and further upgrade product quality and increase the variety of products. With the deepening of economic globalization and China's economic development, the core competitive strength of China's forest products processing industry will shift from a mainly cost basis, to integrated competitiveness of technology, scale and costs. Forest product processing enterprises will transform from being pulled by exports and pushed by resources, to being enterprises of self research and development. The economic growth of the forest industry will change from an extensive pattern to an intensive pattern. The future development of China's forest industry will be characterized by fast but moderate growth, based on an optimized industrial structure, with improved ecological benefits and reduced energy consumption.

In the future, the state will advance forest development under non-public ownership and encourage various investment groups including foreign capital and private capital to invest in the forestry sector to continuously enhance the capital capacity of the forest industry, strengthen enterprises' initiative in developing new products, increase the capital investment in product research and development, reinforce industrial regulation, and gradually form an efficient industrial mode. With the emergence of various trade barriers and the continuous development of forest certification, changes will happen in the product mix, patterns and targeted countries that import Chinese forest products. Overseas forest resource acquisition and cultivation, processing and marketing will be increasingly promoted and the market-orientation and internationalization of China's forest industry will be further advanced.

Status quo and prospect of bio-energy

In 2007, the SFA organized the formulation of the National Energy Forest Planning and the Eleventh Five-Year Plan Construction Plan for Forest Bio-diesel Raw Material Production Base and successively collaborated with the China National Petroleum Corporation, China National Cereals, Oils and Foodstuffs Corporation (COFCO) and State Grid in the construction of oil energy forest bases, implementing projects on industrialization of

bio-diesel production, investing and operating biological power stations and so forth. However, generally speaking, the utilization and development of forest bio-energy in China is still in its initial stage. In spite of early-phase achievements in fields including bio-diesel and wood-based solid fuel and electricity generation, it has not yet entered the stage of practical industrialization.

The priorities of China's bio-energy development in the next 15 years include biomass electricity generation, methane engineering, biological liquid fuels and bio-based solid formed fuels. By 2020, bio-based electricity generators will produce 30 million kilowatts, the production volume of biological liquid fuels will be 10 million tonnes, annual methane utilization will be 40 billion m³, the production volume of bio-based solid formed fuels will be 50 million tonnes, and the annual utilization of bio-energy will account for 4% of energy consumption. Forest bio-energy development will be oriented on market demands and accelerate the construction of a number of oil energy forest bases and wood-based energy forest bases.

Importance of forest ecological benefits

Forests are the core terrestrial ecosystem and the most abundant and stable form of carbon storage. Forests constitute gene, natural resource, water conservatory and natural energy banks. With their functions in regulating climate, conserving water, maintaining soil and water quality, protecting against wind and stabilizing sands, ameliorating soil, reducing pollution and so forth, forests play a decisive and irreplaceable role in improving the ecological environment, safeguarding the ecological balance, and protecting the 'basic environment' for human subsistence and development. Among various ecosystems, the forest ecosystem has crucial and direct effects on the sustainable socio-economic development of China and the improvement of people's lives.

The main direction of China's modern forestry development — at present and for a certain period into the future — is to construct an improved forest ecology system and maximize the ecological benefits of forests. Meanwhile, to complement the continuous acceleration of forest cultivation and reinforcement of timber supply capacity, China will further strengthen natural forest protection and nature reserve construction, advance the key forest programs, and develop forest carbon sequestration and urban forestry, to effectively maximize the multiple purposes, functions and benefits of forests and provide abundant biological products and services for the whole society.

Social benefits of forests

The social benefits of Chinese forests are shown in the following three aspects. Firstly, forests can meet many of the needs of people's lives. The development of urban forests and forest parks has occurred with remarkable progress under policy-making and legislation on urban forestry, and has improved the environment in settlements and urban areas and provides locations for forest tourism and recreation. Thanks to China's attention attached to the

regulation of relationships between forests and water, the protection of forest and wetland biodiversity and the response of forest development to climate change, forests in China meet people's needs for a sound ecological environment and help to safeguard people's physical health. Meanwhile, the ecological philosophy and rich cultural connotations carried by forests can fully meet the public's needs for recreation and culture. Secondly, forest development helps advance the political construction of socialistic democracy. The development of participatory community forestry and the implementation of pilot participatory land-use planning, forestry program construction, and forest monitoring and evaluation, have accelerated environmentally-friendly and economically feasible land and forest resource management.

Thirdly, forestry development can improve people's, especially farmers', incomes. The implementation of the reform of the collective forest property right system enables forest farmers to have ownership of forest trees and use rights to forestlands, by distributing forests and mountainous lands to households. Meanwhile, China is enhancing ecological protection by implementing the Project on Conversion of Croplands to Forests, while simultaneously rural poverty is alleviated by financial and food subsidies and land-use change compensation. The development of small-scale rural forest product processing increases employment opportunities and forest farmers' incomes, while forest tourism also plays a role in diversifying and increasing people's incomes, and has effectively advanced the development of a new type of rural area.

Opportunities and challenges for forestry during globalization

With the development of globalization and regionalization, the internationalization of Chinese forestry has accelerated and international contacts in various forest-related fields have become increasingly closer. The opportunities and challenges for China's forestry during globalization will have increasing impacts on China's socio-economic development and forestry development.

Under the framework of a global free trade market, Chinese forest product production and the import and export trades will develop steadily, with increased vitality. Globalization will effectively encourage the Chinese forest industry to develop towards a global-market-oriented economy, and to obtain more favorable conditions and preferential treatments in utilizing international resources and markets and developing foreign trade. It can also advance the Chinese forest industry by encouraging acceleration of management system reform and the transformation of enterprise management mechanisms to upgrade the enterprises' technologies and management. Meanwhile, it also facilitates the improvement of the investment environment and the absorption of more foreign capital invested in the forestry sector.

Globalization not only brings new opportunities for China to make full use of both domestic and international markets and resources, but also brings challenges to the sustainable development capacity of the Chinese economy and society. In order to survive and develop,

after economic globalization, the Chinese forest industry will have to develop professional, intensive and large-scale management as soon as possible, and drive the development of middle- and small-scale enterprises by deepening the reform of state-owned enterprises and reorganizing and fostering corporation groups or multinational companies. It will also have to use new and sophisticated technologies to improve industrial automation and management to ensure it holds and strengthens its share in fiercely competitive international markets. Consequently, new challenges are produced in terms of industrial equipment, product structure, technological levels and newly-emerging industries. China will also have to further advance its forest law enforcement and execution, promote forest management certification and COC (chain of custody) certification of forest products, and establish and gradually implement the green procurement of forest products, so as to rapidly advance Chinese forestry in an environmentally friendly and sustainable direction.

Measures for harmonious development between society and forests

According to the overall goal — to construct a harmonious society — put forward by the Chinese government, as a sector of importance in ecological protection, provision of forest products and cultural service during national socio-economic development, forestry maintains a significant status and crucial role in the harmonious development between the society and forests. Therefore, Chinese forestry will strengthen the development of the forest ecology system, the forest industry system, and the forest culture system, improve forestry quality, accelerate the innovations of forestry systems and mechanisms, upgrade and modernize forestry, and advance the construction of an ecologically aware civilization to realize the harmonious development of both society and forestry.

The main measures include strengthening ecological improvement mainly through afforestation and greening and ameliorating the ecological state of national land; reinforcing forest management and protection and improving the forest quality; enhancing nature protection and strictly conserving biodiversity; developing the forest industry, including ensuring the provision of abundant forest products and services; and focusing on the reinforcement of forest culture and the construction of an ecologically aware civilization. On the one hand, China plans to construct a green homeland of forest cities, advance the development of urban and rural integration, meet society's needs for ecological products, and achieve the goal of developed production, high living standard, and improved ecology. On the other hand, China will also widely develop education on ecological civilization¹ and promote an ecologically aware culture with emphases on the development of forest culture, flower culture, bamboo culture, tea culture, wetland culture, wildlife culture, eco-tourism culture and green consumption culture².

¹ Ecological civilization is a concept that forms a new requirement for achieving a well-off society. The concept was initiated by General Secretary Hu Jintao at the Communist Party of China's (CPC) 17th Congress. It means harmonious development between human beings and nature.

² The term "culture" is used here to refer to related concepts, products, spirit and awareness.

1. INTRODUCTION

Background

During the first thirty years of the People's Republic of China, the central task for forestry was timber production, which resulted in degradation of fragile environments. However, forestry, as an important industry, made an enormous, non-substitutable contribution to the recovery and development of the national economy, by providing a large volume of timber and forest products during the early stage of P.R. China. Subsequently, a series of forestry ecological and environmental programs was developed, which promoted the development of forestry, improvement of ecological and environmental quality, and healthy development of the national economy. With the arrival of the new century, the Chinese government has spent substantive money on the Six Key Forestry Programs. The aim of the key programs is to address ecological and environmental issues, establish green safeguarding systems with regard to forestry and plant vegetation for the country's ecological well-being, and contribute to the development of an ecological civilization, with a global recognition of 'good ecology' in China.

The evolution process of forestry in China has experienced stages of development, throwback, destruction, redevelopment and rapid development since the foundation of P.R. China. The main task of forestry has been transferred from timber production into ecological construction, since a *resolution of accelerating forest development* was made by the Central Committee of the Communist Party of China (CPC) and the State Council in 2003. In the *resolution of accelerating forest development*, the strategic role of forestry in society and the economy was recognized, a development strategy for forestry focusing on ecological construction was advanced, the orientation of forestry reform and a series of policies were confirmed, and an innovative reform of systems, mechanisms and policies was prompted. Subsequently, the development of forestry entered into a new epoch in China.

Achievements in forestry ecological construction have been made, based on the Six Key Forestry Programs. From 2001 to 2005, the total area of afforestation and reforestation was 39.33 million ha, 34.1% higher than that during 'Ninth Five-Year Plan'. Among these areas, 33.03 million ha resulted from activities under the Six Key Forestry Programs, taking up 83.98% of the total afforested/reforested areas. 12 billion trees have been planted, with 2.75 million people involved in voluntary planting initiatives. With the full implementation of the Six Key Forestry Programs, financial inputs in forestry increased drastically. During the 'Tenth Five-Year Plan' period, 189.2 billion RMB was invested in forestry, 38.9 billion RMB comes from the National Basic Construction Budget (this is 2.28 times that in the 'Ninth Five-Year Plan'), 127 billion RMB comes from the Central Special Finance Budget (6.69 times that in the 'Ninth Five Year Plan', and 23.3 billion RMB is a discount loan for the Sand Preservation Project.

Based on the requirements of the national economy and for social development, the Chinese government initiated the Eleventh Five-Year Planning of Forestry Development and Strategic

Objectives of Middle-long Term for Forestry Development. Under this plan China's forestry development will work to achieve the following three steps in the future:

- (1) Raise the national forest cover to 20% and stocking volume to 13.2 billion m³ by 2010, bring all deteriorating environmental conditions, nationwide, under initial control and rationalize forestry's industrial structure, and ensure the gross output value of the forest industry reaches 1200 billion RMB.
- (2) Major achievements in ecology conservation and construction from 2011 to 2020. The overall objectives are to increase national forest coverage to over 23% by 2020, solve the major ecological problems in key regions, significantly improve ecological conditions nationwide, and enhance forest industrial strength.
- (3) Enter a new stage of sustainable forestry development in China from 2021 to 2050. Increase and maintain the forest cover to over 26% by 2050, build a picturesque landscape, bring ecological conditions into a favorable cycle, alleviate the conflict between supply and demand of forest products, and establish a comparatively complete forest ecosystem and a comparatively developed forest industrial system.

Forest distribution and its coverage

The results of the Sixth National Inventory on Forest Resources (1998~2003) showed that forestry has made significant improvements, characterized by a continuously increasing forest resource area, improved forest quality, reasonable structure, and gradually working towards a perfected national forest management system. The total forest resource area has reached 174.91 million ha. Contrasted to the Fifth National Forest Inventory, forest area has increased by 15.97 ha, with national forest coverage increasing from 16.55% in 1998, to 18.21% in 2003. The stocking volume of forestry was 12.46 billion m³, which increased by 889 million m³ compared with the previous inventory. Especially, the stocking volume of planted forests increased markedly, by 490 million m³, thereby accounting for 55% of the net increment of stocking volume since the last inventory. In terms of forests' geographical distribution, eastern and central China have a higher concentration of forest resources than western China. Forest coverage is 34.27%, 27.12%, and 12.54% in eastern, central and western China, respectively.

Main issues

It must be recognized that the development of forestry still does not meet overall national economic and social requirements, although there have been great achievements in forestry in China during the past decades. Some issues still exist, such as various ecological construction tasks, shortages of total forest resources, high pressure on resource management, low intensity management, shortfalls in supply of some forest products, an irrational forestry industry structure, systemic impediments to forestry, and insufficient forestry infrastructure. Additionally, the support systems for forestry science and development of senior personnel need to be strengthened.

Research process and methods

The International Cooperation Department of the SFA was responsible for organizing related sectors to draft this report. Practically, the report was prepared by the Research Institute of Forestry Policy and Information of the Chinese Academy of Forestry in conjunction with the six departments from the SFA, and the China National Forestry Economics and Development Research Center.

The initial study commenced in May 2007. The draft report was completed and updated on the basis of expert comments and suggestions from January to March 2008. The final report was completed and submitted to FAO at the end of May 2008. The following methodologies were applied:

- (1) Data and information collection. To ensure the authority of the report, all data and information were collected from statistical reports of forest resources and forest economy issued by official departments. Similarly, authorized study reports, for example, *Strategic Study of Forestry on Sustainable Development in China*, were also important documents contributing to the analysis.
- (2) Expert workshop and consultancy. To ensure the scientific reliability of the report, experts from natural science, social science and policy management sectors discussed the outline, drafted the report and gave suggestions and comments for inclusion in the report.

Structure of the report

The report includes four aspects. The first is a current analysis of China's forestry situation, the second is analysis of impact factors on China forestry, the third is a perspective of national development to 2020, the fourth is a forecast study of China's forestry development to 2020. The current analysis of Chinese forestry includes the following topics: main issues faced by Chinese forestry, introduction of forestry trends in the next 10 years, the status of forest resources, timber and forest products, wood energy, non-wood forest products (NWFPs), services of forests, policy and institutional arrangements, and the main issues in forestry.

In the analysis of impact factors on Chinese forestry, topics include: impact of social development, political institutions, economic change, globalization and regionalization, technology evolution, and global issues affecting forestry.

In the perspective of national development by 2020, possible developments in society, the economy, political elements and institutions have been forecasted, and a perspective of national development has been proposed.

In the forecast study of China's forestry development to 2020: status of forest resources, timber and forest products, wood energy, NWFPs, services of forests, and social functions of forest were forecasted. Measures and follow up actions adapted to forestry development were suggested.

2. CHINESE FORESTRY — THE STATUS QUO

Forest resource development status

According to the Sixth National Forest Resource Inventory, China's forest area and stock enjoys continuous rapid growth and forest coverage is steadily increasing. Forest land erosion volume has been reduced and forest cutting and conversion to other land-uses is also declining. Forest quality has improved moderately, and forest structure has been further optimized. Non-state-owned forests have rapidly developed, and forest ownership is becoming increasingly diversified. These factors showcase that China's forestry construction has entered a new fast-growing phase, with forest resource conservation and development being in a benign state.

Forest resources — overall status quo

(1) Forest resource total volume: China's total forest area is 174.91 million ha, with 18.21% national forest coverage. The total standing stock is 13.62 billion m³, with the forest inventory containing 12.46 billion m³. Excluding Hong Kong SAR, Macao SAR and Taiwan P.O.C., China's forest area³ is 172.79 million ha, with standing stock volume of 13.26 billion m³, and a forest inventory of 12.10 billion m³.

China's national woodland area is 282.80 million ha, measured by the recently established woodland classification. There are 169.02 million ha of forest land, accounting for 59.77% of the whole woodland area, 45.30 million ha of shrubs accounting for 16.02% of the whole woodland area, 6 million ha of open forest land area, accounting for 2.12% of the whole woodland area, and 57.32 million ha of other forest land area, accounting for 20.27% of the whole woodland area.

The national total standing stock volume is 13.26 billion m³. The forest stock volume is 12.10 billion m³, constituting 91.24% of the total standing stock. Open forest stock is 128.1639million m³, 0.96% of the total standing stock, while scattered tree stock volume is 710.33 million m³, comprising 5.36% of the total standing stock, and four-side tree stock⁴ is 323.23 million m³, accounting for 2.44% of the total standing stock.

(2) Forest resource regional distribution: For quite a long time, China's forest resources were unevenly distributed due to human activities and natural disasters or disturbances. Major forest resources are mainly situated in the main river sheds or in mountainous areas or hilly lands.

Viewed from the geographical aspect: Forest resources are abundant in the northeast and

³ Forest area includes the forest land, bush etc according to China's standard of forest statistics. Forest land is defined as land where the density of stand canopy is more than 20% of the land area.

⁴ "Four side tree stock" refers to trees planted on the fringes of villages, watercourses, roads and houses.

southwest remote provinces (autonomous regions, and municipality cities) as well as in southeast and south China, especially on hilly lands. Conversely, in the broad area of the northwest region, in central and western parts of Inner Mongolia, the main part of Tibet, the economically well developed northern China, and the central plains as well as in the lower reaches of the Yangtze River and Yellow River area, forest resources are relatively smaller.

Viewed from the main watershed aspect: Of China's ten watersheds, forest resources are mainly scattered in seven of them: the Yangtze River, Heilongjiang River, Pearl River, Yellow River, Liao River, Hai River and Huai River. The land area of the above seven watersheds accounts for half of China's territorial area, the forest area in these watersheds accounts for 70% of the total national forest area. Forest resources in the Yangtze River watershed and Heilongjiang River watershed comprise around 50% of the whole nation's forest resources. Forest stock in the seven watersheds accounts for more than 60% of that of the whole nation, while Heilongjiang River watershed takes the lion's share of the above seven watersheds in terms of forest stock and forest coverage. Forest coverage in the Yellow River, Hai River and Huai River watersheds is below the national average level (see Table 1).

Table 1. Forest resource distribution catalogued by watershed

Watershed	Forest coverage	Forest area (10000 ha)	Forest stock (10000 m³)
Yangtze River	30.53	5495.11	316773.07
Heilongjiang River	45.29	3866.38	320572.81
Pearl River	39.91	1764.60	69570.56
Yellow River	13.62	1024.71	40996.36
Liao River	23.50	516.21	13667.26
Hai River	11.40	299.35	5041.42
Huai River	11.41	307.34	8713.37

Viewed from the main forest area aspect: China has categorized five forest areas, namely: (i) Northeast Inner Mongolia forest area, (ii) southwest mountainous forest area, (iii) southeast low mountain and hilly forest area, (iv) northwest high mountains forest area, and (v) tropical forest area. Their total land area accounts for 40% of the total national territory area, and encompasses 80% of the nation's forest area. The forest stock in these areas accounts for 90% of that of the whole nation (see Table 2).

Table 2. Forest resource catalogued by main forest area

Forest area	Forest coverage	Forest area 10000 ha	Forest stock (10000 m ³)
Northeast Inner Mongolia Forest Area	62.17	3778.49	315593.62
Southeast Low Mountain and Hilly Forest Area	48.18	5358.48	210297.51
Southwest High Mountain Forest Area	20.69	3910.61	491348.65
Northwest High Mountain Forest Area	36.81	478.63	48991.95
Tropical Forest Area	38.91	1030.43	90287.24

Forest coverage change and regional difference

(1) Forest coverage change: To date, China has conducted six comprehensive forest resource inventories. According to the fifth and sixth forest resource inventories, forest coverage was raised to 18.21% in 2003, from 16.55% in 1998. See Table 3 for historic inventory data.

