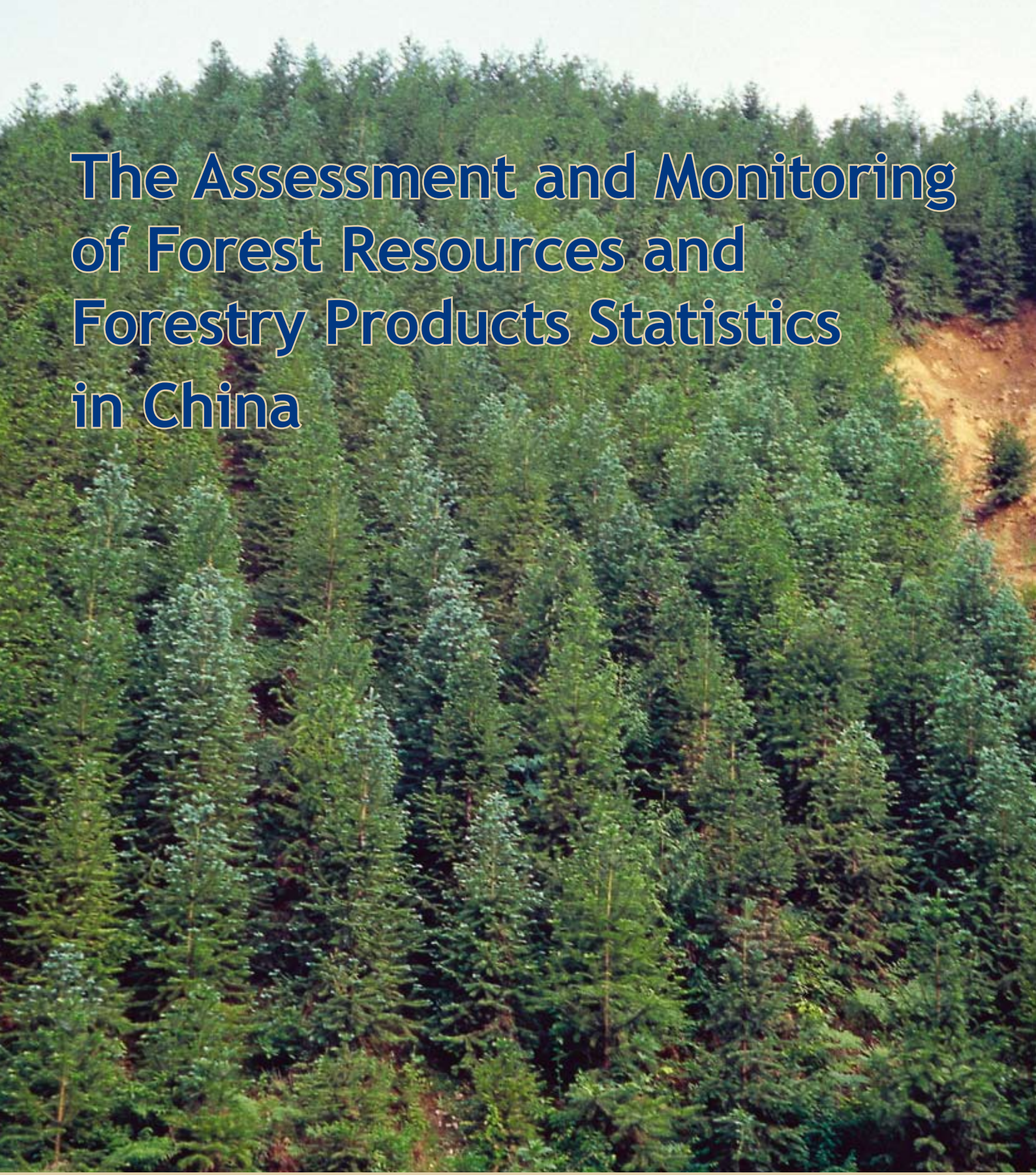

The Assessment and Monitoring of Forest Resources and Forestry Products Statistics in China