Table 3. National forest resource inventory data

Year	1973-1976 (First)	1977-1981 (Second)	1984-1988 (Third)	1989-1993 (Fourth)	1994-1998 (Fifth)	1999-2003 (Sixth)
Forest land (10 ⁸ hm ²)	2.58	2.6700	2.6700	2.6300	2.63295	1.690193
Forest resource area (10 ⁸ m ²)	1.2217	1.1528	1.2465	1.45238	1.58941	1.7491
Forest coverage (%)	12.70	12.00	12.98	13.92	16.55	18.21
Forest stock volume (10 ⁸ m ³)	—	—	—	106.7	112.7	124.56
Standing stock volume (10 ⁸ m ³)	—	—	—	119.5	124.9	136.18

(2) Major regional difference: Generally speaking, China's forest resource is mainly located in the Northeast Inner Mongolia forest area, southwest high mountain forest area, southeast low mountain hilly forest area, northwest high mountain forest area and tropical forest area. These forest areas account for 40% of the nation's whole territory area, while their forest area accounts for 80% of that of the whole nation, and their forest stock accounts for 90% of that of the whole nation. In terms of forest coverage, forest coverage in the eastern region is 34.27%, in the central region it is 27.12%, while forest coverage in the western region is merely 12.54%. Forest coverage in the five northwest provinces, in particular, (autonomous regions) is only 5.86%⁵.

Forest ownership change

At present, China has an area of 285 million ha of forest land, of which 170 million ha are collective-owned forest, comprising 60% of the national total forest land area. In recent years,

⁵ There are many deserts, grasslands and the Gobi region in these areas.

the Central Government and State Council have attached great importance to the Reform of Collective Forest Ownership System. In 2003, the CPC Central Committee and the State Council made the Decision on Accelerating the Development of Forestry, under which deployment of collective forest ownership reform has been given special attention. In 2006 and 2007, the State Council stressed the importance of forest ownership reform in Document No.1. The 17th National Congress of the CPC made new requirements for the Reform of Collective Forest Ownership System. These are all significant decisions that have dramatically spearheaded the reform of collective forest ownership. The Reform of Collective Forest Ownership System is planned to implement forest management reforms, especially ensuring that more and more collective forests will be managed by farmers. It is also a major innovation that will enrich and develop the rural property ownership system. It will mobilize the enthusiasm of all members of society to participate in forest construction, in the development and deepening of the socialist market economy and reform of forest systems.

According to the Sixth National Forest Resource Inventory data, the proportion of non-state-owned forest area has reached 20.32%. For newly afforested land, the non-state-owned proportion is as high as 41.14%. The non-state-owned portion of the forest industry enjoys fast growth, and a diversified industry pattern has been preliminarily formed. In the Tenth-Five-Year plan, non-state-owned forest enterprises comprise 70% of all the country's forest enterprises, while non-state-owned forestry production accounts for 50% of the value of all the nation's forest product output. The proportion of non-state-owned afforestation in the whole nation's afforestation is 62%. In terms of industry inputs, more than 90% of investment capital is coming from the private sector or foreign sources. The change in ownership structure shows a tendency towards becoming more diversified in terms of both forest ownership and investment structure.

Commercial forest management

(1) Total volume of commercial forest change: China has adopted a forest development strategy that has ecological construction as its main core. With the implementing of the Natural Forest Protection Program and forest classified management, tree species structure has changed significantly, and the area of forest resources allocated to timber production has been reduced. A comparison between the two latest forest inventories shows that the timber forest area has been reduced by 19.46 million ha, with an annual average reduction of 3.91 million ha. The timber forest stock volume has been reduced by 1.30 billion m³, an average annual reduction of 258.05 million m³. Mature timber forest and over-mature timber forest area has been reduced by 3.03 million ha, with an average annual reduction of 583.3 000 ha. The stock volume in mature and over-mature forests has decreased by 729.90 million m³, with an average annual decrease of 139.90 million m³.

(2) Commercial forest management economic analysis: China's plantation area is large, but the management level is low with a mainly monocultural species structure. The national plantation area is 53.26 million ha, ranking first in the world. Plantation stock volume is 1.5 billion m³, accounting for 12.44% of the total forest stock volume. The forest formation area

is 32.29 million ha, which accounts for 60.64% of the total plantation. China's overall plantation management level is not high, compounded by the fact that plantations are mainly in the young or middle age classes; 77.40% is classified as young or immature. The average plantation unit area stocking volume is 46.59 m³/ha, which is equivalent to 55% of the average level of all forest stands. In national forest stands, fir, Masson pine and poplar are the most widely planted species, collectively accounting for 59.41% of plantations; coniferous forest comprises 70.69% of plantations. The monocultural structure of most plantations is regarded as a negative factor.

(3) Forest quality is not high and the forest land utilization rate is low: Forest stand average per hectare stock volume is 84.73 m³, equal to 84.86% of the world's average level, and ranking China's forests 84th in the world for stock volume. In the provinces, where state-owned forests take the lead, and where the over-mature forest portion is large, forest stand unit area stock volume is comparatively high, with Tibet being the highest at 268.33 m³/ha. The current woodland area is 285 million ha, of which 175 million ha are land under forest, comprising 61.4% of woodland. In some provinces (regions or municipalities) the forest area is less than 50% of the woodland area.

(4) Large potential in expanding forest resource: At present, China has 57.3232 million hectares (20.27%) of forest land that are not covered by forests or other woodlands. Of this, 40.21 million ha are wastelands or hilly lands suitable for forests, and 14.51 million ha are sandy areas suitable for forests. These areas can be used to further develop forest. There are 18.02 million ha of clear-cut areas, 807.8 000 ha of burned areas, and 6 million ha of open forest land with thin cover of trees and low production ability, not yet up to the forest standard. All this land offers potential to increase forest resources, and raise forest coverage. At the same time, it is manifest that China's tree planting task is still arduous, and needs all of society to be involved in planting efforts.

Forest resource sustainable management

(1) Forest resource overall quantity and quality change: During the Fifth and Sixth National Forest Resource Inventory interval, forest stand stock has increased 2.59 m³ per ha, the average number of trees in each hectare of forest stands increased by 72, while the average tree diameter in forest stands narrowed by 0.3 centimeter (mainly as a result of more new planting compared to harvesting). Average tree density in forest stands has risen as a whole. The forest area with 0.2-0.4 crown density⁶ has declined by 1.61 percent, while the area with 0.6 and above density has risen by 2.67 percent. The young forest area portion of the forest estate has declined by 3.19 percent, the middle and near-mature forest area portion has increased by 1.21 and 1.78 percent respectively. Overall forest structures have been upgraded. The broad-leaved forest area proportion has increased by 2 percent, and the coniferous and broad-leaved mixed forest area has increased by 1 percent. Forest structure has become more diversified, and forest quality been improved as a whole.

⁶ Crown density means the percentage of the canopy area to forest land area.

(2) Six Key Forestry Program implementation has formed a solid base for China forest resource sustainable development: At the beginning of the 21st century, the Chinese government developed and implemented a forestry development strategy with ecology construction as the mainstay. The Chinese government has implemented the following six forest programs: (i) Natural Forest Protection Program, (ii) Conversion of Cropland for Forest and Grassland Program, (iii) Sandification Control Program for Areas in the Vicinity of Beijing, (iv) Key Shelterbelts Program of ‘Three Norths’ and the Middle and Lower Reaches of the basin of Yangtze River, (v) Wildlife Conservation and Nature Reserve Development Program, and (vi) Fast-Growing and High-Yielding Forests Base Construction Program. The Six Key Forestry Programs have involved more than 97% of China’s counties, cities, regions or banners⁷, with the planned afforestation area exceeding 76 million ha, and planned investments of 700 billion RMB. The forest construction under the six Programs covers resource protection, national land greening, soil erosion control, sand prevention and control, wetland protection, bio-diversity conservation and commercial forest base construction.

(3) Forest resource protection and development of a safeguarding system have been preliminarily formed: As a first step in establishing a comprehensive forest protection and safeguarding system, a forest resource management administration system has been set up. China has basically formed a forest resource management administration system, forest administration management being the main body of the system, with resource monitoring and forest resource supervision being the two assisting components. Secondly, a comparatively complete forest resource management administration legal system has been formed. Since the period of major economic reforms and liberalization, China has successively promulgated 6 laws directly related to forest resource management administration, 14 forest administrative statutes, and 31 forest sector rules and regulations. Besides, local governments have set forth local statutes and regulations, more than 300 in total. Thirdly, China has set up a comparatively complete forest resource monitoring system. The state government has successively promulgated more than 60 technical standards, rules, regulations and norms related to silviculture, forest management, and resource supervision. Fourthly, establishment of China’s forest certification system has made continuous progress. Since September 2001, when a China Forest Certification Working Group was formed, and especially since September 2007, when the State Forest Administration promulgated the China Forest Certificate for Forest Management and China Forest Management and Multi-site Chain of Custody as forest sector standards, China’s forest sustainable management has accelerated.

Timber and timber products

Forest industry development — overall status

(1) Forest industry’s total output value has increased rapidly: During the ‘Tenth Five-Year Plan’, China’s forest industry has maintained good progress and momentum, with total forest

⁷ A banner is a special administrative region in China.

output value increasing at a rate above the 6% to 8% of GNP growth. Forest product production has accelerated, industry structure has been further upgraded, and forest enterprises' economic profits have improved. In 2006, the forest economy's total volume continuously increased, forest industry's total output value reached 1065.22 billion RMB, an increase of 219.35 billion RMB and a rise of 25.93% compared with 2005. The first, second and tertiary industry output value was 470.88 billion RMB, 519.84 billion RMB and 74.5 billion RMB respectively, increases of 8.11%, 49.1% and 20.82% respectively, compared with 2005.

(2) The position in world forest product market is on a gradual rise: In the 'Tenth-Five-Year Plan', China's forest industry has made remarkable progress, and has gradually become a major world centre for forest product production, processing and trade. Wood-based panels, including plywood and fibreboard, have increased production in the last 4 years to rank first in the world. Wooden floor production is second in the world, close behind the European Union; the wooden furniture production output value reached almost 400 billion RMB, exceeding Italy, to rank first in the world. Gum rosin production is also first in the world. The output in 2006 was 9.09 million tonnes. Paper and paperboard total production volume and consumption volume both ranked second in the world.

(3) Not yet a world forestry industry giant: In recent years, China's main forest product production volume and trade volume have enjoyed substantial growth and China has become a major player in the global forestry industry. However, due to the small scale of most forestry enterprises and production of many low grade products, as well as enterprises' weak innovative capacity, China's forest product market competitiveness has not been strong. Compared with other developed (forestry industry) countries, China still has great scope for development.

Timber and timber product production and consumption level

Timber and timber product production

(1) Logs and sawnwood: From 1997 to 2002, China's planned timber production volume decreased from 63.95 million m³ to 44.36 million m³, a drop of 30.6%. In 2006, China's timber production reached 66.12 million m³⁸, with the majority of this resurgence coming from increased production in forest plantations. In the years to come, China's domestic timber production will mainly depend on a steady increase in plantations. However, large-diameter timber and high quality hardwood timber will be the main type of imported timber for quite a long time (see Table 4).

⁸ This figure means recorded production of China's forest harvest in 2006. It is drawn from *China Forestry Statistics Year Book 2006*. China's planned forest harvest is different to this figure, as are some researchers' estimates of actual production.

Table 4. 1997—2006 planned timber production volume (10000 m³)

Year	Production volume	Industrial timber	Fuelwood
1997	6394.79	5935.0	460.0
1998	5966.20	5556.0	410.0
1999	5236.80	4848.0	388.0
2000	4723.97	4395.72	328.25
2001	4552.03	4197.03	355.00
2002	4436.07	4127.21	308.86
2003	4758.87	4319.86	439.01
2004	5197.33	4712.09	485.24
2005	5560.31	5022.87	537.45
2006	6611.78	6111.68	500.10

Source: China Forestry Statistics Year Book (1997-2006).

In 2006, China's sawn timber production volume was 24.86 million m³, an increase of 38.89% of that in 2005. National sawn timber production volume ranked by the top five provinces in 2006 is detailed in Table 5.

Table 5. 2006 national sawn timber production statistics

Region	Production volume (10000m ³)	Percentage
Nation	2486.46	100
Zhejiang Province	280.59	11.28
Inner Mongolia	264.86	10.65
Hunan Province	242.35	9.75
Shandong Province	223.94	9.01
Guangxi Province	190.50	7.66
Five Provinces in total	1202.24	48.35

Source: China Forestry Statistics Year Book (2006).

(2) Wood-based panels: Wood-based panel industries mainly include plywood, particleboard and fiberboard. In the most recent 10 years, wood-based panel production has seen a continuous increase. In 1994 6.65 million m³ were produced, compared with 74.29 million m³ in 2006, an annual average increase of 22.3%.

In terms of product structure, in 2006, plywood production was the main component of wood-based panel production, equal to 36.7% of total wood-based panel production volume. Close behind is fiberboard with a production of 24.67 million m³, about 33.2% (of which MDF takes up 94%) of the total production. Particleboard production volume was 8.43 million m³, only 11.4% of the total volume. Other wood-based panel production was 13.9 million m³, about 18.7% of the whole production.

(3) Wood furniture and wood flooring: Since the economic reforms, China's furniture industry has grown into an important industry with a broad structure encompassing a

traditional handicrafts sector, but with mechanical production being the core. At the beginning of the 21st century, China had become a global furniture producing and exporting giant. According to the China Furniture Association's statistics, the total output value of China's furniture production increased to 44.6 billion RMB in 1995 from 1985's 2.9 billion RMB. By 2006, it had further increased to 430 billion RMB. During the period 1985 to 2006, average annual growth was as high as 27%. China's furniture is mainly wooden furniture, taking up 80% of the market share. Till the end of 2006, there were 2149 furniture sector enterprises.

At the moment, China has 3000 wooden flooring-related enterprises, with 1 million people involved, working in wooden flooring production, marketing and related services. In 2006, China's wooden flooring total output volume reached 233.99 million m² (of which laminated flooring totaled 84.71 million m², solid wooden flooring was 73.55 million m², wood composite flooring totaled 51.84 million m² and bamboo-wood compounded flooring was 6.13 million m²). Annual total value equaled 17.7 billion RMB, which robustly excelled the national economy's development. In national wooden floor markets, the solid wood flooring share gradually declined, while the wood composite flooring share increased, laminated flooring kept a steady increase, and bamboo flooring enjoyed a steady rise.

(4) Paper, pulp and paper products: According to the National Light Industry Administration's statistics, since the 'Tenth Five-Year Plan', China's paper and paperboard total production and consumption has steadily increased. In 2006, China's paper and paperboard production was 68 million tonnes. Although China has grown into the third largest paper pulp producing country, grass fiber is still the main material used in the paper-making industry. Wood pulp's portion as a raw material is small in Chinese paper-making. China's paper-making industry is faced with pressures of complying with environment protection ordinance and matching international competence, at the same time.

Forest timber and timber product consumption

Forest timber product market consumption consists of domestic consumption and exports. Domestic consumption includes industry and construction timber consumption, farmers' self-produced and consumed timber, and wood fuel consumption. Exports include exports of logs, sawnwood, wood-based panels, solid wood flooring, wood furniture, wood pulp, paper and paper products, waste paper and other timber products. In 2006, China's total consumption of timber products (roundwood equivalent [RWE]) was 337.39 million m³.

(1) Industry and construction timber consumption: According to the statistics of the China Statistics Administration and related departments, and the timber consumption co-efficient of relative products, it is calculated that in 2006, China's construction and industry timber consumption was 244.97 million m³ (RWE). Among which, construction timber (including decoration) totaled 87.49 million m³, furniture timber 42.35 million m³, paper-making timber consumption was 97.02 million m³, coal industry timber consumption was 9.58 million m³, vehicle and watercraft manufacture, railway, chemical and other materials totaled 8.54 million m³.

(2) Farmers' consumed timber and fuel timber: In 2006, farmers' self-produced and consumed timber consumption was 14.6 million m³, while farmers' fuel wood consumption was 28.47 million m³. Ninety percent of farmers' self-consumed timber was used for house-building, about 13.14 million m³ (included in [1] above). Discounting the double measured volume, farmers' self-consumed timber and fuel wood consumption were 29.93 million m³.

(3) Exports: China's log export volume was 4300 m³. In 2006, other timber product export volume equaled 62.48 million m³ (RWE).

Forest product trade

In the last ten years, with China's rapid economic development and the pace of globalization, China's forest product industry has not only produced many products, such as wood-based panels, paper and paper board as well as solid wood flooring, but also its production volume ranked highest in the world. The country's giant import and export trade position has become ever-more apparent. The main feature of China's forest product trade is that the major imported commodity is raw material, while the major export commodity is finished products.

Key forest product import conditions

(1) Logs: Logs are still the largest imported raw materials in forest products. In 2006, the import volume of logs was 32.15 million m³, valued at US\$3.93 billion; year-on-year increases of 9.5% and 21.1% respectively. In terms of imported logs, the tropical timber import volume was 7.74 million m³, 24.1% of the total import volume, and an increase of 4.3% on the previous year. The top 10 countries that exported logs to China are listed in Table 6.

Table 6. 2006 Chinese imports of logs by country

Country	Import volume (10000 m ³)	Percentage	Increase rate (%)
Russian Federation	2182.6	67.9	8.9
Papua New Guinea	204.6	6.4	12.5
Malaysia	141.2	4.4	-4.1
Myanmar	102.7	3.2	-9.4
Gabon	95.8	3.0	17.7
New Zealand	90.5	2.8	41.1
Solomon Islands	77.5	2.4	18.7
Germany	46.8	1.5	5.2
Australia	39.0	1.2	65.3
Equatorial Guinea	38.1	1.2	25.3

(2) Sawnwood: In 2006, imported sawnwood totaled 6.0678 million m³, valued at US\$1.69 billion, increases of 1.6% and 12% respectively. Imported sawn wood mainly came from the

Russian Federation (1.17 million m³, 19.3%) and United States of America (1.02 million m³, 16.8%). Countries with annual import volume above 100,000 m³ are listed in Table 7.

Table 7. 2006 Chinese imports of sawn wood by country

Country	Import volume (10000 m ³)	Percentage	Increase rate (%)
Russian Federation	117.4	19.3	11.1
USA	102.2	16.8	20.0
Thailand	70.7	11.7	-7.2
Indonesia	45.0	7.4	-37.5
Canada	39.8	6.5	13.7
Malaysia	37.6	6.2	-20.8
Brazil	34.1	5.6	21.8
New Zealand	28.1	4.6	29.5
Myanmar	17.8	2.9	-44.5
Chile	13.2	2.2	-7.7

(3) Wood-based panels: Plywood — in 2006, imported plywood was 413.4 thousand m³, valued at US\$197 million, decreases of 29.8% and 28.7% respectively, compared with the previous year. Imported plywood mainly came from Indonesia and Malaysia. Fibreboard, particleboard and veneer — in 2006, import volumes of these products were 567 000 tonnes, 352 000 tonnes and 101 000 tonnes, respectively. Import values were US\$195.71 million, US\$101.73 million, and US\$118.16 million respectively. Compared with the previous year, the import volume declined by 16.2%, 14.6% and 11.4% respectively. The import value dropped 14.6%, 11.9% and 2.5% respectively.

(4) Wood pulp and waste paper: China's imported wood pulp and waste paper comes mainly from the United States and Japan, comprising 33.9% and 12.2% of the total import volume respectively. The import volume of hardwood pulp from Indonesia is also large.

Paper pulp: In 2006, the total volume of imported paper pulp was 7.96 million tonnes, valued at US\$4.39 billion, the largest imported forest product. This was an increase of 4.9% compared with the previous year; the import volume increased by 17.9%.

Waste paper: National imported waste paper in 2006 totaled 19.62 million tonnes, valued at US\$2.75 billion, an increase of 15.1% and 11.8% respectively on the previous year.

(5) Paper and paperboard: In 2006, total imported paper and paperboard was 4.37 million tonnes, valued at US\$3.4 billion, a decrease of 17% and 4% respectively on the previous year.

(6) Wood furniture: In 2006, total imported wooden furniture was 1,2901 million pieces, valued at US\$118 million, an increase of 68.1% and 44.2% respectively, on the previous year.

Key forest product exports

Sawnwood: national exports of sawn wood totaled 808.3 000 m³, and the export value was US\$352.85 million, an increase of 30.2% and 26.7% respectively on the previous year (Table 8).

Table 8. 2006 Chinese sawn wood exports by country and region

Country and Region	Export volume (10000 m ³)	Percentage	Export volume (10000US\$)	Increase rate (%)
Japan	42.56	52.6	21527.0	61.0
USA	11.36	14.1	3159.9	9.0
South Korea	8.54	10.6	2914.7	8.3
Taiwan P.O.C.	4.1	5.1	940.2	2.7
Vietnam	3.17	3.9	1023.5	2.9
Hong Kong S.A.R.	2.54	3.1	523.2	1.5

(2) Plywood: The total export volume of plywood was 8.3 million m³, and the export value was US\$2.91 billion, an increase of 48.5% and 54.9% respectively, on the previous year. China's plywood has been sold to 185 countries or regions. The United States imports the largest share (2.18 million m³) equal to 26.3% of China's total exports. Japan and another five countries have large import volumes as listed in Table 9.

Table 9. 2006 Chinese plywood exports

Countries	Export Volume		Export Value	
	10000m ³	percentage(%)	10000 \$	percentage(%)
United States	218.13	26.3	93768.0	32.2
Japan	63.14	7.6	20221.2	6.9
Great Britain	53.95	6.5	16562.1	5.7
South Korea	52.49	6.3	14597.4	5.0
United Arab Emirates	35.42	4.3	9815.1	3.4
Hong Kong S.A.R.	24.73	3.0	6495.1	2.2

(3) Fiberboard: In 2006, the total export volume of fiberboard was 1.46 million tonnes and the export value was US\$635.78 million, increases of 51.4% and 60.5%, respectively. Fibreboard is one of the forest product exports with the largest increased range. China's fiberboard has been sold to 158 countries or regions. Countries with large import volumes were Saudi Arabia with 208 000 tonnes (14.2%), the United States with 190 000 tonnes (13%), South Korea with 138 000 tonnes (9.5%), Turkey with 120 000 tonnes (8.2%), Canada with 97 000 tonnes (6.7%) and Russian Federation with 73 000 tonnes (5%).

(4) Wooden furniture: The total export volume of wooden furniture was 248 million pieces in 2006, and the export value was US\$8.78 billion, an increase of 37.4% and 39.4% respectively. China's wooden furniture has been sold worldwide. The United States, Hong Kong S.A.R., Japan and Great Britain are major importers of Chinese furniture. In terms of a trade model, according to China's Customs statistics, in 2006, wooden furniture exported after value-added processing of imported materials was valued at US\$3.57 billion, 41% of the total value of wooden furniture exported.

(5) Paper, paperboard and paper products: In 2006, the export volume of paper and paperboard was 3.05 million tonnes, and the export value was US\$2.24 billion, increases of 44.1% and 16.8% respectively on the previous year. Paper products exports have rapidly increased in recent years. The total export volume of paper products was 2.15 million tonnes, and the export value was US\$3.15 billion, increases of 201.8% and 174.5%, respectively on previous years.

Timber and timber product production, consumption and trade change

Timber production and consumption characteristics and trends

Since 1998, when the Chinese government commenced implementation of the "Natural Forest Protection Project", China's timber production and consumption were initially both on a declining trend. Forest stock volume has increased and in the past several years, so has timber production. Several important characteristics in timber production have also changed. The main timber producing areas have shifted from northern locations to the south. Felling has been converted from natural forests to plantation forest. The proportion of timber produced for fiber has increased, while timber with large diameter has decreased. The timber product consumption potential is huge, and the consumption structure has been gradually adjusting to changing supply conditions.

Although China's main forest product output has ranked top in the world, timber per capita consumption was still merely 0.12 m³, less than 1/5th of the world's average of 0.68 m³. Paper and paperboard consumption per capita was 45 kilograms, 80% of world's average level. In the next five to ten years, with China's steadily growing economy, total timber consumption will be increased.

Timber and other product trade characteristics and developing trends

(1) Trade volumes will continue to rise, surplus volume further expanded: In 2006, the value of China's forest product (including a number of NWFPs) import and export trade had reached US\$47.07 billion, an increase of 23.8% compared with that of the same time in 2005. The import value was US\$19.39 billion, an increase of 9.99% on the previous year. The export value was US\$27.68 billion, an increase of 33.8%. The forest product trade surplus

increased sharply, reaching US\$8.29 billion, an increase of 170.7% compared with that of the previous year.

(2) Wood products were the main component of forest product import and export trade:

In 2006, forest product imports of logs, sawnwood, paper pulp, paper and paperboard, as well as other kinds of wood-based boards were valued at US\$18.49 billion, equating to 95.4% of all forest product import value. The import value of NWFPs was US\$894 million, just 4.6% of the total forest product import value.

In terms of forest product exports, in 2006, wooden furniture, other wood products, paper products and plywood export values reached US\$24.27 billion, comprising 87.69% of forest product total export value, other non-wood product export volume was US\$3.41 billion, only 12.31% of forest product export value.

(3) Status as a giant in global forest product trading has become increasingly solid:

In 2006, China's import volumes of roundwood logs, waste paper and wood pulp had reached the highest in the world. Paper and paper board import volumes had climbed to second place, closely behind the United States. In 2004, China's furniture exports exceeded Italy, ranking first in the world. In 2006, the export value had been further raised to US\$17.47 billion. In 2006, China's export volume of all kinds of plywood was 8.3 million m³, an increase of almost 50% in 2005. In 2004, China's plywood export volume exceeded those of the traditional export giants, Malaysia and Indonesia, ranking first in the world.

(4) Timber imports mainly come from the Russian Federation:

In 2006, the Russian Federation was still China's major log import supplier, and the import volume was 21.83 million m³, an increase of 8.9% on the previous year. Although the Russian Federation's share in China's total log imports declined moderately, it was still as high as 67.9%. In terms of sawnwood imports, the Russian Federation, the United States, Thailand, Indonesia, Malaysia and Canada ranked highest as suppliers.

Forest biomass energy

Forest biomass energy — development status

Forest biomass energy is an important renewable resource. It is a vital step to explore the utilization of forest biomass energy to expand the resource supply, protect the environment and achieve sustainable development. In 2007, the State Forest Administration compiled a National Energy Forest Planning and Eleventh Five Plan Construction Plan for Forest Bio-diesel Raw Material Production Base, and has successively established cooperation with China Oil, COFCO and the State Grid. Under this plan, China constructed about 66,700 ha of oil energy plantations in Yunnan, Sichuan, Hunan and Anhui provinces; China also constructed a *Pistacia chinensis* seed collection base, as well as implementing a bio-diesel industrialization project, and put into production a timber-based bio-electricity power plant in Shandong Province. In Heilongjiang Province and Inner Mongolia, a timber-based

bio-electricity power plant is presently under construction.

Despite being a potentially major player in bio-energy production, China's forest bio-energy exploration and utilization is still at a very preliminary stage. To date, although China has achieved phased results in production of bio-diesel and timber solid fuel electricity, many initiatives are still in the trial and demonstration stage, and have yet to enter an industrialized development period.

Policies and regulations that concern forestry bio-energy development

The Chinese government has promulgated a China Renewable Energy Law, which came into force on January 1, 2006. Related statutes have also been successively established, such as the Renewable Energy Industry Developing Guild Catalogue, Renewable Energy Generated Electrical Pricing and Fee Sharing Management Rules and Management Regulations for Electricity Generation from Renewable Energy. These measures and regulations have provided clear prescriptions on bio-energy electricity production and have mandated a bio-energy generated electricity price subsidy. The outline of the Eleventh Five-Year Plan for National Economic and Social Development has prescribed a renewable energy development target, and proposed to adopt preferential financial support and taxation as well as establishing an investment policy so as to encourage and enhance the market share of renewable energy production and consumption, and raise the renewable energy proportion of total energy consumption. These measures are good for enhancing forest bio-energy development.

Replaceable fuel development trend

China is rich in forestry bio-energy resources. Among current forestry bio-energy material, there are 3 million tonnes of energy biomass that can be used as industrial energy raw material. If fully utilized, this can replace 2 million tonnes of standard coal, equal to 1/10th of China's fuel energy consumption. According to experts' primary estimates, China has 1500 million tonnes of existing agro-forest waste equal to 740 million tonnes of standard coal. The potential quantity explored equals to 460 million tonnes of standard coal. By virtue of exploring the utilization of bio-energy sources and realizing bio-energy technology's industrialization and development, China can effectively increase energy supply and ensure energy's sustainable development.

Non-wood forest products

Main NWFPs and their economic significance

China's NWFPs are mainly economic plantation products, bamboo and rattan products, as well as flowers. China's NWFP resources are abundant and widely distributed. To energetically promote NWFPs will not only help to increase forest resources, but also have an important influence on refining the ecological environment. With the rise of processing and

utilization skills, and development of new products and new technology, forest industry development will accelerate and forest industry production and benefits that accrue will also be raised. NWFP development and domestication will enhance agricultural development, with economic benefits becoming more and more significant. NWFPs will play an ever more important role in increasing farmers' incomes and lifting poor people from poverty. In promoting mountain area and forest area economic development, these functions are irreplaceable, being a major channel in spearheading China's forestry modernization.

Non-wood forest products resource management status

In 2006, economic forest⁹, bamboo and the flower industry made significant progress. The newly planted economic forest area in 2006 reached 403.3 000 ha, an increase of 19.39% compared with that of 2005. Total economic forest product quantity reached 101 million tonnes, an increase of 9.66% on production in 2005. In 2006, major bamboo products maintained momentum, and output of bamboo reached 1312 million pieces in 2006, an increase of 13.89% compared with 2005. The flower industry also maintained its development momentum, and output of freshly cut flowers, freshly cut leaves and dried flowers increased moderately in 2006. The gross output value of the flower industry reached 42.08 billion RMB in 2006, an increase of 8.9% compared with that of 2005. China's NWFP development faces challenges of uneven regional development, with low levels of management inputs, and little industrialization and organization.

Services of forests

Forest recreation

China's forest recreation is enjoying rapid growth. Till the end of 2006, China's forest garden areas at various levels reached a total of 2067, with a total planning area of 15.68 million ha, among which there are 660 national forest gardens (including Bai-shan city national forest tourist area), with an operational area of 11.24 million ha. In 2006, national forest gardens received 213 million tourists (person/time) exceeding 200 million person/time for the first time. Direct income from tourists with entrance tickets provided the main revenue, totaling 11.83 billion RMB.

Rapid development of forest gardens has vigorously accelerated the "New Countryside Construction"¹⁰, and improved the neighboring people's incomes. According to a specialized investigation, for 20 years China's forest garden construction and forest tourism has benefited 2 700 counties, 12 000 villages and 20 million farmers, and spurred 4 654 villages to be lifted from poverty, and created about 500 000 job positions for the farmer population. With incomplete statistics, in 2006, national forest gardens have created about 440 000 job positions. Based on the National Tourist Administration's estimates of domestic per capita tourist consumption, in 2006, forest gardens spurred comprehensive tourist income of 95

⁹ Economic forest is forest whose main products include food, fruits, grains, oils etc.

¹⁰ This is a campaign in China whose goal is building a prosperous and civilized new countryside.

billion RMB.

Urban forestry

With rapid economic development, the traditional living structure where village populations predominated has changed. China's urbanization has accelerated. Until the middle of this century, it is expected that China's urbanization will increase to 60-70% of the population, from 37.7% in 2001. To cope with the problems of urban atmospheric pollution, water pollution and noise pollution as well as industrial solid wastes, urban rubbish, heat island effects, light pollution etc, urban forestry and constructing "forest cities" have become hot issues for China's forestry development.

Since the economic reforms and liberalization, China's urban forestry construction has made great progress. Up to 2006, the urban green coverage rate had reached 32.54%. Public grass area per capita is 7.89 m². In recent years, China's urban forestry construction has seen vigorous development. Many cities have set clear forest city construction goals; more and more cities have fixed the norm of a green target to introduce forests into cities, to mosaic city areas into forests, and generally to build more amiable "forest cities" for people to live in. In 2007, the SFA published an index of national forest cities, which mainly includes assessment of the following seven aspects: comprehensive indexes, forest coverage, forest ecological network, forest health, public leisure, ecologic culture and rural afforestation. The provincial capital cities of Guiyang, Shenyang, Changsha, Chengdu and non-capital cities at the municipal level including Baotou and Li'nan have been awarded the title of "national forest city".

Forests and water

China's increasingly acute water resource shortage and large-scale recovery of forest vegetation have made the forest and water resource relationship a focus issue. To energetically protect and scientifically manage all sorts of forest vegetation and to make full use of forests' hydrology functions is an important part of water resource management and protection, and a crucial part of safeguarding China's ecological security. The Research of Chinese Sustainable Forestry Development Strategies has set a strategic goal of forest vegetation construction and water resource protection. From 2000 to 2010, a cross-sectoral national water resource utilization and water environment protection construction plan will be made. This plan will bring forest hydrology into the national water resource management allocation program, and complete mapping of national water resource protection regions at various grades. The proposal for preferential protection and management of major water resources would bring more than 30% of China's main water resource area and major river water resource management and water environment protection into a substantial recovery stage.

Bio-diversity conservation

China is a country with rich bio-diversity, boasting more than 30 000 high level plants, 6 347 vertebrates, encompassing 10% and 14% respectively, of the world's species in these categories. China is particularly rich in endemic genera of endemic and rare species.

The Chinese government has attached great importance to biodiversity conservation. China has signed and adhered to obligations under the United Nations Convention on Biological Diversity and the Ramsar Convention. China has also promulgated a range of biodiversity-related policies and legislation including the National Strategy for Ecological Conservation, the Law of the People's Republic of China on the Protection of Wild Animals, the Law of the People's Republic of China on the Protection of Wild Flora, General Guidelines of the Conservation of Nature Reserves and Regulations on Import and Export of Endangered Species etc. China has also launched wild fauna and flora protection programs and nature reserve construction programs to enlarge nature conservation areas, to recover from damage to wild fauna and flora species, raise public awareness of the necessity for nature protection and bio-energy conservation. China has also made remarkable achievements in bio-diversity protection scientific research, public education and in situ conservation and ex situ conservation and species breeding.

Till the end of 2006, the Chinese forestry sector had established 1 737 nature reserves with a total area of 120.13 million ha of different forest types and at various grades. This is 12.51% of the national territory area. Construction of nature reserves has effectively protected 90% of terrestrial ecological systems, 45% of natural wetlands, 85% of wild fauna populations and 65% of higher plant populations. The national protected area network covers 20% of natural, high-quality forest and 30% of the desert area, making a major contribution to conserving bio-diversity and promoting sustainable development.

Forests and climate change

Forests comprise the main body of the territorial ecological system and they are also the largest carbon sink. Forest protection and/or destruction will have a significant influence on CO₂ density in the air, and thus influence global climate change. The Chinese government has paid special attention to developing forests to curb climate change. In June 2007, the Chinese government issued China's National Program for Climate Change, in which forestry's importance in carbon sequestration and other functions has been described. To actively promote an afforestation program within the Clean Development Mechanism (CDM) under the Kyoto Protocol, China has implemented a World Bank Bio-Carbon Fund Forestry Carbon Program in Guangxi Autonomous Region. This is the world's first CDM forestry carbon program. At the 15th APEC conference, President Mr. Hu Jintao made a proposal to construct an "Asia Pacific Forestry Recovery and Sustainable Management Network" aimed at implementing a strategy to safeguard the global climate. Meanwhile President Hu has made a commitment to raise China's forest coverage from the current 18.21% to 20% by 2010.

This proposal has been well received and highly appreciated by the international community. It has been honored as the forest program to specifically aim at curbing global climate change.

To ensure forests play a full role in curbing climate change, the State Forestry Administration has formed a working group and carbon sink management agency, and established a China Green Carbon Fund in July 2007. Till now, seven provinces have launched an initial project under the China Green Carbon Fund. The China Green Carbon Fund is a specialized fund under the China Green Fund, which encourages Chinese enterprises, associations and individuals to join in tree planting and forest management protection activities to better support curbing of climate change.

Policy and institutional arrangements

Overview of forestry policy, legislation and implementation

In 2003, the Central Committee and State Council promulgated the Decision on Acceleration of Forestry's Development. Since then, the political environment for forestry policy-making and legislation, as well as implementation, has been much more receptive, as well as becoming more scientific and democratic.

(1) Legalization has been accelerated: In accordance with China's constitution and overarching legal framework, and based on the forestry administration's scope and classification, China has preliminarily formed a forest legal system, with the Forestry Law of the People's Republic of China as the main body for forest resource protection; the Law of the People's Republic of China on the Protection of Wildlife and Regulations of the People's Republic of China on Wildlife Protection are the main organs for wildlife protection; The Regulations of the People's Republic of China on Nature Reserves and Regulations of the People's Republic of China on Forest and Nature Reserves of Wildlife Protection target nature reserve protection. Other important laws are the Law of the People's Republic of China on Prevention and Control of Desertification for combating desertification; the Seed Law of the People's Republic of China and Regulations of the People's Republic of China on the Protection of New Varieties of Plants for forestry seedlings; and the Criminal Law of the People's Republic of China and other criminal law amendments related to forest resource violations and wildlife violations for protecting forest resource and wildlife.

(2) Policy-making power enhanced: The Chinese government has attached great importance to forestry policy-making; although laws and regulations have played an increasingly important role in forestry development, policies still have a major function in regulating forestry development. In June 2003, the State Council promulgated a Decision on Accelerating the Development of Forestry. This is the second important document (related to forestry) issued by State Council since the economic reforms and liberalization. The document makes a clear deployment of forestry production layout, points out the key fields and phases of forestry reform and identifies policy measures for safeguarding forestry development. In September 2007, the State Forestry Administration and the National Development and Reform Committee, as well as seven other ministries, issued The Outline of Forestry Industry Policies document. This is the first forestry industry policy outline issued in China, and it points out the key developing areas of forestry and supporting policies for

forestry industry development in terms of finance and taxation.

(3) Forestry law enforcement and administrative supervision have been intensified: The forestry administrative departments have adopted systems for forestry administrative enforcement, assessment, and investigation of misjudged cases. In 2006, the State Forestry Administration issued the Notice of State Forestry Administration on Implementing Forestry Administrative Enforcement Responsibility System. On the basis of this, the State Forestry Administration also drew up the State Forestry Administration's Work Program for defining law enforcement responsibility legally. This document requires that forestry administration officials should hold a Forestry Administrative Enforcement Certificate when they are engaged in law enforcement activities. China will continue to improve the forestry administrative license system, standardize forestry administrative permission, and a 'Scientific and logical, legal enactment, well-coordinated, high efficiency and powerful supervision' administrative permission (work) mechanism should be gradually set up.

Policy change concerning forestry development: Since 1998, a tremendous change has taken place in China's forestry development. Policy changes concerning forestry development are manifested in the following new measures: Forestry development strategic changes; considerable increases in government investments in forest establishment and rehabilitation; development of a classified management system for forests; establishment of a Compensative Funds System of Forest Ecological Benefits; conduct of the Reform of Collective Forest Ownership System in some provinces or regions.

(1) The major strategic change in forestry development is that forest establishment and rehabilitation should change its focus from timber production to maintaining and improving forest ecological systems. The Decision on Accelerating Forestry Development made by the State Council clearly outlined the intention to change the orientation of forestry from timber production to ecological reconstruction. It made clear that forestry development should set ecological reconstruction as the key strategic issue and sustainable development of forestry should make ecological reconstruction the main priority.

(2) To adopt a classified forest management system. To ensure clear recognition of forests' multiple functions, each forest should be classified according to its main purpose. National forests should be classified as either ecological forests or commercial forests. Different management, operational and policy measures should be applied accordingly. The ecological forests should be managed by government officials, with government investment being the main source of funding; social funds in improving management should also be mobilized. The commercial forests should be managed as commercial entities, with sales of forest products providing the major source of funding, with the government giving support when needed. For all forest resources which are classified as ecological forest, the government will provide relevant compensation to existing users/investors in various forms.

(3) With the launching of the Six Major Forestry Programs, central government inputs to

forestry have increased. The programs involve 97% of national counties, cities, regions or banners. Planned plantation will exceed 76 million ha, with total investment of more than 700 billion RMB. The six major forestry programs' effective implementation will improve China's ecological condition and safeguard the national ecology, promote agriculture and agricultural economic development, and increase urban and rural employment and farmers' incomes.