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Contents

Abbreviations

CIFOR	**Center for International Forestry Research**
FAO	**Food and Agriculture Organization of the United Nations**
GIS	**Geographical information system**
GPS	**Global positioning system**
IUCN	**The World Conservation Union**
IUFRO	**International Union of Forestry Research Organizations**
MoF	**Ministry of Forestry**
NFI	**National forestry inventory**
NWFPs	**Non-wood forest products**
PSPs	**Permanent sample plots**
SFA	**State Forestry Administration**
SID	**Statistical Information Division (tongj xinxichu in Chinese) of SFA**
SSB	**State Statistical Bureau**
TSPs	**Temporary sample plots**

1. Introduction

Reliable and timely information on the state of forest resources, including forest area and forest area change, growing stock, biodiversity, wood and non-wood products, the use of forests for recreation and for environment services and the contribution of forests to the national economy, is essential for policy formulation and development, as well as for program planning (FAO 2005, Sayer *et al*. 1997). The need for reliable data presents a great challenge, as traditional methods of gathering forestry statistics have often failed to provide accurate information. For example, in developing countries inventories provide reliable data for only 14% of the forest area covered by the inventories (Persson and Janze 1995). In the past, forestry statistics have typically concentrated on forest products and on the economic value of forests (Wardle 1995).

China's forestry statistics face the same challenge. Its statistical system was based on the Soviet model in the 1950s, which was developed to serve a centrally planned economy. China benefited little from the cumulative experiences of other countries up to the early 1980s because of its lengthy isolation. Since its reforms and the adoption of an open-door policy, China has made efforts to gather new types of forestry information and to improve its system of collecting forestry statistics, including the development of a national forest inventory scheme, in a bid to promote standardised and compatible collection and reporting of forest information. It has interacted with international organizations, receiving technical assistance from the Food and Agriculture Organization (FAO) and others (MoF 1992), and has been involved in the global forest resources assessment, providing information to the FAO. The State Forestry Administration (SFA) has also sent its staff to attend international conferences and training workshops to improve its collection of forestry statistics. Despite these achievements, more needs to be done to develop a nationwide forestry statistics system that meets the need for reliable data and for an expanded scope of forestry information in our ever-changing world. This includes sharing information on China's forest resources with the international community.

This paper reviews China's forestry statistical system, including the institutional arrangements, the scope of information, the standards and methods for information collection, and the dissemination of information. This paper identifies areas that need to be improved and briefly discusses future directions for a forestry statistical system that will effectively serve national and international information needs.

Two important dimensions of forestry statistics are the assessment and monitoring of forest resources and the analysis of forestry products. Forest resources assessment and monitoring is largely about gathering information on forest area and on forest stock and volume, while forestry products statistics include information on wood and non-wood products that are harvested, as well as processed products such as rosin, processed shellac and vegetable tannin extract.

2. Forest Resources Assessment and Monitoring

China has developed an integrated assessment and monitoring system to assess forest resources and monitor changes. The system includes three components:

- a forest inventory and assessment,
- an annual plantation establishment review, and
- an annual wood consumption survey.

Forest inventory and assessment are conducted on three levels to meet different information needs:

- a national forest inventory (NFI) (*senlin-ziyaun-qingcha*, *lianxu-qingcha*, or *yilei-diaocha*)
- an inventory for forest management planning and design (*guihua-sheji-diaocha* or *erlei-diaocha*)
- an inventory for forest operational planning (*zuoye-sheji-diaocha* or *sanlei-diaocha*)

This section addresses each type of forest inventory, with a focus on the national forest inventory, the annual wood consumption survey, the annual plantation establishment review, and the institutional setup for forest resources assessment and monitoring.

National Forest Inventory

The national forest inventory (NFI), the core of China's forest resources monitoring system, is conducted to generate information for policy formulation and strategic planning purposes at both national and provincial levels.

Historical Review

China's NFI has evolved in recent decades in terms of the techniques and methods used and in terms of its institutional development. Before 1972, there was no forest inventory at the national level in China. The first national inventory was conducted between 1973 and 1976, in response to the national need for forest resources data. Six NFIs have now been completed and one is in progress. Innovations and improvements were introduced in each successive NFI.