(4) A Compensative Funds System of Forest Ecological Benefits has been established. In 1998, the Forest Law explicitly stipulated that a Compensative Funds System of Forest Ecological Benefits should be established and defined the legal status, scope and objectives of the funds and compensation system. In 2004, the Ministry of Finance officially set up the Compensative Funds System for Forest Ecological Benefits. By 2006, government capital input to the system totaled 3 billion RMB, with an area of 40 million ha of forests being covered by the program. In 2007, the Ministry of Finance and State Forestry Administration released the Regulation of Central Committee's Comparative Funds for Forest Ecology Benefits. The government's fiscal input to total compensation reached 3.34 billion RMB, with the compensated area of key public forests reaching 44.53 million ha.

(5) Reform of the Collective Forest Ownership System. Since 2003, Fujian Province and Jiangxi Province have conducted collective forest ownership system reform. In 2006, the State Forestry Administration announced that up to the end of the Tenth Five-Year Plan, forest ownership reforms will be carried out to allocate clear property rights and ownership titles, household will be issued contracts for feasible management, and the philosophy that "Mountains have owners; owners have rights; with rights come responsibilities; but responsibilities also have benefits" will be realized.

(6) Fully promote modern forestry construction. In 2007, the State Forestry Administration launched a new strategy for constructing a modern forestry system, with a major focus on forestry ecology, including development of industry and a culture focused on forest ecology. Forests will provide raw materials, ecological enhancement, and culture products for national economic and social development. Construction of a modern forestry system will have a major and continuous influence on China's forestry development and ecology conservation.

Forest management systematic arrangement

According to current law and regulations, China's forest management system includes the following aspects:

- Forest, forest timber, and forest land registration and certification system
- Auditing system enabling confiscation or acquisition of forest land
- System for transferring use rights for forests, forest timber and forestland
- Compulsory tree planting system. Planting trees and protecting forest is a legal obligation for each citizen
- Forest plant quarantine system
- Forest pest and disease control

- Forest fire prevention system
- Forest cutting quota management
- Forest timber cutting license system
- Forest timber processing management
- Forest timber transport certification
- Value-added wood export administration
- Forest germplasm resource protection
- Key forest commercial seedling production certification

Forestry scientific research and education

(1) Forestry scientific research: Since the economic reforms, forestry science and technology in China have made substantial progress. A preliminary complete system focusing on forestry scientific research and development, technology extension and industrialization, establishment of technical standards and quality control supervision and forestry scientific management has been formed. There are more than 240 forestry research institutions with 10,000 professionals involved at, and above, the prefecture level.

Forestry scientific research has made many fruitful achievements in recent times. According to (incomplete) statistics, more than 5000 key scientific results pertaining to forestry have been recorded since the reforms. Of these, more than 250 have received national scientific progress awards, national innovation awards and/or national natural science awards. A further 1 848 scientific progress awards have been made at the provincial level. Since the 'Ninth Five-Year Plan', forestry science has entered a period of rapid growth, with more than 1100 key scientific achievements recorded, of which 72 have received national scientific awards and 346 awards for scientific progress have been made at the ministerial level. These achievements have also been made at the international leading level or international advanced level, or have filled in a specific gap in China's forestry scientific technology.

At the same time, it can be noted that, viewed from the perspective of the magnitude of demands on forestry development and ecological construction, China's forestry science and technology reserve is inadequate, innovation ability is weak, and supporting capacity is limited. Science resources have not yet been effectively allocated or fully utilized. Scientific and technological personnel and the overall quality of science staff do not yet meet the new tasks' requirements. The state of forestry science and technology research still remains an important restrictive factor for forestry development.

(2) Forestry education and training: At present, there are 6 forestry universities for higher education, 15 providing training on national key disciplines, 36 providing provincial training on key disciplines, 98 authorized to issue doctoral degrees in forestry (13 with Master degree authorization), and 14 post-doctoral research stations. In addition, there is 1 forestry public safety higher junior college and 12 higher junior forestry (ecology) vocational technical colleges. Besides, 256 other universities for higher education have conducted forestry college education or higher vocational education. Forestry's higher education scale has been

expanded (see Table 10), with middle forestry vocational schools especially enjoying rapid growth (Table 11).

Table 10. Student numbers from 2001/2002 to 2005/2006 in common forestry colleges for higher education and other higher education and research institutions

Project	Total	2001	2002	2003	2004	2005
Master, college and junior college enrollment student	236283	35324	40057	47573	57586	55743
Post graduate students	14550	1391	1851	2877	3823	4608
Doctoral students	2432	293	344	496	640	659
Master students	12118	1098	1507	2381	3183	3949
College and junior college students	221733	33933	38206	44696	53763	51135
Bachelor students	144316	23712	25994	29229	32359	32842
College and higher vocational students	77597	10221	12212	15467	21404	18293
Master, college and junior college graduate student	110100	10100	12300	20553	28408	38739
Post graduate students	5359	531	714	1000	1329	1785
Doctoral students	965	111	170	205	215	264
Master students	4394	420	544	795	1114	1521
College and junior college students	104741	9569	11586	19553	27079	36954
Bachelor students	71026	7218	8305	13436	18300	23767
College and higher vocational students	33695	2351	3281	6097	8779	13187

Table 11. 2001/2002 to 2005/2006 middle grade forestry vocational school students

Item	Total	2001	2002	2003	2004	2005
Enrollment	131727	21027	22163	29720	28492	30325
Forestry (garden) school enrollment	79925	16163	17324	15774	12386	18278
Graduates	148015	27790	26989	30657	33329	29250
Forestry (garden) school graduates	91401	20364	20892	18607	14773	16765

The State Forestry Administration has established forestry training bases in more than 20 provinces or regions. The Beijing State Academy of Forestry Administration (the former Beijing Forestry Management Staff College) is a professional training institution under the State Forestry Administration. From 2001 to 2005, the academy trained 14.33 million persons. The State Forestry Administration has also organized Sino-Germany Technology Cooperation training and Sino-Japan forestry ecology training programs. The State Forestry Administration

has also established cooperative training relationships with South Korea, Germany, Switzerland, Canada, and other countries.

Major issues and challenges for forestry

Although China's forestry construction has made many notable achievements, it is worth noting that China's forestry development is not yet well matched to overall requirements for national economic and social development. There are still some prominent problems or issues.

(1) Ecological reconstruction is arduous; the total volume of forest resources is inadequate and unevenly distributed: China's national soil erosion area is 3.56 million km², 37.1% of total national territory. The soil desertification area is 1.74 million km², 18.1% of total national territory. China's forest coverage is merely 61.52% of the world's average level, ranking 130 in the world.

(2) Resource management pressure is high; forest management is extensive: According to the Sixth National Forest Resource Inventory, during the inventory interval, 10.11 million ha of forest land had been converted to other uses or become non-forest land by acquisition. State-owned forest land converted into non-forest land totaled 3.7 million ha, with an average annual area of 739.4 000 ha. Extensive forest management with low efficiency overall means that overall forest quality is low, and this is borne out in the national forest average stock per ha, which is only 84.75 m³ (with planted forest stock at 46.65 m³).

(3) Forest product supply shortfalls are acute; the forestry industry structure is irrational: Due to a rapid increase in forest product demand and forest resource inadequacy, compounded by the bans on felling in natural forests and consequent reductions in timber production, China's timber supply shortfall has become increasingly acute. Timber import dependency has become even heavier. In 2006, the quantity of imported logs and sawn wood, plywood, fiberboard, paper pulp and paper products was equal to 120 million m³ roundwood equivalent, of which 32.15 million m³ was directly imported logs. Additionally, the forest industry, especially the forest product processing structure is not rational. The secondary and tertiary industries are not fully developed.

(4) Institutional restrictions on forest development have not yet been eliminated: At present, China's forestry is undergoing an overall transformation, but a holistic macro system and a system of supporting services suited to a market economy has not yet been built up. Progress in reforming systems governing key national forest areas, state-owned forest industry enterprises, and state-owned farm land is slow; a modern enterprise system has not yet been formed. Forest ownership reform policies still need to be improved and policies for circulation and transfer of forestland and forests, deforestation as well as forestry cooperation organization, etc. also still need to be enhanced urgently.

(5) Forestry infrastructure construction is still weak: In recent years, China's investment in forestry infrastructure has been significant. However, capacities relating to forest seeding,

improved collection and cultivation of forest seedlings, as well as processing and storage, forestry information and e-policy, forest fire control capacity, and pest and disease testing and control, as well as other basic development factors are weak.

(6) Support for forestry science and innovation should be further strengthened: Forestry scientific innovation, R&D and technology transfer are poor; forestry engineering and construction and forestry production's scientific value should be further promoted. The total number of forestry personnel is inadequate and the overall science structure is not rational; the overall quality is not high. Forestry training and education capacities lag far behind the actual demand.

3. FACTORS INFLUENCING FORESTRY DEVELOPMENT

Principal characteristics of social development

Demographic change

Demographic changes will definitely change the demand of socio-economic development and for goods and ecological services that forests can provide. In the long run, demographic changes, mainly in the number of people and the population structure, will be an important factor influencing forestry development.

(1) Demographic number: With the increasing improvement of integrated national power and the shift of the strategic focus for forestry development, China has quickened the pace of forestry development, while effectively controlling demographic growth. Consequently, forest resources have achieved growth both in area and in stocking levels, and the ecological services provided by forests are gradually being improved and enhanced. By the end of 2005, China's population had reached 1.31 billion people (see Table 12).

Table 12. Change in population and forest resources (ha, m³)

Time	Forest land area	Per capita forest land area	Forest stock	Per capita forest stock
2005	174909200	0.134	124558458	9.52
Mid-1990s	124558458	0.128	112665914	9.048
The beginning of the 1990s	112665914	0.114	101367532	8.622
The middle of the 1980s	101367532	0.115	91410764	8.418
The beginning of the 1980s	91410764	0.120	90279533	9.100
The middle of the 1970s	90279533	0.130	86557900	9.300

(2) Demographic structure: By the end of 2005, the city and township population in China had reached 562.12 million, and the rural population stood at 745.44 million, accounting for 43% and 57% of the total, respectively. The distribution of urban and rural population will exert an impact on society's demands for forest goods and ecological services. However, as far as forestry development in China is concerned, the impact has been limited. The impacts of an accelerating urbanization process in China on forestry development mainly shows in the fact that many young and middle-aged laborers in rural areas choose to work in urban areas, thus having a negative impact on the intensity and level of forest management and care in collective forest regions.

Forestry sector evolution

The fifty-year development of the forestry sector has witnessed three distinct stages: (i) development, frustration, damage; (ii) renewing of development, and (iii) great development. In the three development stages, the development objectives, missions and outcomes have been different.

- In the more-than 30 years before the reform and liberalization in 1978, forestry development in China was centered on timber production, and forest resources were severely damaged. This resulted in deterioration of the overall ecological environment, which had become very fragile. But forestry made an irreplaceable and important contribution to national economic development, especially in the early years of New China, when forests supplied a wealth of timber and forest products for the recovery and reconstruction of the national economy
- After the United Nations Environment and Development Conference (UNCED) which was held in 1992, China initiated a forestry development process for the 21st century, in which the concept of sustainable forestry development was recognized and (in principle) accepted. Thereafter, stress has been increasingly placed on ecological and environmental development, and the State has initiated a full range of ecological and environmental projects, the implementation of which will greatly promote forestry development, improve the ecological environment, and facilitate the healthy development of the national economy
- In the 21st century, the Central Committee of the CPC and the State Council ratified the Decision on Accelerating Forestry Development, thus forestry development in China entered a new historical stage with a focus on ecological development, rather than timber production. The Decision recognizes the strategic position of forestry in the country's overall socio-economic development, establishes a forestry development strategy with a focus on ecological development, identifies the orientation of forestry reform and relevant policies and measures, and accelerates the innovations of the system, mechanisms and policies in terms of forestry development. In order to solve serious ecological and environmental problems, China has made a large investment in the implementation of the Six Forestry Programs. These programs effectively enhance and improve the deteriorated ecological environment, and gradually establish a "green" system that is focused on forest vegetation to effectively maintain eco-security, and make positive contributions to the achievement of an "eco-good" ecological civilization in China.

Increasing of public ecological awareness and the change of the consumption concept

The burgeoning of a nationwide voluntary tree-planting campaign has effectively promoted the rapid development of afforestation and greening, and social forestry. Consequently, the whole of society has devoted time towards developing forestry and greening the environment, in the expectation of reconstructing good ecology and building a beautiful landscape, which will characterize and highlight China's forestry development. Since the first National Tree-Planting Festival in 1982, on the 12th of May every year, every person — from the leaders of the Party and the country to the general public — takes part with great enthusiasm

in tree-planting activities, which are obligatory, statutory and contribute to public welfare. The unfolding of volunteer tree-planting activities has more extensively evoked public awareness of ecology, the environment, greening and responsibilities to value and protect forests. The extensive participation of the public has promoted the development of social forestry, and exerted a positive and far-reaching impact on forestry development in the new era.

China is undergoing a social transition, and society's consumption patterns are shifting from subsistence consumption to a combination of subsistence, development, and luxury consumption. In this context, people have an increasing demand for green consumption, which is becoming a new economic growth engine for forestry development in the new era. Green consumption has become a new pursuit and a new fashion sought by people, especially by urban residents in recent years. Forests, as "the lungs of the earth", have been greatly recognized for such functions as water conservation, climate regulation, soil and water protection, arable land protection, maintenance of biodiversity, environmental purification, etc. The rise of ecological consumption and green consumption has also promoted China's forestry towards ecological development.

Change in the energy use structure of rural areas

The energy structure of rural areas in China lags behind developments in urban areas. At present, the energy used in rural life is still concentrated in burning of straw, coal and fuel wood. This low-grade energy consumption will inevitably conflict with emerging agricultural modernization, the burgeoning development of rural industry and the improvement of farmers' livelihoods. Among the energy consumed in rural areas, straw stalks contribute 31% of the total and fuel wood 25%, while in the process of traditional cooking with stoves, the energy utilization rate of straw stalks and fuel wood is only 10%-15%. The situation has evolved to one of more people and less forests; hence about 80 million farming households across the nation are short of fuel wood, thus causing excessive logging of forests and trees and rampant digging of grass roots, which in turn leads to damage to the ecological environment. This shortage can be relieved by changing the energy utilization structure in rural life, while the energy utilization rate in rural life can be improved by changing the traditional utilization approaches. Now China is initiating construction of a "New Countryside", during which the changing of the energy structure in rural life is an important component.

Political and institutional environment

Implementation of western region development

The western region of China is both rich in natural resources and fragile in its ecological environment. The region is characterized by low forest coverage, serious losses of soil and water, a large area of desertification, and severe hazards to agriculture. In January 2001, the Central Committee of the CPC and the State Council initiated an important strategy to ensure western development in the new century. Strengthening ecological and environmental

development in the west is a prerequisite to economic development and constitutes a fundamental basis to implement the western development strategy. Hence environmental development is the priority task during implementation. Along with the overall upsurge of western development, forestry in the western region has also become a strategic focus of national forestry development. It is recognized that forest resource distribution patterns in the west should be gradually improved in a holistic way, in order to increase national forest cover.

Revitalization of the old industrial bases in northeast China

The northeastern region is the forest region in which the forest area is the largest and forest resources are the richest in China. The forestry industry in the key state-owned forest regions located in the northeastern region and Inner Mongolia is the most important component of old industrial bases located in Northeast China. Due to years of excessive logging — and a focus on harvesting instead of tending — forestry in the northeast is faced with a severe situation, which is mainly characterized by resource crises, ecological degradation and economic dilemmas. The revitalization of the old industrial bases in Northeast China is a strategic decision made by the Central Committee of the CPC, in keeping with principles of scientific development, with a focus on the comprehensive construction of a prosperous society, in keeping with strategies of opening up the eastern coastal area and western development. At present, forestry development in the northeastern region has a long way to go, but it will eventually provide an ecological barrier to assisting in the revitalization of old industrial bases and the integrated, coordinated and sustainable development of the northeastern region as well as making a greater contribution to the construction of a prosperous society by revitalizing the forest economy.

Change in the public financial system

Sustainable forestry development is directly related to the sustainable development of economy and society. Thus forestry is an important pillar of development, warranting support by public finance. For example, under the six key forestry programs, the State has greatly increased its investment in forestry, fully demonstrating the strength of support from public finances to forestry. In terms of public finance development trends, forestry will be integrated into the system for public financial support for the long term, and which will possibly become a standardization system.

Enforcement of property law

The Property Law of the People's Republic of China came into force on 1 October 2007. The Law defines forest resource protection by providing greater protection of property rights. The Law will definitely play a strong role in ensuring, regulating and promoting ongoing reform of the forest ownership system and the construction of modern forestry in China.

Firm stand in combating illegal logging

The Chinese government takes a firm stand in favor of ecological protection and against illegal logging and its related trade, and has made great efforts in these areas. The Chinese government has made an international commitment to the common adherence and implementation of 7 principles as a response to illegal timber logging and related trade: adherence to the principle of national sovereignty, adherence to the principle of government leadership, adherence to the principle of strengthening sustainable forest development, adherence to the principle of international trade protection, adherence to the principle of global cooperation, adherence to the principle of scientific definition, assessment and reporting, and adherence to the principle of community participation and common action. The Chinese Government has signed Memoranda of Understanding against illegal timber logging and related trade with neighboring countries such as Indonesia, the Russian Federation, Myanmar, and others. Meanwhile, China has developed a strict monitoring procedure for the import and export of timber. The SFA and other relevant departments place high priority on monitoring of forest products and combating illegal activities in accordance with relevant laws in China, thereby playing a very important role in ensuring the well-balanced development of the forest product trade.

Change in economy

The impact of economic growth on forestry

In the past 50 years, a profound change has taken place in the quality and quantity of forests in China. The proportion of forestry production value in the national economy has continuously decreased, indicating that national economic growth has decreased its dependence on forests (Figure 1). At the same time, the growth of integrated national power provides an economic basis for the protection and development of forest resources. After the economic reforms and opening-up of China to the world, and especially in the past several years — with the improvement of integrated national power — the country has stressed the importance of forestry development, and increased the investment in the six key forestry programs (see Table 13). In 2001-2005 (during the Tenth-Five-Year Plan), the total investment was 148.2 billion RMB, 5.27 times more than the total investment under the Ninth Five-Year plan (which was 28.12 billion RMB). State investment reached 127.8 billion RMB, accounting for 86.24% of total investment. This fully indicates the great support of the nation to forestry ecological development.

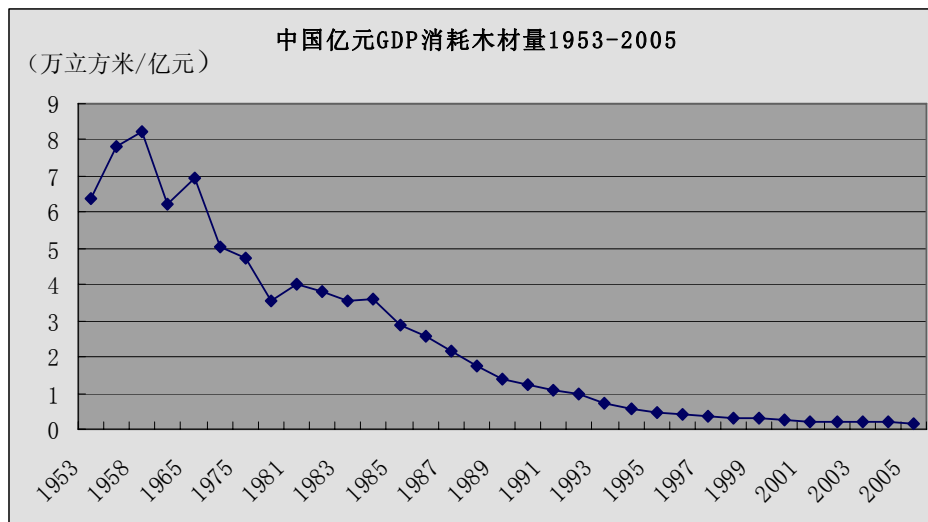


Figure 1. Timber consumption volume per 100 million RMB GDP in 1953-2005 in China

Table 13. Investment in Six Key Forestry Programs (2001-2005) Unit: 10 000 RMB

Projects	2001	2002	2003	2004	2005
Natural forest protection program	949319	933712	679020	681985	620148
The conversion of farmland from forest program	314547	1106096	2085573	2142905	2404111
Beijing-Tianjin rim combating desertification programs	183275	123238	258781	267666	332625
The "three-north" shelterbelt and Yangtze branches development program	303066	316711	232083	352661	192556
Wildlife protection and nature reserve construction program	20917	39261	52406	44465	51452
The program of establishment of fast-growing and high-yielding timber plantation	24675	38986	31297	20560	15410
Total	1795799	2558004	3339160	3510242	3616302

Rural development trend and its impact on forestry development

In China, mountainous areas account for 69% of the total land area, and the population in these areas is 56% of the total, including 30 million poor people. Forestry has unique advantages, which means that development of forestry in mountainous areas can make a great contribution to rural economic development and poverty reduction. In some senses, forestry projects themselves are the largest poverty reduction projects implemented by the nation; good forestry projects can help improve ecological and economic development and generate income for farmers. The Conversion of Farmland from Forests program, especially, is the

largest poverty reduction project involving millions of households, among which farmers can benefit the most.

The rapid, continuous and healthy development of China's economy has created increasing demand for various forest products, and forestry plays an increasingly important role in adjusting agricultural structures, developing a flourishing rural economy, and generating incomes for farmers. In the construction of the socialist "New Countryside", fast-growing and high-yielding forests, commercial forest and the bamboo industry as well as "ecological and green" industries such as forest food industry, forest tourism, forest medicine industry, etc. have become important new income-generating channels for farmers and the new growth engine for rural economy. Consequently, forests play an important role in solving the "three agriculture" problems (described later).

The impact of the mixture of agriculture and forestry on forestry development

Historically, there have been many conflicts between forestry development and agricultural development in areas including both agricultural land and forestry land. In these areas, the forest operational region overlaps with agricultural administrative jurisdiction. In these cases, the forest resource managerial right and administrative right are not consistent, the relationship is not streamlined, and therefore management is confused. This results in sub-optimal outcomes such as excessive logging, deforestation for reclamation, and overgrazing, all of which have greatly jeopardized forest resource protection and generated many negative effects on forestry development.

The Conversion of Farmland from Forest program has played a positive role in mitigating various conflicts between agriculture and forestry in these areas. The program is most closely associated with providing benefits to farmers, among the six key forestry programs. A total of 32 million farming households and 120 million farmers are involved in the program. By the end of 2006, the government had invested over 130 billion RMB in the program. Once the agricultural land is converted into forest land, farmers will devote more effort to forestry, sideline occupations and multiple-use management, as well as developing new industries, which will in turn promote rural economic development.

The impact of future energy demand on forestry

(1) Current status and trends of forests as sources of bio-energy: China is experiencing rapid economic development, but is very short of domestic energy resources. According to a survey by the Social Science Academy, China's reserves of coal, crude oil and natural gas, calculated based on proven reserves and mining capacities, are sufficient to meet demands for 80 years, 15 years and 30 years, respectively. The import dependency on crude oil has reached 47% of the national energy budget, which poses a degree of risk to national energy security.

The main form of forest bio-energy use in China is fuelwood. At present, the total area of fuelwood forest across the nation is 3.03 million ha, with a growing stock of 56 million m³. Fuelwood forest is an important energy source in large remote mountainous areas and forest

regions. Once China attaches greater importance to the development of renewable energy, forest bio-energy development will inevitably enter a new stage and become an important component of national renewable energy development.

(2)The new trend in fuel production and its impact on forestry: Under the Eleventh Five-Year plan, the rural economy will be targeted for faster development by developing agricultural and forestry biomass power generation, planting energy crops and energy plants, and developing a new rural energy industry. Efficient and clean burning fuel can be provided to rural people to improve living conditions by developing marsh gas, biomass solid fuels, and biomass gasification. A new channel for development will be opened by encouraging production of energy substitutes to crude oil, such as biological fuel ethanol and biological diesel oil, to offset shortages of oil resources. Industrialized development of bio-energy technology can be achieved to effectively increase energy supplies and promote sustainable energy development by developing bio-energy resources on a large scale.

Globalization and regionalization

With the advancement of globalization and regionalization, forestry in China has also witnessed an accelerating development trend, and various fields of forestry have made increasingly closer communications with international counterparts. This has had important impacts on socio-economic development and forestry development in China. When China joined international trade and economic organizations, such as the World Trade Organization (WTO) and Asia-Pacific Economic Cooperation (APEC), challenges such as the evident shortage of effective supplies of timber products produced in China became prominent. Consequently, China reduced the import duties for timber and timber products as well as non-tariff barriers. By 2005 the import duty on furniture was reduced to zero and the average import duty rate for paper and paper products was reduced from 7.5% in 2004 to 4.6% (zero duty continues to be applied to raw material products such as logs, sawn timber, pulp, etc).

China has actively participated in international forestry cooperation arrangements such as the Montreal Process, FLEG, UNFF, etc., and also in regional forestry cooperation such as the European Forestry Ministerial Conference, ASEAN Forestry Ministerial Conference, Asia-Pacific Forestry Commission, Asian Forest Partnership, and others. Intergovernmental cooperation arrangements for which the SFA is responsible have increased to 10, and sectoral cooperation arrangements presently stand at 37. Seventeen intergovernmental and cross-sectoral agreements have been signed, which has created a good international environment for China's forestry development.

Technological advancement

Forest technologies used in China have made good progress towards full modernization, with prominent achievements in the fields of scientific research and development, technology extension and industrialization, establishing technology standards and quality monitoring, and forest technology management systems. Rapid development has been accomplished with

regard to supporting infrastructure and enabling conditions, such as key forest laboratories, Terrestrial Ecological System Observation and Research Stations, germplasm resource pools, project centers, forest scientific data centers, technological park zones, technique extension stations, quality testing centers, new variety testing bases, forestry technology and information networks, and a new platform for forestry technology innovation has completed an initial phase of establishment. During the Tenth Five-Year Plan (2000-2005), more than 1 100 key technological achievements have been made in the forestry sector, more than 500 standards have been developed, and 630 technological achievements and applicable techniques have been used for extension and application. The National Forestry Technology Conference held in 2006, developed a strategic plan describing the objectives, missions and priority fields for medium- and long-term forestry technological development.

It needs to be pointed out, however, that the present rate of forestry technology innovation, and the overall level, cannot meet the demand for forestry development, and there exists a great gap compared with the advanced forestry countries in the world. Therefore, it is necessary to consider the improvement of independent innovations as the priority task for forestry technological development in the new era. China needs to change the passive situation of forestry science and technology as soon as possible in which partial advancement and general backwardness coexist and forestry research is based on tracking studies, while innovation research remains inefficient. China should make an effort to narrow the gap with advanced forestry countries and improve the supporting capacity of technology for forestry development, and thus promote both rapid and well-balanced development of forestry.

Environment problems and environment policies

Aiming to solve the environmental problems that China is presently encountering (issues such as damage to forest resources, desertification, water resource crisis, air pollution, etc) the Chinese Government has made environmental protection a basic national policy, and has adopted a range of measures to accelerate the construction of a resource-conserving and environmentally friendly society. Important measures include: optimizing industry structures, developing a recycling economy, and promoting clean production so that environmental pollution can be controlled at its source. Secondly, China will implement major ecological development and environmental renovation projects to effectively curb the deterioration of the natural environment. Thirdly, China plans to promote urban and rural environmental development, strengthen integrated environmental control and management in urban areas, and improve the rural living environment and the appearance of villages. Fourthly, China will accelerate environmental technology innovation, enforce special pollution treatments, and consolidate the control of pollutant discharges with a focus on the prevention of water, air and soil pollution.

The environmental policy system in China mainly includes three horizontal fields, i.e. (i) environmental pollution prevention and treatment, (ii) rural ecological and biodiversity protection, and (iii) reasonable natural resource exploitation and utilization. The three fields are closely related to forestry development, especially to rural ecological and biodiversity

protection and reasonable natural resource exploitation and utilization. After several decades' effort, China has established a relatively complete environmental policy framework, which has played an important role in environmental protection and ecological development. Currently, China has issued 6 laws with regard to environmental protection: e.g. the Environment Protection Law; 9 laws with regard to resources, e.g. the Forest Law; 28 statutes and more than 90 regulations with regard to environmental protection; and prepared 375 national standards and more than 900 local regulation with regard to environment protection; together they form the environmental law and policy system in China.

Major factors influencing forestry development in the next 20 years

National economic development

In recent years, the national economy in China has maintained a relatively high growth rate. With rapid growth, the demands that socio-economic development have created for forestry have experienced fundamental change. Firstly, some important changes have taken place in the social demands for forestry. Control, protection, and improvement of the ecological environment have gradually replaced timber production as the primary contribution of forests to national economic and social development. Secondly, the predominant economic growth pattern, which operated at the cost of environment and resources, has changed. This will cause essential changes in national economic demands on forestry. Thirdly, the advancement of scientific technology and the updating of ideas will improve public understanding of the roles of forestry.

The 17th People's Congress Report in 2007 plans that, based on "structural optimization, benefits improvement, consumption reduction and environment protection", by 2020, per capita GDP will have quadrupled compared with the 2000 level. The report lists ecological development as one of the main objectives of comprehensive construction of a prosperous society, and also points out the development direction for forestry in the new century.

Urbanization process

Urbanization is an important process as well as a symbol of modernization. While it has been brought about through great socio-economic progress, it also has caused severe social and environmental problems in cities, not only influencing the physical and mental health of urban citizens, but also threatening the survival and sustainable development of cities.

As an important component of urban ecological systems urban forests have a major environmental purification function, and play roles that other urban infrastructure cannot replace in terms of human health protection, regulating ecological balance, improving environmental quality, urban landscape aesthetics, etc. The development of urban forests is an important field of China's ecological development, as well as the main part of urban ecological development. Urban forests provide goods, culture and ecology for urban citizens, and bring into play economic, social and ecological benefits in the sustainable development of

urban economic society. Urban forests are the key and the link in the fulfillment of harmonious relationships between humans and nature and between individuals and society. Therefore, it is a necessary requirement of urbanization processes to accelerate forestry development and urban forest development.

“Three agriculture” problems

The three-agriculture problems refer to (i) agriculture, (ii) the countryside, and (iii) farmers. As a large agricultural country, the three-agriculture problem relate to the quality of people's livelihoods and economic development, as well as social stability and national wealth. Forestry plays a significant role in the settlement of the three-agriculture problems. This is because forests are not only a renewable resource, but also have multiple functions providing ecological, economic and social benefits. Forestry does not develop in isolation from agriculture, so the three-agriculture problems cannot be solved without including forestry in the equation.

Energy security

In the context of energy shortages, seeking substitute energy sources and developing new energy and renewable clean energy — such as nuclear energy, water power, wind energy, geothermal heat, solar energy, bio-energy, etc. — are the focus of attention across the world. In September 2007, the State Development and Reform Commission officially issued Medium- and Long-term Development Planning for Renewable Energy, which plans that by 2010, renewable energy consumption such as solar energy, wind energy, geothermal energy, ocean energy, bio-energy, etc. will provide about 10% of the country's total energy consumption, and by 2020 about 15% of energy consumption. It also proposes that annual production capacity of fuel ethanol will have reached 10 million tonnes and production of biological diesel oil will be 2 million tonnes by 2020. The State Development and Reform Commission emphasizes that the bio-energy represented by non-grain fuel ethanol and biological diesel oil, will be pivotal to future development.

China has prepared a strategy of vigorously developing a non-grain-based bio-energy industry on the basis of full recognition of the need to maintain grain supply security, encouraging the planting of energy crops, and the development of a bio-energy processing industry. This provides a rare opportunity for forest bio-energy development. Moreover, forestry will play a major role in mitigating any energy crisis in China, and in the country's response to climate change. The SFA recognizes forest bio-energy development as an important component of modern forestry development, and lists the large-scale cultivation of energy forest as part of the Eleventh Five-Year Forestry Development Plan. Two important documents, the National Energy Forest Development Planning and Eleventh Five-year Development Program for Biological Diesel Oil Feedstock Forest Base have been completed, with the initial concept that, by 2020, 13.33 million ha of energy forest will have been cultivated. Together with existing forest resources, this will provide 6 million tonnes of biological diesel oil feedstock and 400 million tonnes of woody fuel each year. It can be predicted that the development of

renewable energy, including forest bioenergy, will markedly alter the traditional energy pattern in China.

Economic globalization

The development of economic globalization and trade liberalization continue to drive towards a more open forestry sector in China. Increasing demands for forest products in national and international markets mean that trade, including both imports and exports of forest products in China will continue to increase. The forestry industry will encounter more opportunities, as well as severe challenges in international competition, and the traditional forestry production pattern with extensive, small-scale, decentralized management will gradually lose vitality in China. Therefore, in the long run, the forestry sector in China will play a more important role in the international market, and the forestry industry will also grow amongst fierce competition. With the rapid development of international free investment and trade, in the process of import and export of resource products, exchange and transfer between resources and environment will exert considerable negative impact on the safe supply of Chinese resources.

FLEG issues

Forest Law Enforcement and Governance (FLEG) initiatives aim to help solve four problems: forest degradation, rural poverty, climate change, and illegal trade, which are closely associated with forestry development. As early as 1992, at UNCED, forests and sustainable forest development were priority issues in international environmental policy and the political process. For 15 years, the United Nations has been devoted to promoting sustainable forest management, while the international community has made a joint effort to promote FLEG.

In September, 2007, the SFA and the European Union co-hosted the Sino-EU Forest Law Enforcement and Governance Conference in Beijing. The conference established a platform for communication among stakeholders including timber producing countries, consumer countries, private sector and state-owned enterprises, environmental protection organizations, etc. This was an important step in promoting sustainable forest resource management and integrated utilization, and towards curbing and combating illegal timber logging and promoting globally sustainable forest management.

China's FLEG has a very important position in the world. In terms of tree planting and afforestation, China has established the greatest area of forest of any country in the world in the past five years; moreover prominent achievements with regard to poverty reduction have also been made. In terms of prevention of global climate change, the role of China cannot be neglected. In the current situation, with globalization and regionalization being increasingly important, China's forestry sector will play an increasingly important role in the international trade chain for forestry.

4. POSSIBLE SOCIAL, ECONOMIC, POLITICAL AND INSTITUTIONAL DEVELOPMENT SCHEMES FOR THE NEXT 20 YEARS IN CHINA

Identification of the theoretic basis of the scheme

Identification of the economic basis of the scheme

Firstly, micro-economic analysis will provide theoretical support for the prediction of the future development of Chinese enterprises. Identifying the future development and fluctuation of productive enterprises based on the analyses of such indicators as supply and demand for products and services, prices, costs, benefits, etc., will have important impacts on national economic development trends and long-term forest industry balance. Secondly, macro-economic analysis is important for the prediction of overall economic development trends in China. This combines indicators such as investment, interest rates, taxation, inflation rates, import volumes, export volumes, etc. together in economic development models with overall demand and overall supply as the main thread. Other economic theories such as institutional economics, agricultural economics, and resources and environmental economics also analyze factors that impact on overall economic development trends, in some respect.

Identification of the ecological basis of the scheme

The ecological environment is very important to economic and social development. Understanding ecological and environmental development trends will contribute to the analysis of overall future development trends in China. Monitoring and prediction — in terms of plant population shift, biotic population change, water pollution, land degradation, climate warming, etc. are of fundamental importance in ecological and environmental analysis. The importance of ecological theory is evident in the fact that it can be used to analyze people's recognition of ecological values in economic development, and also provides a full range of indicators that help to make an integrated assessment of ecological benefits, which can help ensure the ecological environment is properly accounted for within the sphere of sustainable development.

Identification of the policy analysis basis of the scheme

The theory of political systems and structures can be used to analyze trends relating to economic and ownership structures in future society. Democratic system theory can be used to analyze the positions of future interest groups in China such as enterprises, families, government, etc. in the entire society. Political theory provides an important basis to analyze the economy, society, ecological environment, policies, etc.

Identification of the statistical basis of the scheme

Statistics provide important tools in quantitative analysis, and inevitably play a fundamental role in prediction; the statistical analysis of economic and ecological indicators is an

important method to identify the intrinsic drivers behind data. In practice, various indicators of economic, social and ecological development can be quantitatively described and statistically analyzed. Statistical analysis is often used in fields in which many realistic data are available, problems are relatively complicated, and the accuracy of data is relatively high.

Identification of the realistic basis of the scheme

Economic situation

China's economy increased outputs and commensurate benefits in the period of the Tenth Five-Year plan, with financial incomes achieving prominent increases year-after-year, while prices have remained relatively stable. The national GDP in 2006 was 20 940.7 billion RMB; among which, primary industries contributed 2 470 billion RMB, secondary industries contributed 10 200.4 billion RMB, and tertiary industries accounted for 8 270.3 billion RMB. Primary, secondary and tertiary industries respectively accounted for 11.8%, 48.7% and 39.5%, of GDP. At the end of 2006, the number of employed persons, nationally, had reached 764 million, state foreign exchange reserves stood at US\$1066.3 billion, and the national tax income in the entire year was 3 763.6 billion RMB (excluding duty, farmland occupation tax and deed tax). Figure 2 shows the GDP and growth rate between 2002 and 2006.

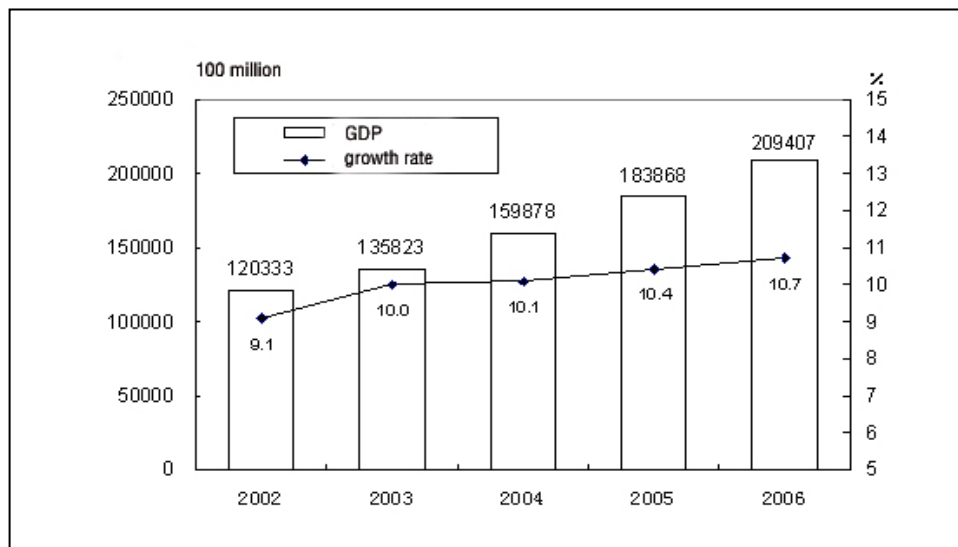


Figure 2. GDP and its growth rate in 2002-2006

Natural resources

(1) Land resources: The land area in China is 9.6 million km² and the territorial sea area is 47.3 million km². The arable land area is 123.39 million ha, forest land 233.97 million ha, grassland 263.11 million ha, other agricultural land 25.51 million ha, settlement and independent industrial and mining land 25.35 million ha, land for transportation 2.15 million ha, and land for irrigation facilities 3.57 million ha. The remaining land is classified as unused land.

(2) Water resources: Per capita runoff in China is 2,200 m³, accounting for 24.7% of the world per capita runoff. The distribution of water resources is characterized by relatively more water in the south, and relatively less in the north, while the distribution of arable land is lower in the south, with more in the north. The water energy resource reserve is calculated at 680 million kWh, ranking first in the world.

(3) Biological resources: There are 300 families, 2,980 genera and 24,600 species of seed plants in China, among which there are 2,946 genera of angiosperms (accounting for 23.6% of the world total of angiosperms). There are 2,070 terricolous vertebrates in the country, accounting for 9.8% of the world's terricolous vertebrates, among which there are more than 1,179 birds, 400 animals and 184 amphibian species, accounting for 13.5%, 11.3% and 7.3% of their world counterparts, respectively.

(4) Mining resources: Mining resources are rich, with 171 kinds of minerals present. A reserve of 157 kinds of minerals has been explored.

Demographic situation

China is a developing country with the largest population in the world. The basic national situation in this development stage of China is characterized by a large population, relative shortages of resources, and a relatively weak environmental carrying capacity, which will take time to improve.

(1) Demographic numbers: At the end of 2007, the total population in China was 1.32 billion, with an annual natural growth rate of 0.52%. At present and in future decades, the population in China will grow at the speed of 8-10 million persons per year.