- The first NFI, 1973-1976
- The second NFI, 1977-1981
- The third NFI, 1984-1988
- The fourth NFI, 1989-1993
- The fifth NFI, 1994-1998
- The sixth NFI, 1999-2003
- The seventh NFI, in progress

During the first NFI, most provinces used a random sampling method, while a few provinces adopted a subcompartment survey. Counties and state forest enterprises were the basic sampling units. Data of all counties and state forest enterprises were aggregated to generate provincial statistics that were subsequently aggregated to generate national statistics. This inventory provided the first set of national forest resources statistics. However, there was inconsistency in the inventory methods and technical standards used across the country. Using temporary sample plots (TSPs) for data gathering made it difficult to compare subsequent data sets and monitor change in forest resources over time. This was particularly the case in efforts to assess the growth and consumption of forest resources (MoF 1986, Yuan 1996).

A continuing national forest inventory scheme was established during the second NFI and is still in use today. A network of permanent sample plots measured at five-year intervals was put in place. Most provinces used the new scheme from the beginning. Heilongjiang, Shandong and Sichuan had a transition period during which both temporary sample plots and permanent sample plots coexisted. Consequently, this inventory was undertaken on 160,000 sample plots, of which over 140,000 (nearly 90%) were permanent sample plots (PSPs). Under this inventory scheme, a province is usually the basic sampling unit, although a province with uneven forest distribution can be further divided into several subunits. Provincial data are aggregated to generate national statistics. Shanghai and Tibet were not included in the inventory scheme. Assessment of forest resources in Tibet was carried out through satellite imagery during the second and the third NFIs (Tibet did not become an integral part of the NFI scheme until the fourth NFI). Adoption of this new inventory scheme ensured the use of inventory methods and technical standards that were consistent across the country and comparable over time (MoF 1986, 1987, 1989; Yuan 1996).

During the third NFI, the Ministry of Forestry (MoF, or the State Forestry Administration since 1997) used the *Technical Standards for Forest Resources Inventory* enacted in 1982 to ensure the consistency and homogeneity of inventory methods and techniques. The number of sample plots was expanded to 255,000 of which 204,500 (about 80%) were PSPs. The increase in sample plots resulted largely from the attempt of some provinces to generate forest data adequate for forest management planning at the county level. Also, computers were first introduced to forest inventory in 1984, which significantly improved the efficiency of data processing and analysis. Consequently, the MoF was able to release data from the NFI in July 1989, only half a year after the end of field data collection (MoF 1989, Yuan 1996).

Several innovations were introduced during the fourth NFI. This NFI covered an increase in land area. Previously, the network of sample plots mainly covered existing forests, but now it was expanded to those areas formerly poor in forest resources but with new plantations, especially in the plains. This NFI used remote sensing sample plots (measured from aerial and satellite imagery) to complement ground sample plots. A total of 106,300 remote sensing sample plots was used, making up more than 30% of total sample plots (333,500). The fourth NFI gave increased attention to inventory quality by requiring stricter compliance with the *Technical Standards for Forest Resources Inventory* and by appointing inspectors to evaluate the quality of the work of the inventory teams. In this inventory, computer technology was improved and used more widely, which permitted the inventory results to become available immediately after the end of fieldwork. The NFI also conducted a field survey of 717 sample plots in Tibet. Tibet's forest resources were assessed through ground sample plots, in addition to airborne and satellite remote sensing (MoF 1989, 1991, 1994; Tibet

Forestry Bureau and Central-South Institute of Forestry Inventory 1993; Yuan 1996).