(2) Population and quality of life: The average life expectancy of Chinese inhabitants has increased from 35 years at the beginning of New China, to 73 years in 2005. The Chinese Government has promoted the development of education, and popularized nine-year compulsory education, which has improved the population's quality of life in terms of science and culture.

(3) Demographic structure: The population in China is characterized by a high rapidly ageing proportion that is generally ageing before accumulating sufficient wealth to live comfortably. At the end of 2007, the population above 60 years old accounted for 11.6% of the total population. From the perspective of gender, the ratio of male to female in the total population is approximately 106 to 100, and the ratio at birth is 120 males to 100 females.

(4) Demographic distribution: From the perspective of the demographic distribution in urban and rural areas, by the end of 2007, the population living in cities and township had reached 593.79 million, accounting for 44.9% of the total population, while the number of people living in rural areas was 727.5 million, accounting for 55.1% of the population.

Technological situation

In order to fulfil the strategy for revitalizing the nation through science and education, and to improve the scientific and technological innovation capacity of China, the state fiscal budget for spending on science and technology has been increased year after year. The number of scientific and technologically qualified people continues to grow with the structure moving towards optimal levels. By 2004, the number of persons devoted to scientific and technological activities had reached 3.48 million, among which scientists and engineers had reached 2.25 million, accounting for 64.7% of the total. Scientific and technological achievements have attracted the attention of the world, and the number of patent applications has increased rapidly. During the period of the Tenth Five-Year Plan, high-technology industries in China maintained a rapid rate of increase, which has upgraded the competitiveness of Chinese high-technology products in world markets.

Policies

The key government policies include:

- Improve independent innovation capacity and construct an innovation-oriented country. This is the core of the national development strategy and the key to improving integrated national economic power
- Accelerate economic development, and promote the optimization and updating of industrial structures. This is an urgent and important strategic mission related to the overall national economy
- Incorporate specific urban development and rural development initiatives into national development, and promote the construction of the socialist New Countryside
- Strengthen energy sources and supplies, resource conservation, and ecological and environmental protection, and reinforce sustainable development capacity
- Promote coordinated development among regions and optimize land development patterns
- Improve basic economic institutions and complete development of a modern market-based economic system
- Implement additional financial and taxation system reforms and improve the macroeconomic regulation system
- Widen the extent and depth of China's "opening-up" to the world, and improve the level of open economy

Identification of the prediction scheme

Economic aspects

- GDP and per capita GDP
- Economic growth rate
- The proportion of the primary, secondary and tertiary industries in GDP

- Per capita income of urban residents, per capita net income of rural households and consumer price index (CPI)
- Engel coefficient (the proportion of family income that is spent on food)
- Per capita house floor area of urban residents

Population aspects

- Net population growth rate
- Total number of people
- Senior citizen population
- Labor population

Society aspects

- Percentage of urban population
- Gini coefficient (measurement of relative income inequality)
- Household computer popularization rate
- College enrollment rate
- The number of doctors per thousand residents
- Minimum cost-of-living rate of urban residents

The aspects of resources and environment

Table 14. Resource and environment prediction indicator system

Indicator	Basis
Total energy demand (100 million tonnes of standard coal)	Reflects the consumption of non-renewable energy, especially non-renewable fossil energy represented by coal
Per capita biomass (kg)	Reflects per capita possession of renewable biological resources
Per capita grain (kg)	Reflect the yield of grain as a principal food source of humans
Per capita arable land (ha)	Reflects the change in per capita arable land
Per capita forest land (ha)	Reflects the change in per capita forest land
Per capita grassland (ha)	Reflects the change in per capita grassland
Per capita volume of meat/poultry (kg)	Reflects the change in per capita food sources
Energy consumption of unit GNP	Reflects the increase mode of GDP
Exhaust emissions (100 million m ³)	Reflects the situation of industrial and subsistence pollution
Waste water emissions (100 million m ³)	Reflects the situation of industrial and subsistence pollution
Solid waste emissions (100 million m ³)	Reflects the situation of industrial and subsistence pollution
CO ₂ emissions (100 million m ³)	Reflects the emission situation of CO ₂
SO ₂ emissions (1 million tonnes)	Reflects the emission situation of SO ₂
CFC emissions (tonnes)	Reflects the emission situation of gas that damages the ozone layer
Land erosion area (1 million km ²)	Reflects the situation of soil and water loss
Forest cover (%)	Reflects the change in forest resources
Desertification area (10 000	Reflects the situation of land

km ² /year)	desertification
Industrial water consumption (100 million tonnes)	Reflects the demand by industry production for water resources

Possible development situation in 2020

Economic aspects

China plans to achieve a quadrupling of per capita GDP by 2020 compared with 2000, which means that per capita GDP in China will increase from US\$850 in 2000 to US\$3,400 in 2020. By 2020, China will have achieved a comprehensively prosperous society, with per capita GDP exceeding US\$3000, which the country has benchmarked as the level of comprehensive prosperity.

Average per capita income of urban residents will be 18,000 RMB. Per capita net income of rural households will be 8,000 RMB. The Engel coefficient will be lower than 40% (i.e. less than 40% of household income will be spent on food). Per capita housing floor area for urban residents will be 30 m². The Consumer Price Index will be stabilized at 3%. China will rise to the ranks of high- and medium-income countries, compared with the current rank among low- and medium-income countries, thus accomplishing a great transition of national development.

By 2020, China's score in the Human Development Index¹¹ (which provides normalized measures of life expectancy, literacy, educational attainment, and GDP per capita) will be not less than 0.80, and the ratio of rural to urban population will have been restricted to less than 1.80. People will become more wealthy, income distribution more equitable, and the city-countryside dual structure problem, which haunts today's development prospects, will have been mitigated to some extent. By 2020, the proportion of secondary industry in GDP will have exceeded 75%, which means the basic fulfillment of industrialization.

Population aspects

Based on *Sustainable Development Program in China: Chinese Society Advancement and Sustainable Development* (Lu Xueyi 2007), it is predicted that in accordance with a total fertility rate of 0.18%, by 2010 and 2020 the population in China will grow to 1.37 billion and 1.451 billion respectively, and the number of elderly people in China will continue to grow at a rate of 3.2% per year. In 2020, the percentage of elderly people at and above 60 years of age in the total population will be 16.72%; in 2016, the labor force population (aged between 15 and 64 years) will approach a peak value of 1.01 billion people, and in 2020 will remain at approximately 1 billion people. The average life expectancy by 2020 will be 76 years.

Social aspects

Based on Lu Xueyi (2007), institutions will play a huge role in promoting urbanization because China is under rapid institutional transition. By 2020, the urbanization rate in China

¹¹ <http://hdr.undp.org/en/>

will have increased by about 5-8% per year, from 41.8% in 2004 to 49.8-54.6%. Thus urban capacity of 700-800 million people will have been obtained to shape a “city system” which incorporates large, medium and small cities together with the characteristics of reasonable structure, complementary functions and gross benefit maximization.

Based on Lu Xueyi (2007), it is predicted that by 2020, the Gini coefficient in China will be maintained at the level of 0.395-0.474, the popularization rate of household computers at 20%, college enrollment rate at 20%, the number of doctors per thousand residents at 2.8 and the minimum cost-of-living rate of urban residents at above 95%.

The aspects of resources and the environment

The Chinese Government attaches great importance to food security, and plans that up to 2020, the arable land area will be maintained above 120 million ha. However, due to urban development, the overall scale of land used in urban construction and the scale of urban and rural construction land will increase; besides which, gardens, forestland and grasslands will also increase to a certain extent.

In 2003, the Ministry of Land and Resources organized efforts to prepare the report Study on Possible Supply of Major Mineral Resources in China. The report analyzed the predicted demand for — and national supply capacity of — mineral resources in China by 2020, and calculated that there will be a large gap for some important “pillar” minerals such as crude oil and iron ore, and the competitive advantage of several minerals will be weakened.

In terms of water resources, based on Lu Xueyi (2007), it is predicted that by 2020, water supply volume will reach 720 billion m³, among which about 650 billion m³ can be used for most household and industrial purposes.

In terms of environment, since the State pays great attention to environmental protection, by 2020, environmental quality and the ecological situation will have been significantly improved, the control of desertification will have fulfilled preliminary targets and the trend of overall deterioration in grassland ecological environments will have been basically curbed, which will contribute to fundamental improvement in the ecological environment.

5. CHINESE FORESTRY DEVELOPMENT BY 2020

Forest resources

According to the anticipated results in the Eleventh-Five-Year Forest Plan and the National Plan for Long- and Medium-Term Forestry Development, by 2020, the total forest area of China will reach 220 million ha, the forest coverage will reach 23.46%, the unit stock volume of existing forest stands will be around 105 m³/ha and the gross forest stock volume will welcome a dramatic increase. Forests for public ecological benefits will be strongly developed and their area will occupy more than 20% of the total land area. The contribution of science and technology to forestry will be significantly highlighted, the contribution rate of science and technology to increases in forestry's economic development will be 50%, and the utilization rate of quality seeds for afforestation will reach 65%. There will be approximately 2,300 nature reserves nationwide, of various types such as forest reserves and wildlife reserves whose area will be 140 million ha and take up 14.5% of the total land area. These will provide sound protection for 95% of the country's wildlife species under national priority protection and include representative areas of all typical ecosystem types. There will be over 600 wetland reserves nationwide and about 80 wetlands of international significance. Over 60% of the natural wetlands will be effectively protected.

Table 15. Main anticipated indicator values of forest resources by 2020

Indicators	Anticipated value by 2020
Forest Coverage	23.46%
Forest Area	Over 220 million ha
National Key Ecological Forest ¹²	110 million ha
Percentage of National Key Ecological Forests to Total Land Area	11.3%
Percentage of Ecological Forests to Total Land Area	Over 20%
Area of Nature Reserves at Various Level	135 million ha
Percentage of Nature Reserves to Total Land Area	14%
Area of National Nature Reserves	90 million ha
Percentage of National Nature Reserves to Total Land Area	9.4%
Proportion of Well Protected Natural Wetlands	Over 60%
Annual Afforestation Area (Including Closure)	Approx. 5 million ha
Percentage of Newly Controlled Sandified Area to Total Area Suitable for Control	Over 50%
Unit Stock Volume of Forest Stand	105 m³/ha
Supply Rate of Commercial Timber by Plantations	80%
Contribution Rate of Science & Technology Findings	50%
Seed and Seedling Supply Rate by Bases	80%
Utilization Rate of Quality Seeds	65%

Source: The Eleventh Five-Year Forest Plan and the National Plan for Long- and Medium-Term Forestry Development.

¹² According to China's National Plan, forests where the ecological status is very important and very fragile and subject to ecological environmental protection of regional forests, trees and woodlands are to be treated as National Key Ecological Forests.

Changes in forest coverage

In light of the development goal for China's forest coverage identified in the Resolution on Accelerating Forest Development by the CPC Central Committee and the State Council, and based on the results of the Research of China's Sustainable Forestry Development Strategies and the Eleventh Five-Year Forest Plan and the National Plan for Long- and Medium-Term Forestry Development, China's forest coverage rate will reach more than 19% of national land area by 2010. Considering the afforestation area under the Six Key Forestry Programs and the continuity of forest ecosystem development after 2010, and estimating that 60% of the net increment of forest coverage rate will be achieved by 2020 (based on the planned net increment of forest coverage rate from 2010 to 2030), by 2020, the forest area will reach 220 million ha; the forest coverage rate will reach 23.46%; the annually increased forest area will be about 0.3% of the total land area; and the newly-established forest area will be 29.6 million ha.

Changes in ecological forest area and commercial forest area

(1) Ecological forests: Approximately 110 million ha of national key ecological forests will be effectively protected and they will occupy 11.3% of the total land area. Along with local ecological forests, the total area of ecological forests under protection will occupy more than 20% of the total land area. The total area of nature reserves at various levels will reach 135 million ha and occupy 14% of the total land area¹³. The area of national nature reserves will reach 90 million ha and take up 9.4% of the total land area, providing sound protection for over 60% of the natural wetlands. Local nature reserves will amount to 45 million hectares.

(2) Commercial forests: A large area of efficient, fast-growing and high-yield timber forest bases will be developed. It is planned that 13.33 million ha of fast-growing industrial timber forests will be established to cultivate valuable tree species and large-diameter timber species. These will mainly be established by State-owned forest farms and forest enterprises. Secondly, significant areas of bio-energy forests will be developed. The State plans to develop fast-growing, high-yield, high-heat and high-“oiliness” bioenergy forest bases and construct a number of demonstration bases for biological diesel oil and bio-ethanol energy forests in eastern and central China during the next decade.

Area of forests under sustainable management

The Chinese Government attaches great importance to forestry development and has formulated a series of guidelines and measures to ensure China's forestry development obtains remarkable achievements. The most significant advances in recent times include: China's forest resources have increased in terms of both forest coverage and stock volume, the excessive exploitation of forests has been effectively controlled, forest resource management has been effectively strengthened, and forest quality is being gradually improved. Since UNCED in 1992, the Chinese Government has also paid great attention to sustainable

¹³ There is overlap between the area of Nature Reserves and Ecological Forests.

forestry development and sustainable forest management, and viewed this as the central goal of China's forestry development. Currently, Chinese forestry is undergoing an historic transformation from having a core focus on timber production, to mainly focusing on ecological improvement and gradually entering into a new phase of sustainable development. As sustainable forest development is a dynamic concept, it is very difficult to accurately assess and estimate the area of sustainably managed forests in China. However, market-oriented forest certification has witnessed rapid development in China. By 2007, 750,000 ha of forests managed by seven forest enterprises had achieved Forest Stewardship Council certification, which is an international certification system providing proof of sustainable forest management, as adjudged by an independent, accredited third party. With "green" developments in international markets, and the improvement of Chinese forest management, there will be many more forests in China approved by certification. In line with the current rate of development, the area of certified forests in China can be forecast to reach 4.5 million ha by 2020.

Stock volume, increment and annual harvest

By 2020, the total forest area will reach more than 220 million ha, the forest stock volume will reach 14.5 billion m³ and the average annual growth increment in fast-growing and high-yield forest bases nationwide will be about 15 m³/ha. With further improvement in forest breeding and cultivation technology, there is promise for growth to realize an average annual increment of 20 m³/ha in fast-growing and high-yield forest bases.

By 2020, China's annual harvest will be increased on the basis of current management levels to meet 70-80% of the domestic demand of timber, i.e. 304 million m³. Under reasonable forest management, the standing stock volume per ha can reach the world's average level with annual allowable cut of around 420 million m³. Such an increase will mainly result from the improvement of forest quality. Increases in annual increment and gross stock volume will provide potential room to markedly increase the sustainable forest harvest. Besides, thanks to the improvement of quality seeds and intensive management of timber forests, the output per unit area will be increased and thus more timber can be produced, while the forest area is kept relatively stable.

Timber and timber products

Forest product production

According to the specific objectives of Chinese forest resource protection and development in the new period, and the program of fast-growing and high-yield forest base development, as well as the overarching trends in China's macro-economic development and predictions for forest industry development, by 2020 the nation's total commercial timber supply will be about 304 million m³. The output of wood-based panels in 2020 is expected to be around 1200 million m³.

Bamboo will be an important substitute for wood. Characterized by its short growing cycle and large output, bamboo also has superior qualities to wood in certain fields, including decoration, furniture and craftwork. According to the national forestry development plan, the output of bamboo products by 2010 will be 31.88 million tonnes and bamboo pulpwood production will be 6.25 million tonnes. These production levels will increase markedly by 2020.

Currently China is the country that produces the largest volume of pine rosin. In light of development trends in the world's pine rosin product market, it is anticipated that China's yield of pine rosin will be around 1.2 million tonnes by 2020.

Demand for forest products

A study by an SFA Project Team making predictions of forest product supply and demand during the Eleventh-Five-Year Plan period shows that the annual demand for timber in China in 2004 was 242-247 million m³, while the demand for timber in 2020 is anticipated to be 457-477 million m³. From this analysis it appears that (excluding farmers' demands for self-produced wood and fuel wood), the gap between supply and demand for commercial timber in 2020 will be 150-170 million m³ and a shortfall between domestic supply and demand will still exist.

Table 16. China's gross consumption of wood products and structure in 2004 and anticipation for 2010 and 2020 (unit: million m³)

Structure of Supply and Demand		2004	2010	2020
Architecture	Framework Building	34.6	41-43	32-34
	Decoration	19	34-36	40-42
	Construction	30	29-31	34-36
	Subtotal	83.6	104-110	106-112
Furniture		11	20-22	35-37
Paper		44	66-70	140-145
Wood-based Panels		83	110-120	141-143
Miscellaneous		20-25	25-30	35-40
Total		241.6-246.6	325-352	457-477

Table 17. Correlation between timber consumption and national economy

Period	1998-2004	2004-2010	2010-2020
GDP Growth Rate	9.7%	7.8%	7.2%
Growth Rate of Timber Consumption	7.8%	5.4%	3.6%
Elasticity of Timber Supply and Demand	0.8	0.7	0.5

China's share in the global forest product market through foreign trade

Currently, China is one of the major countries involved in forest product trade in the world. China's forest product trade volume accounts for 7% of the world's total, of which the import volume accounts for 10.5% and the export volume accounts for 3.3%. In terms of imports, China is the world's largest importer of industrial logs, wood pulp and waste paper. China is the fourth largest exporter of wood-based panels. In addition, China has been the largest exporter of wooden furniture and plywood since 2005.

Forest products imported by China are mainly commodity products including logs, sawn timber, waste paper, wood pulp and so forth, while exports are mainly finished products e.g. furniture, wood flooring and plywood. Considering the international context, especially the increasing importance attached to environmental protection in all countries, there are daily more and more countries restricting and prohibiting the harvest of natural forests, and crackdowns on illegal logging and timber smuggling are increasingly reinforced. In addition, many major timber exporting countries — for example, the Russian Federation — have adopted measures to limit log exports, such as by increasing export tariffs so as to improve the value-added component of export commodities, and to develop their own respective national economies. It is forecast that the international timber market will be further tightened in future and continuous increases in timber prices will be inevitable. China's demand for raw materials and commodity products is increasing so the import share will be gradually increased based on the current situation; China's forest product import volume will continue to account for around 10% of the world's total. In terms of exports, China is now involved in negotiating a number of trade conflicts and disputes. With the frequent emergence of various trade barriers e.g. anti-dumping and anti-subsidy measures, the timber industry is operating in an increasingly difficult environment to further expand exports. Generally, China's forest product production will increase to meet a degree of increase in demand for China's exports, but the rate of growth will be steady and moderate. The proportion of China's forest product exports in 2020 is anticipated to be around 5% of the world's total.

Conflicts between supply and demand for timber in China

Analysis of the balance between the supply and demand for timber and major forest products in China shows that a gap exists between projections for supply and demand for timber during the period 2010-2020. China has an annual demand of 150–170 million m³ (roundwood equivalent) for timber and primary wood products. The important contributing factors to the gap are the increasing demand for timber in line with rapid socio-economic development, and the rapid growth of exports e.g. furniture, building materials (mainly wood flooring), wood-based panels (especially plywood) and paper products, as China is becoming a manufacturing center for wood-based products. China will be mainly short of high-quality, large-diameter logs, in particular valuable hardwood species, while the timber demand for fiber-based boards (including wood pulp, fiberboards and particle boards) can basically be

met. Against the gap between supply and demand, China is striving to establish a large area of fast-growing and high-yield forest plantations amounting to 13.33 million ha and with an annual timber yield of 130 million m³. Together with the yields of general forests for timber, the annual domestic timber yield will reach 304 million m³ and thus the dependence on imports will be greatly reduced.

Development trends in the forest product industry

According to the major trends of forest product supply and demand at home and abroad, as well as the requirements of China's socio-economic development and its impacts on the forest product industry, the development of the Chinese forest product industry will be dominated by the following trends:

(1) In the past decade, the Chinese forest product industry has experienced a period of rapid development mainly in terms of production volumes. In the future five to ten years, industrial development will be promoted mainly in terms of quality. Forest product processing enterprises will be transformed from being "pulled" by exports and "pushed" by resources, to being enterprises driven by research and development. OEA and OEM enterprises will be reduced, ODM and OBM enterprises¹⁴ will be increased and an industry structure that prioritizes large enterprises will be formed.