Further changes were made during the fifth NFI. The *Technical Standards for Forest Resources Inventory* was revised in 1994. This included revised definitions of natural forests, plantation forests, open woodland (or sparsely stocked stand) and other forest land types. A natural forest was redefined as land with a canopy cover of 20% or more, rather than 30% as defined previously, which affected the extent of China's forest area. Also, the NFI was implemented for all provinces at regular intervals, that is, it was to be conducted in approximately one-fifth of provinces in each of five consecutive years. All provinces inventoried in the first year of this inventory would be inventoried in year one of subsequent NFIs. The same rule was applied for provinces inventoried in years two, three, four, and five. Moreover, advanced techniques such as GIS and the global positioning system (GPS) were more widely used during this NFI. The number of sample plots was lowered to reduce workload, while data needs were met and quality standards were ensured. This NFI was conducted on 274,706 sample plots, of which 184,479 were ground sample plots (181,332 were PSPs) and 90,227 were remote sensing plots (MoF 1999-2000).

The sixth NFI increased its fieldwork in Tibet, with inventory conducted on 2,154 ground sample plots, compared with 717 plots during the fourth NFI (MoF 2002). Also, for the first time, the NFI collected information on mangrove forests as a separate type of forest (previously mangrove forests were included in other forest types) and on forests of farmer households that were included as collective forests in the previous NFIs.

Information Generated by China's NFI

Each of the six NFIs generated a data set. Each data set provided information on land use, area and volume of forest, growth and consumption of volume, and so on. The data can be reclassified to be consistent with categories defined for other systems, such as the Global Forest Resources Assessment organised by FAO (2005). These data sets, excluding the set from the first NFI, are comparable, since they were generated through the same forest inventory scheme.

Data was organised for provincial and country levels, and also summarised for large watershed areas, such as the Yangtze River Watershed, and key forest areas, such as northeast China and southwest China. The information is presented as text, tables and maps, usually including the following categories:

- Forest land by type. Forest land is classified into six categories: forest, open woodland, shrub, young plantation, nursery and non-forested land (see Appendix A, Figure 1).
- Forest by type. Forest is further classified into forest stand, economic forest (NWFPs) and bamboo forest (see Appendix A, Figure 1, Figure 2, and Figure 4).
- Growing stock (standing tree volume). Growing stock includes the volume of forests, open woodlands, scattered trees and trees outside forests such as "four-side" plantings. Since the volume is not measured for economic forests and bamboo forests, the figures given for forest volume are the same as that given for forest stands (see Appendix A, Figure 1, Figure 3, and Figure 4).
- Area and growing stock of forest by type (see Appendix A, Figure 1).
- Area and growing stock of forest by ownership. Forest area data is organised as state-owned and collective respectively; forest volume data is organised as state-owned, collective and private (see Appendix A, Figure 5).
- Area and growing stock of natural forest (see Appendix A, Figure 1).
- Area and growing stock of plantation forest (see Appendix A, Figure 1).
- Area of economic forest (NWFPs) by type.
- Area of bamboo forest (Appendix A, Figure 1) and the number of bamboo individuals.
- Area and growing stock of timber forest by dominant species.
- Growing stock of nearly mature, mature and overmature timber forest by species
- Area and growing stock of nearly mature, mature and overmature timber forest by accessibility.
- Area and growing stock of young and middle-aged timber forest.

Quality Control of National Forest Inventories

China has taken a number of measures to ensure the quality of resource statistics generated through NFIs. A quality control system has been in place, comprising the *Technical Standards for Forest Resource Inventory* and quality control reviews. As noted earlier, these technical standards were enacted in 1982 and revised in 1994, in response to lessons learnt from the second, third and fourth NFIs. Inventory teams must comply with these *Technical Standards* and these standards are also the basis on which forest inventory quality is reviewed and assessed.

Each of the four inventory institutes directly affiliated with the State Forestry Administration set up a quality control division, called a 'special inspection team', to review the quality of forest inventory work by its own inventory teams and by provincial inventory institutes. Similarly, provincial forest inventory institutes set up a quality control team to review the quality of NFI work conducted by their inventory teams and others. The quality control teams assess the quality of fieldwork and in-house data processing. Quality control has been implemented through re-assessment of 1% of ground sample plots, and there have been cases where fieldwork had to be repeated when the quality control team found quality standards were not met (MoF 1989).