(2) China's wood resources will shift core production from natural forests to plantations; meanwhile, bamboo, rattan, other herbaceous, wooden and gramineous plants and waste woods will be widely utilized. Society will increasingly demand harmonization between the quality, performances and functions of wood-based materials and wood-based products and the ecological environment. As a result, the future development of the Chinese forest product industry will be characterized by fast, but moderate growth based on an optimized industrial structure, with comprehensive benefits and the reduction of energy consumption.

(3) The economic growth of the forest industry will change from extensive to intensive patterns, so as to improve productive efficiency, maximize the use of limited resources, and realize the largest values. Increasing scale of production is an inevitable trend for the forest product industry, particularly the wood-based panel and wood pulp and paper production, with high added-values and obvious scale benefits.

(4) Non-public-owned forests have shown strong vitality. The state will continue to encourage private capital to invest in the forestry sector in future. With continuous investments of foreign capital and private capital, as well as the emergence of trading companies, the financial capacity of the forest product industry is being reinforced and the holistic sectoral trend of mergers and reformations will continue.

¹⁴ OEA (Original Equipment Assembling), OEM (Original Equipment Manufacturing), ODM (Own Design Manufacturing), and OBM (Own Brand Manufacturing) are patterns of enterprise being developed in China.

(5) The emergence of various trade barriers and the development of forest certification will cause changes to China's export structures, patterns and targeted countries. Well-known brands will gradually become the dominant forces in the forest product market, more attention will be paid to brand competition and service competition, and the implementation of brand strategies will be an inevitable general trend.

Forest bio-energy

Development trends of forest bio-energy

According to the Long- and Medium-Term Development Plan for Renewable Energy formulated by the Chinese government, by 2020, the electricity generated from biomass will reach 30 million kilowatts, biological liquid fuel production will reach 10 million tonnes, the annual utilization of methane will reach 40 billion m³, the production of biological solid formed fuel will reach 50 million tonnes and the annual utilization of bio-energy will account for 4% of energy consumption. Therefore, being oriented to market demands, the development of forest bio-energy will use production methods integrating forest products and oil, forest products and electricity, and so forth, to accelerate the development of a number of oil forest bases and wood-based energy forest bases. China is striving to develop raw material supplies in the energy forest bases for production of biological diesel oil and bio-electricity to meet at least 30% and 4%, respectively, of the production goals set for bio-energy and renewable energy in the Long- and Medium-Term Development Plan for Renewable Energy.

Advantages and restricting factors of forest bio-energy development

(1) Advantages: China's advantages in developing forest bio-energy include the abundant tree species resources suitable for energy forests and rich land resources suitable for growing forest energy crops. China presently has more than 57 million ha of barren hills and lands appropriate for afforestation, and over 100 million ha of marginal lands unsuitable for agricultural production — e.g. saline and alkali lands and sandy lands — among which many marginal lands are suitable for planting energy forests of specific species. Consequently, China has significant potential land resources that can be employed in developing energy forests. A third significant advantage is that China is equipped with a solid level of energy forest cultivation technology and expertise.

(2) Restricting factors: Currently, the scale of forest bio-energy exploitation and utilization is too small to meet the requirement of industrialized utilization. Secondly, research, extension and application of energy forest cultivation and utilization technology still lag behind. Thirdly, the major focus of forest bio-energy, at present, is simply to cultivate and manage energy forests as fuel wood forests. The current exploitation of biomass energy focuses on the utilization of agricultural straws and underestimates the potential of forest biomass, and thus has severely constrained the process of forest bio-energy development.

Impacts of related policies

It has been largely common sense for the international community to develop renewable energy sources e.g. wind energy, solar energy, hydrological energy and bio-energy. The national and international political environment and policy directions related to energy will greatly accelerate forest bio-energy development. The Chinese government has attached high importance to development of renewable energy sources, including forest bio-energy, by issuing and bringing into effect the People's Republic of China Renewable Energy Law and matching regulations, and formulating the Long- and Medium-Term Development Plan for Energy and Renewable Energy. The Outline of the Eleventh Five-Year Program for National Economy and Social Development has defined the goal of renewable energy development; proposed to execute preferential taxation and investment policies and compulsory market share policies to encourage the production and consumption of renewable energy and increase the proportion of renewable energy in energy consumption; and clearly put forward a strategy to accelerate the development of bio-energy, including construction of a number of power stations generating electricity with straws and forest woods, and improving the productive capacity of solid formed bio-fuel, fuel ethanol and biological diesel oil.

Technical issues in forest bio-energy utilization

According to future development trends for forest bio-energy, China's exploitation and utilization should focus on strengthening research on key technology for the cultivation and transformation of biomass resources. The key technologies in need of breakthrough developments mainly include: (i) special cultivation technology for energy forest resources, which mainly needs to focus on innovative research on cultivation technologies for the three major forest energy resource types, specifically fiber energy forests, wooden oil energy forests and wooden amyllum energy forests; (ii) biomass thermo-chemical transformation technology, i.e. pyrogenation, liquefaction, gasification, direct burning and other techniques to transform forest biomass to biological oil, compound gas and solid carbon through thermo-chemical treatments; (iii) forest biomass saccharification technology, which aims at using lignocellulose biomass to produce inexpensive malt sugar for fuel, chemical products and material production; (iv) preparation technologies for forest biomass derivatives, with the key needs for technical research being the transformation of fuel ethanol and biological diesel oil, biomass gasification, electricity generation, heating, solid formed fuel, the replacement of petroleum-based products, the fast pyrogenation of biomass and biological oil preparation, and so forth.

Prospects for NWFPs

China has made significant achievements and accumulated abundant experience in the production of NWFPs that are under continuous improvement and development. The next decade will be an important period for the rapid development of China's NWFPs. The scale of

NWFP production bases will be further enlarged, efforts to readjust the structure will be continuously increased, and industrialization will be further accelerated.

The Outline of Forestry Industry Policies issued by the SFA in 2007 proposes to focus on the development of new, well-known, characteristic and high-quality economic forest product bases, with attention to the storage, transportation, preservation, selection, packaging, deep and fine processing of economic forest fruits; development of integrated utilization techniques and a modern logistics and delivery industry; and the flower and forest wood seedling industries as the key emphases of industry development. It also proposes to strongly develop forest plantations to produce oils, forest medicinal materials, forest foods etc., and the cultivation and collection systems of NWFPs in forests. The production value of plantations and collection of economic NWFPs in 2006 was 255 billion RMB, which is four times that of timber logging. Based on this proportion, by 2020, the net production value of plantation and collection of economic forest products will reach 561 billion RMB and the net production value of NWFPs¹⁵ will reach 740 billion RMB.

Services and functions of forests

The general trend

By 2020, the services and functions of Chinese forests in conserving water, protecting soil, sequestering carbon and producing oxygen, regulating the climate, cleansing the environment, conserving biological diversity, protecting the agriculture, etc. will be gradually strengthened. Forest landscape structures will be optimized, the landscape fragmentation index will be much reduced, landscapes will have more tiers, the area of semi-natural forest stands and the forest area under sustainable management will be increased, and the forest quality will be improved.

Forest tourism and recreation

The main way in which forest landscape resources are utilized and forest tourism is developed in China is through the establishment of forest parks, safari parks and game parks and by designating tourism areas in nature reserves. Improved access to forests makes recreation available, including traditional forest tourism and daily forest leisure activities.

By 2020, the overall plan for construction and layout of forest parks throughout China will be completed. The total number of forest parks will increase. Forest tourism will be rapidly developed in future and forest parks, nature reserves and other state-owned forests will play a key role in forest tourism.

Wildlife management

Stressing the in-situ protection of rare and endangered fauna and floral species and typical

¹⁵ Including forest tourism income.

ecosystem types, China's wildlife management thoroughly implements the Wildlife Conservation and Nature Reserves Development Program and the National Forest Nature Reserves Development Plan to advance the sustainable and healthy development of biological diversity conservation and nature reserves in China. Legislation on wildlife conservation will be further improved, and management systems and law enforcement and supervision systems for wildlife conservation at all levels will be further reinforced. By 2020, 95% of the wildlife species of national importance will be effectively protected and 60% of the species resources of national importance will be restored and increased.

Urban forestry

According to the strategic need to safeguard urban ecological security and develop ecologically friendly cities, as well as requirements to develop cities within forests, roads within green belts, houses in garden settings, and for people to live in natural landscapes, it is necessary to establish an urban forest ecological network. This urban ecological network should be dominated by forest trees, but in appropriate quantities and in efficient and diverse arrangements, utilizing diverse plant species and establishing classic natural landscapes so as to form a green ecological circle that is harmoniously integrated with urban areas, peri-urban areas and suburban areas. Development of urban forests should integrate urban parks, gardens, green spaces, waterways, roadside forests, forest parks, nature reserves and so forth.

By 2020, China will establish a comparatively improved urban forest network with large-scale continuous forests and broad forest corridors as the principal framework, and various types of forest shelterbelts as supplements. It is envisaged that 70% of cities in China will have a forest coverage rate of at least 40%. Forests comprising mainly arboreal species will be the priority and will form the principal part of urban green spaces. Urban eco-environments will be improved to a great extent and the phase goal to see "blue sky, clean water, and green land" will be generally achieved.

Forests and water

Forests have important functions in conserving water supplies and preserving soil and water quality, especially by supplying water in drought seasons and preventing floods in rainy seasons, as well as improving water quality. In the coming years, China will mainly adopt measures to regulate the relationship between forests and water, including: (1) forest ecological improvement in key watershed areas; (2) the establishment of compensation mechanisms for forests' ecological benefits in conserving water; and (3) the acceleration of forest network and water network development.

Forest biological diversity conservation

According to the Wildlife Conservation and Nature Reserves Development Program and the National Forest Nature Reserves Development Plan, by 2020, nature reserves established and managed by the forestry sector will account for around 14.5% of the total terrestrial area in

China. It is planned that 95% of wildlife species of national importance and all typical ecosystem types, and 90% of the important natural wetlands, will be effectively protected. Additionally, 60% of species of national importance will be restored and increased.

Forest carbon sequestration: potentials and limitations

Due to the tremendous population pressure in China, and some unscientific production methods, carbon storage in the country's terrestrial ecosystems is still at a low level and the potential capacity of forest vegetation to sequester carbon is still far from being fully utilized.

Chinese forests have strong potential for increased carbon storage: (1) the enlarged afforestation area can increase the capacity of forest carbon storage; (2) the reinforced forest management can improve forests' carbon sequestration; and (3) the regeneration and reafforestation of clear-cut areas of mature forests and over-mature forests can expand the capacity of forest carbon storage.

Limiting factors: (1) breakthroughs are needed on topics such as afforestation technology on difficult sites, such as desertified lands, sandified lands and other infertile lands with harsh environments; (2) forest quality and forest land productivity are still in need of improvement; and (3) public awareness of forests' roles in carbon sequestration, emission reductions, carbon storage capacity expansion, etc. is still insufficient.

Forests' social functions

Forests and employment

In 2020, forests will make a greater contribution to employment, mainly in the following aspects: (1) the employment capacity of the tertiary forest industry, dominated by forest tourism and services, will be strengthened; (2) the development of the forest product processing industry, particularly furniture manufacturing, NWFP processing, sawn timber processing and bamboo-and-wood-based product processing will provide many employment opportunities; and (3) employment in primary forest industries will remain stable.

Forests' roles in rural development

Issues related to agriculture, rural areas and rural populations are among the most important issues for the Chinese government to solve. Among them, rural economic development is of particular significance. The key to developing the rural economy currently lies with the implementation of the strategy for urban-rural integration. In the next decade, forestry will play a crucial role in accelerating holistic, harmonious and sustainable rural development. Forestry can advance rural economic development by providing employment opportunities to surplus rural labor forces on the one hand, and by helping farmers to increase their incomes from timber on the other. Additionally, the implementation of the key forestry programs, especially the Program for Conversion of Cropland to Forest will effectively improve the

ecological environment in rural areas. The rapid development of forest-friendly and ecologically-friendly cultures will actively promote China's rural culture.

Overview of forestry in 2020

Advantages and opportunities

(1) The Chinese government has attached great importance to ecological improvement. The Chinese government views the protection of the ecological environment as an important outcome and policy. The 17th National Congress of Communist Party of China put forward the goal to construct an ecologically educated and prosperous society by transforming the country's growth from an orientation based on resource consumption, to one based on resource conservation. A range of ecological and environmental indicators — e.g. forest coverage rate — has been included in the set of criteria that will determine achievement of the goal to build a prosperous, and holistically balanced society by 2020. Therefore forestry, as an important force for ecological improvement, will continue to be regarded as important in the future. The State has strengthened its investment in forestry and, with the in-depth focus on forest ecological improvement, such inputs will be further strengthened, with substantial governmental financial support applied to compensation for provision of ecological benefits, under the Six Key Forestry Programs.

(2) The reform of the collective forest ownership system will accelerate forestry development. The reform of the collective forest ownership system is being carried out in various pilot provinces. After three years' work, forest farmers in various localities have increased their investment in forestry after being granted forest property rights and their incomes have been increased by various degrees. Forest farmers in some southern provinces have achieved some remarkable income increases. In terms of the macroeconomic context, the national timber supply has been increased, and in terms of forest product enterprises, timber sources have been diversified and the resource restrictions due to human factors have been reduced. With appropriate and carefully designed implementation, the reform of the collective forest ownership system will be an important driving force for China's forestry development in the future.

(3) China's timber supply increases. By 2020, with the basic stabilization of the forest property rights structure and the gradual deepening of the collective forest ownership system reform, farmers' initiatives in afforestation will be improved and more timber will be provided. Thanks to good planning, the area of fast-growing and high-yield forests in China will have increased significantly. Meanwhile, thanks to technological improvements, the utilization of new species, and the application of new cultivation and management technology, China's industrial timber production will be increased and the total afforested area will be increased. The establishment of the national timber security safeguarding system will also enhance the national timber supply.

(4) The competitive advantages of the forest product processing industry will be maintained.

The relatively inexpensive labor force and relatively cheap raw materials are a development trend, which will maintain its competitive advantages in forest processing for the long term, thus, the supply of low cost labor to forest product processing enterprises will be guaranteed¹⁶. International demands for forest products will also continue to increase, and thus the major risk to forest product processing enterprises lies in the acquisition of raw materials. However, China will increase supplies of domestically-produced timber and NWFPs, the internal structures and external positioning of such enterprises are being rationalized, and the competitive advantages of the Chinese forest product processing industry will evolve from dependence on scale and low costs to being strongly based on research and development, with strong marketing channels, etc.

(5) The demands for tertiary forest industry services are continuously increasing. With ongoing improvements in the quality of people's lives, the demands for forest tourism and recreation will increase. Forests provide important tourism locations, and will attract significant attention from people seeking holiday and recreation facilities. In this context, forest tourism products will be continuously promoted to meet people's needs for forest ecology and forest culture. Thus, forest tourism will become an important growth pole for the forest economy.

Disadvantages and challenges

(1) The national forest resources are presently insufficient in terms of quantity, poor in quality, and unevenly distributed. Forest management is carried out in an extensive manner with low benefits and poor holistic forest quality. There is an enormous gap to be bridged to achieve sustainable management. According to the Sixth National Inventory on Forest Resources, the average unit forest stock volume per ha in China is only 84.75 m³, that of the plantations is only 46.65 m³, and the tending of middle-aged and young trees, as well as the improvement of poor quality and poor efficiency forests, still requires major improvement.

(2) The ecological environment is changing unpredictably. The changes in the ecological environment e.g. global warming and increased desertification have impacts on the protection, restoration and development of China's forest resources.

(3) Forest-related technology is weak. Investments in forest science and technology (S&T) are insufficient. The capacity for continuous S&T innovation is weak. The forest S&T extension system is unreliable and the disconnection between S&T and production has not been fundamentally and effectively resolved.

(4) Forest product trade faces challenges. In recent years, with the rapid development of China's international forest product trade and the escalation of shares in international markets, a number of international trade disputes have occurred in succession.

¹⁶ As forecast by the China Social Science Academy, the Chinese population will reach a peak in 2030, thus the labor supply is increasing through 2020.

(5) The institutional obstacles restricting forestry production still exist. China has not yet established a macro forestry regulation system, and the support services systems are still adapting to the market-oriented economic system. Reforms in the key forest areas, the state-owned forest enterprises, and the state-owned forest farms are sluggish. The property rights of forest resources need to be more clearly defined.

Long-term economic vitality

(1) Institutional reforms will make forest farmers the most important “builders” of China’s forestry. With the in-depth reform of collective forest property rights in China, farmers will increasingly obtain rights to forest lands and will naturally also acquire more economic benefits when they obtain rights to these lands. By 2020, a large proportion of the rural labor force will be actively engaged in forestry production, and forest farmers will become a very important force in the ecological, economic and cultural development of Chinese forestry.

(2) Economic globalization and the development of free trade systems enhance the strengths and competitiveness of the Chinese forest industry. At present, economic globalization and free trade are accelerating continuously. These favorable factors provide important development opportunities for China to implement the “going global strategy¹⁷” and to enhance the strengths of the forest industry and the competitiveness of forest products.

(3) The government’s public financial policies provide important support and guarantees for forestry development. The government will improve its regulation mechanisms for the forest economy and establish a reliable safeguarding system for forest industry development by continuous forestry reforms and innovations, including improvements to the legal system, policy system, investment system, human resources system and S&T innovation system.

(4) The participation of society as a whole will inject new vitality into forestry development. The boom of the nation’s voluntary tree-planting activities is arousing wider public awareness of ecology and effectively speeding up the development of afforestation and greening, and development of community forests. These initiatives facilitate the building of a beneficial atmosphere to involve the whole of society in forestry.

¹⁷ This means that Chinese enterprises will go abroad to do business.

6. HOW TO BUILD A BETTER FUTURE?

Responses to changing social needs

In over a decade from now, to 2020, after being satisfied with basic subsistence materials and reaching the initial stages of prosperity, people's lives will be continuously ameliorated by widening consumption of goods and services, optimizing the types of goods consumed, meeting the diverse needs for goods, services and culture, and improving the overall standard of living. At the national level, people's consumption is changing from mainly subsistence consumption, to a combination of subsistence consumption, development consumption and recreational/luxury consumption. With people becoming generally more prosperous, most will have an intense desire to see both their living environment improved, and improvement in their quality of life. Society's need for forests will change from simply looking to increase the quantity of forests and forest ecology to seeking improvement with equal focuses on rates of growth and quality.

This means that the forestry sector will have a multi-layered and multi-purpose development task in the coming period. It will be faced with various challenges, e.g. insufficient forest resources, the vulnerable ecological environment, and the huge gap between forest product supply and demand. Such issues must be appropriately solved in order to meet the changing social needs. As a result, the SFA will regard accelerating modern forestry construction as a development theme, regard transforming forestry growth patterns as the main route, and regard establishing the three major forestry systems as the development objectives. The SFA will also exert itself to cultivate forest resources, deepen forestry reforms, advance forestry revitalization through science and education, administer forests in compliance with laws, strengthen forest management, enhance supporting infrastructure, give full play to the three benefits¹⁸ of forests and meet the diverse social needs, so as to make a greater contribution to the development of the Socialist New Countryside and the construction of a harmonious society.

Policy changes inside and outside the forestry sector

Up to 2020, forestry development faces both favorable circumstances and tough challenges, and various uncertainties will have impacts on Chinese forestry development.

The favorable policy factors inside and outside the forestry sector include:

(1) The policy context for forestry development will be more agreeable. In order to solve the issues related to agriculture, rural areas and rural populations, the Chinese government has issued various preferential policies, including the abolishment of agricultural taxes, direct compensation to food-growing farmers, and other similar measures. Farmers directly engaged in agricultural production and food production fully enjoy the government's preferential policies. Compared to food-growing farmers, forest-managing farmers still bear a greater

¹⁸ Economic, ecological and social benefits.

burden of taxation. The Chinese government is expected to start to gradually adjust policies to alleviate forest farmers' burdens and issue pertinent preferential measures to encourage farmers to invest in afforestation and ecological environment improvement.

(2) The global responses and adaptation to climate change have brought new development opportunities for forestry. The response to global climate change has generated historic new missions and new development opportunities for forestry. The initiation and implementation of the Clean Development Mechanism, Kyoto carbon markets, non-Kyoto markets, and related mechanisms will play an active role in driving afforestation, reforestation and forest protection. In 2007, the Chinese government committed to the APEC conference held in Sydney, to build the Asia Pacific Network for Sustainable Forest Management and Rehabilitation. This network will promote forestry development in the Asia-Pacific region and even at the global level, and will also inject new vitality into the already rapid forestry development in China.

(3) Forests policy will affect energy. With the reduction of petroleum-based energy in the world, bio-energy — including biological diesel oil and bio-ethanol — will take up a greater proportion of global and national energy budgets. Bio-energy industrialization will be sped up in China and the marketing level will be improved. Chinese bio-energy development will be on a rational basis. Demands on corresponding bio-energy will rise. Forests as important sources for bio-energy industry will receive greater attention from enterprises and the public. The development of energy forests will be included in the strategic plan for industrial development of national importance, as an important forest type, and energy forest development will help to effectively advance the healthy development of Chinese forestry.

(4) Urban areas have real needs for forest policies. China's urbanization process has gradually accelerated and cities need policies to regulate forestry development in urban areas. Urban forestry policy must meet the objectives of regional development planning. The population in coastal developed regions is greater than in inland regions and per capita land area is much smaller. Hence, urban land use is heavily constrained, so urban forestry policy and industrial development policies need good cooperation. Urban forestry development is particularly poor in the western region, where urban forestry policy must be coordinated with policies designed to protect against land degradation and other environmental protection policies

(5) The CPC and the government attach importance to forestry policy. The CPC central committee and State Council attach great importance to the development of forestry. Some policy documents such as "On speeding up forestry development" and "To promote reform of the system of collective forest right decision" have been released in the new century. They have promoted the development of forestry greatly in China and provided a pointer for all levels of government to make forestry policy. Forestry will affect farmers' incomes more and more, with the collective forest tenure reforms and ecology projects. Rural issues, including forestry, will remain a very high priority for China's government, given that the majority of Chinese still live in rural areas. Forestry policy is also very important to China's recycling development goals, by contributing to the reduction of raw resource consumption, and to

reuse and recycling.

(6) Public participation in making forestry policy: The ways of achieving broad public participation in forestry policy are diversifying and include opportunities to participate in the people's congress and political consultation with NGOs. More and more NGOs are having the opportunity to influence the development of forestry policies and promote policy-making, implementation and provide feedback on the entire process. Participatory community forestry, a system of public hearings, and the government information systems, as well as development of public associations support the development of more effective, fair, feasible and participatory forestry policies.

The unfavorable factors inside and outside the forestry sector include:

(1) Land use: The continuous growth of the Chinese population imposes increasing pressure on food production. China has established a basic cropland protection system to meet the challenges of food production. However, with the continuous acceleration of economic development and urbanization, new land resources are needed. On the precondition that croplands are strictly protected, forest lands will become the main source of construction land and this will cause gigantic pressure on the conservation of existing forest resources and potentially undermine the development space for forestry.

(2) Economic factors and forest product trade: There are numerous fluctuations in the "forestry economy", because humans, land issues, financial issues and similar external issues affect forestry, as well as forestry policy-making and implementation. As a developing country, China's economy has many uncertainties, and the uncertainties cannot be predicted using a simple linear analysis, because of the multiple layers of economic complexity. All this requires forestry policy to make specific analyses to address specific issues and to adjust constantly to change.

The rapid socio-economic development of China is placing new and greater demands on forest product production and trade. For a relatively long period, the timber supply capacity of China's forests has struggled to effectively meet demands; and the gap between supply and demand still exists. Important log supplying countries for China — e.g. the Russian Federation and Indonesia — will further adjust their policies on log exports. The international market will also likely apply stricter environmental criteria on China's forest products. China's forestry development will be heavily impacted by policy changes relating to international forest product trade.

(3) Factors relating to institutional restructuring: China is currently in an economic transitional period. In order to meet the needs of socio-economic development, the State Council's relevant sectors will inevitably be restructured after some time. In all likelihood, the SFA will be restructured and such organizational change will undoubtedly cause a series of policy impacts.

(4) Impacts of natural disasters: Natural disasters occur periodically, including some that may affect, or be mitigated by forestry (including typhoons, earthquakes, landslides, floods, sandstorms, etc). They require the forestry sector to establish capacity, policy support, and mechanisms to deal with forecasting and assessment of — and reconstruction of damage caused by — natural disasters. China has a vast land area, with rich and varied forests producing a wide range of forest products. This implies potential local susceptibility to a wider range of natural disasters requiring a broader range of contingency plans and policies to prevent and mitigate the effects of disasters.

Institutional changes

Reform of the forest ownership system

While continuously accelerating the reform of the collective forest ownership system across the country, China will also gradually deepen other reforms, e.g. the reform of state-owned forest farms, the reform of the key state-owned forest resource management system and forest enterprises, the reform of the classified forest management system, etc. This process of reforms is expected to thoroughly revamp the overall system and eliminate many institutional issues hampering forestry development. China will gradually form new systems, mechanisms, property right systems, management modes, market subjects, incentive mechanisms, executive modes, policy measures and so forth, which can meet the needs of modern forestry development. On the one hand, China will give full play to the market on issues that should be solved by the market, and at the same time fulfill the government's responsibilities and obligations on issues that should be solved by the government. On the other hand, reforms will work to inspire the internal vitality of the entire forestry sector and mobilize forest managers' enthusiasm to strengthen the driving forces for forestry development.

Amendment and improvement of the Forest Law

The existing Forest Law was approved in September 1984, and amended in 1998. The issuance and enforcement of the Forest Law has played an important role in protecting, cultivating and utilizing (moderately) forest resources, accelerating the greening of the national territory, advancing ecological improvement, safeguarding national eco-security, promoting harmony between humans and nature, etc.

Since the implementation of the development strategy focusing on the ecological improvement in 2003, China's forestry has undergone a significant and historic transition. Consequently, some regulations in the Forest Law can no longer meet the needs of development and thus amendment and improvement are needed.

Development of sectoral regulations

Considering the reality of forestry development and according to the authorization stipulations of laws and rules, within the authority scope, the Chinese forestry sector will

formulate a number of sectoral regulations, e.g. the Regulations on Supervision of Forest Tree Seedling Quality, the Regulations on Safari Park Management, the Regulations on Supervision and Management of Timber Transportation and so forth. Meanwhile, based on the implementation requirements of the Administrative Permission Law, sector regulations that control the permitted conduct by the SFA are under intense scrutiny and any sectoral regulations and regulatory documents that violate the overarching regulations of the Administrative Permission Law will be abolished, so as to actively promote sustainable forest management and legitimate forestry production.

Improvement of related forestry policies

After the reform of the forestry ownership system, there will be significant changes in the Chinese forest property rights structure. To adapt to such changes, protect the legal rights of various property right holders, and mobilize their initiatives in afforestation and forest management, corresponding changes will be required in forestry investment and financing policies, taxation policies, resource management policies, property right transfer policies, policies of ecological forests, and so forth.

Regional and global collaboration

China will continue to responsibly execute its commitments under forest- and forestry-related international conventions and processes

As a responsible major international power, China will continue to responsibly execute the obligations and requirements for forest protection and forestry development identified by the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Ramsar Convention and so forth, and actively participate in — and promote — the international forestry process.

China will actively participate in the development of related international forestry rules

China will further enhance research and studies on international forest-related rules, actively participate in important international activities related to forestry, take part in the development of various international rules, improve the Chinese forestry criteria and indicators system, further strengthen the studies on WTO rules to meet the challenges of the international markets, and attach importance to the development, improvement and implementation of international forest product technological criteria, so as to advance the sustainable development of modern forestry.

China will make full use of “the two resources” and “the two markets”¹⁹

China will actively implement the “going global” strategy, and make full use of the “two resources” and the “two markets”, then develop domestic and overseas markets, and promote the extroverted enterprises and actively join in international competition. The priorities include (i) strengthening Sino-Russian cooperation in forest resource development, actively investigating effective approaches and specific ways to cooperate with Africa, Southeast Asia, South America, etc. in developing forest resources, and obtaining long-term resource security through external investment to relieve the conflicts between timber supply and demand in China; (ii) combining with external investment and implementing the policies on labor exports for exploring selected countries’ forest resources to integrate foreign country forestry development projects; and (iii) planned investment including installing mature technologies and specialized equipment from China in the forestry processing industries of other developing countries.

China will realize the transition of executive functions

The globalization of environmental issues and the development of free trade will certainly lead to the internationalization of forestry, which will bring huge impacts on China’s forestry administration systems and policy systems. Therefore, China needs to further open the forestry sector up to the outside world and improve the systemization, legislation, standardization and programming of the forestry administration, to ensure the government forestry agency provides better services and support in the new era of forestry internationalization.

International cooperation and exchange of forest science and technology and professionals

China’s modern forestry development and the fully implemented Six Key Forestry Programs; on the protection of natural forests, the conversion of croplands to forests and so forth have aroused the wide attention of the international community. Meanwhile many countries, including China, also need to further strengthen international scientific cooperation and exchange. The Chinese forestry sector will make full use of multilateral and bilateral mechanisms to develop wide and in-depth international scientific cooperation in forestry in fields including forest cultivation, processing and utilization, ecological protection, etc, to improve forestry scientific development and advance sustainable forestry development in China.

Forest science and technology advancement

China’s key science strategies are encapsulated as “revitalizing forestry by science and education” and “thriving forestry by talents”. The essence of these strategies is outlined in the

¹⁹ The “two resources” mean domestic and overseas forest resources. The “two markets” mean domestic and overseas forest product markets.

Resolution on Accelerating Forest Development by the CPC Central Committee and the State Council; the Outline of National Plan for Medium to Long-term Scientific and Technological Development 2006-2020; the Eleventh Five-Year Forest Plan; the National Plan for Long- and Medium-Term Forestry Development; and the general requirements of the Plan for Long- and Medium-Term Forest Science and Technology Development 2006-2020. Science and technology advancements and innovations should be the principal driving forces for the development of the forest ecological system and the forestry industrial system. These should enable China to take a path marked by independent innovations for the development of China's forestry, establish a national forest science and technology innovation system, upgrade the holistic forest science and technology level in all aspects, support the rapid and sound development of forestry, and accelerate forestry modernization.

Major developmental objectives

By 2020, a national forest science and technology innovation system — with a rationalized structure, mature functions, efficient performance, and strong support — will be established. The principal research fields will be those that aim to give China leading status in the world in ecological and industrial advancement, and the contribution rate of science and technology advancements to forestry's economic advancement will be increased to over 50%. The research and development level of industrial technology will be improved, and the per unit yield of industrial timber forests will be increased by 30%. The research and development of sophisticated technologies to promote increases in forest biomass will see breakthroughs, and the bio-technology production value will be increased by 20%. The utilization rate of timber will reach over 80%.

Priority fields to be developed

- Bio-technology and quality seed cultivation
- Research on the relationship between forests and the environment
- Construction of ecological systems and rehabilitation of degraded eco-systems
- Prevention and control of forest disasters
- Directed cultivation and sustainable management for forest
- Efficient utilization of forest bio-based materials and resources
- Forest eco-energy
- Information technology and digital forestry
- Equipment and technology for modern forestry
- Macro strategies and forestry policies

Six forest S&T programs to be implemented

- S&T Program for Ecological Improvement and Eco-Security
- S&T Program for Forest Bio-Technology and Quality Seeds Cultivation
- S&T Program for Protection and Utilization of Forest Biological Germplasm Resources
- S&T Program for Industrial Development of Forest Biomass

- S&T Program for Digital Forestry Development
- S&T Program for Forestry Innovation Capacity Building

Working priorities and strategies

Firstly, ecological improvement mainly through afforestation and greening should be reinforced and the ecological situation of the national territory should be ameliorated. Voluntary tree planting initiatives will be substantially developed. The Six Key Forestry Programs on (i) natural forest protection, (ii) conversion of croplands to forests, (iii) desertification control for areas in the vicinity of Beijing and Tianjin, (iv) shelterbelt development in the “Three Norths” and the Yangtze River Basin etc., (v) combating and controlling desertification, control of soil and water erosion, and (vi) base development of fast-growing and high-yield forests and coastal shelterbelt development will be continuously implemented. The afforestation scale of such programs will be moderately enlarged.

Secondly, forest management and protection should be strengthened and forest quality should be improved. The national key ecological forest management program and plan will be initiated and implemented and the forest management scale will be enlarged. The cultivation of valuable tree species will be accelerated and a national program on valuable species cultivation will be initiated and implemented. Forest land productivity and resource utilization should be improved. Prevention and control of forest fires, forest pests and illegal appropriation of forest lands will be reinforced. Forest health will be promoted. The area of forest lands area must remain above 310 million hectares.

Thirdly, nature protection should be enhanced and biological diversity should be strictly conserved. The Wildlife Conservation and Nature Reserves Development Program will be continuously implemented. The implementation plan of the wetland protection program will be fully executed and the protection, restoration and sustainable utilization of wetlands will be reinforced.

Fourthly, forestry industrialization should be developed and an ecological culture should be promoted. Industries that are dependent on forests, e.g. bamboo and wood processing, economic forests and forest food, forest medicinal materials, forest and wetland recreation etc., will be developed. Green homesteads and forest cities will be promoted. Urban and rural integration will be advanced. Society’s needs for ecological products will be met. The goals of advanced production, prosperity, and a sound ecological environment will be achieved. Ecological education for civil society will be developed widely. An ecological culture will be promoted, with emphasis on forest culture, flower culture, bamboo culture, tea culture, wetland culture, wildlife culture, eco-tourism culture and green consumption culture.

Fifthly, a support system for forestry development will be established to provide effective support for forestry development in terms of human resources, funding, institutional support, legal systems, science and technology support and so forth. The government must enforce more financial and monetary policies especially state subsidies, forestry insurance and loan

policies.

7. SUMMARY AND CONCLUSIONS

Main conclusions

The strategy for sustainable forestry development

The strategy for sustainable forestry development is being led by the scientific development concept; to build a path to sustainable forestry development focusing on ecological improvement; to establish a national territory eco-security system that gives priority to forest vegetation and integrating forests and grasslands; to construct an ecologically educated community living in a sound ecological environment; and to effectively protect, cultivate and reasonably utilize forest resources, so as to serve the development of a resource-conserving and environmentally friendly society and to contribute to the development of new socialistic rural areas; the building of a prosperous society in a holistic manner; and the realization of a harmonious relationship between humans and nature.

China's forestry blueprint to 2020

The blueprint of basic forestry development by 2020 will be as follows: Gross forest resources are gradually increased and the quality of the forest ecological environment is improved; forestry's status as a pillar of national development is enhanced; the forest management system is reliable; forestry investment mechanisms are improved; forests' ecological, economic and social benefits are fully promoted, and the diverse and high-class needs of the public are met; forestry industrialization is upgraded, the timber yield rises, conflicts between supply and demand are relieved, timber supply security is guaranteed, the variety of forest products processing industries is broadened and the scale is upgraded; and forest tourism and forest services are normalized, with incomes from forest tourism, particularly, becoming an important economic growth point in the forestry sector.

Major development indicators

The major development indicators include: A newly afforested area of 29.6 million ha, forest coverage reaching 23.46% of national land area; an area of nature reserves distributed throughout China totaling 161.2 million ha and accounting for 16.8% of the total land area of the state; the total number of nature reserves of various types — e.g. forests and wildlife — reaching 2,300, providing a high level of protection to 95% of wildlife species of national protection importance and all typical bio-systems; the number of wetland reserves across the country reaching more than 600, including around 80 wetlands of international importance, and the effective protection of over 60% of all natural wetlands; an area of desertification control of 20 million ha; urban tree coverage in 70% of Chinese cities reaching 35%; the rate of quality seeds planted in plantations reaching 65% of total plantings, the unit stock volume per hectare of existing timber plantations reaching approximately 100 m³, and the contribution rate of science and technology advancements to forest economic growth reaching 50%.

The main policy measures to realize the development indicators for Chinese forestry by 2020

The main policy measures to realize the development indicators for Chinese forestry by 2020 include:

- Implementation of the forestry development strategy focusing on ecological improvement, advancing the key forestry programs, promoting harmony between humans and nature, and building an ecologically educated and aware society
- To speed up modern forestry development, actively maximize forests' ecological, economic and social benefits, promote the development of an improved forest ecology system, implement an advanced forest industry system and an ecological culture system
- To continuously strengthen forestry reforms, advance the reform of collective forest property rights, the reform of state-owned forest enterprises, and the reform of state-owned forest farms; gradually form a new system and mechanisms, new property right systems, and policy measures to meet the needs of modern forestry development
- To readjust forestry policies step-by-step, relieve forest farmers' burdens (such as taxation inequities), issue pertinent preferential measures and encourage farmers to invest in afforestation
- To actively promote the CDM and gradually establish and improve a Chinese forest carbon trade market; to include the development of energy forests into the strategic plan for forest industries of national importance and accelerate the development of forest bio-energy
- To protect the legitimate rights of various property right holders and actively advance the continuous improvement of forestry investment and financing policies, taxation policies, resource management policies, property right transfer policies, policies on ecological forests and so forth

Follow-up actions

According to the general goal of developing an ecologically friendly and ecologically educated civilization put forward by the 17th National Congress of CPC, and the requirements of the Eleventh Five-Year Forest Plan and the National Plan for Long- and Medium- Term Forestry Development issued by the SFA, the following follow-up actions will be taken:

- Greater efforts to implement the Natural Forest Protection Program, carrying out strict management on natural forest harvests, effectively protecting the 94.18 million ha of natural forests within the program areas, and afforesting areas in the upper reaches of the Yangtze River and in the upper and middle reaches of the Yellow River, covering an area of 5.79 million ha
- Sound implementation of the Program for Conversion of Croplands to Forests and Grass mainly in areas stricken by soil and water erosion in the Yangtze River Basin and the Yellow River Basin, and areas stricken by sandification. Practical

implementation of related compensation policies for farmers whose croplands are converted to forest or grasslands, encouraging the development of follow-up industries with good market potential, thereby combining agricultural restructuring with industrial development suited to local characteristics and resolving the long-term subsistence issues for the farmers whose croplands are converted

- Sound implementation of the Sand Control Program for Areas in the perimeters of Beijing and Tianjin, and protect and increase forest and grass vegetation through integrated approaches, e.g. designating reserved areas for enclosure, planting trees and grass, managing small watersheds, restricting grazing and adopting enclosed feeding, migrating for ecological reasons²⁰ and rationalizing utilization of water resources, protecting the 6 million ha of sand-affected lands and effectively controlling sand damage in the capital and other major stricken areas
- Continuously accelerate various afforestation and protection programs including the Shelterbelt Development Program in the “Three Norths” and the Yangtze River Reaches, the afforestation program in Taihang Mountain Areas and surrounding plain areas, and the program on coastal shelterbelt systems, advancing the construction of green spaces in the “Three Gorges” Area, establishing various shelterbelt systems and protecting them in line with local conditions, and intensively controlling various potential ecological disasters in these areas
- Effectively protecting and restoring wetlands, establishing 222 wetland reserves and rehabilitating important wetlands by rational allocation and management of water resources
- Protect and improve the natural ecological environment in Sanjiangyuan region of Qinghai Province, and effectively restore the ecological environment in this area by conversion of cropland to forest, mountain enclosure for forest cultivation, desertification control, Blackland control²¹, rodent damage control, and so forth
- Provide greater attention to the Wildlife Conservation and Nature Reserves Development Program, intensively rehabilitate endangered rare species, restore typical eco-systems, extend the area of nature protection, improve the protection framework and practically protect China’s wildlife resources, wetland resources and biological diversity
- Advance the integrated control of desertified areas and enhance the practical control of desertification by vegetation protection, conversion of cropland to forest, establishing mountain enclosures for forest and grass cultivation, and other measures
- Accelerate forest industry development focusing on fast-growing and high-yielding timber forests, promoting intensive forestry in suitable areas with necessary growing conditions, accelerating the development of various types of timber forests and other commercial forest bases, improving the effective supply of forest products including timber, and alleviating environmental pressures through ecological improvement

²⁰ This means relocating people in ecologically sensitive places to new areas.

²¹ This means controlling degradation of areas with black soil.

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