Trees outside forests are particularly important in areas where few natural forests exist. Many trees have been planted on farm boundaries, around villages, and along roads and waterways. All of these are called "four-side" plantings (Wang 1996). China's NFIs collected information on these "four-side" plantings and on scattered trees on other non-forest land (land with a canopy cover of less than 10%) and included them in the statistics of growing stock (Appendix A, Figure 1).

Potential Improvement of NFIs

China's NFI scheme was developed to collect information on the forest area and on growing stock, so it is not able to meet the information needs for the wide range of forest functions that are outlined in the *International Guidelines for Forest Monitoring* (IUFRO 1994) or in the FAO's *Global Forest Resources Assessment* (2005). With respect to the global forest resources assessment, China's NFIs were able to provide only partial information on the value of wood removal and they had no information on the value of non-wood forest product removal or on the diversity of tree species. *IUCN Red List and Plant Encyclopaedia of China* were used as sources for listing the diversity of tree species. Similarly, the figure for biomass stock includes only woody biomass, biomass of economic forests (NWFPs) and biomass of bamboo forests, rather than all living biomass (FAO 2005).

In one NFI, the forest inventory is conducted in about one-fifth of the provinces each year. Consequently, national data, generated by aggregating provincial data, are on forest resources of all provinces in different years. When published, the data is already five years old for those provinces inventoried in the first year of the NFI. Hence the NFI scheme is unable to provide up-to-date information.

Advanced technologies, such as remote sensing, GIS and GPS, were introduced to NFIs in the 1980s or 1990s and have been increasingly used. However, the use of these technologies could be extended further.

Inventory for Forest Management Planning and Design

The inventory for forest management planning and design generates information for counties and state-owned forest (logging) enterprises, including the information used to determine logging quotas. It is also designed to monitor forest resources over time at the county or forest enterprise level. This is because the NFI is only for policy formulation and strategic planning purposes at the national and provincial levels and does not meet the needs for monitoring forest change at county and forest enterprise levels.

By regulation, this type of forest inventory is conducted at 10-year intervals, using subcompartment investigations and surveys as the primary methods of analysis. It begins with the division of subcompartments and compartments, with the maximum area of a subcompartment being 15 hectares in south China and 25 hectares in other parts of China. Tree measurement is conducted on one to three sample plots for each forest subcompartment. Subcompartment data are used to generate data for compartments that in turn are aggregated to generate data for an operational unit (*linchang*) of a forest enterprise or a township, and then further aggregated to generate data for a forest enterprise or a county.

Topographical maps and aerial imagery are used for subcompartment division. Since the late 1980s, satellite images and the geographical positioning system have been used increasingly to locate sample plots and subcompartment boundary lines. Tree measurements are made using ground sample plots, satellite imagery or remote sensing, as well as ocular measurements and aerial photo interpretation, but the measurement of ground sample plots is the most common method. Information is collected on 15 parameters or indicators of forest stand, including origin, species composition, dominant tree species, mean age, mean tree height, mean diameter, canopy cover, tree number per hectare and volume (Beijing Forestry University 1986).

The quality control system for this type of forest inventory has three important elements:

- There are technical standards for this type of inventory and strict compliance with the

technical standards is required, including a requirement for qualified inventory teams.
- Quality control team(s) review and check about 3% of the fieldwork of inventory teams and the data processing to see whether the quality of work meets the technical standards.
- A random sample inventory is conducted parallel to the subcompartment survey. Data sets from both the subcompartment survey and the sample survey are compared to assess the quality of the subcompartment survey. If the difference between the two data sets is within the allowed range, the quality of the subcompartment survey is considered to be satisfactory. Otherwise, the inventory team must re-conduct their fieldwork (MoF 1986, 1987).

Inventory for Forest Operational Planning

A forest operational planning inventory assesses forest resources to meet the information needs specific to operational planning, such as technical plans and designs for logging, forest-tending designs, and forest-improvement designs. Operational plans for logging need information on the area and volume of a compartment, or a larger area of forest, for decisions regarding the volume to be harvested and the harvesting methods to be used (i.e., clear-cutting or selection cutting).

Annual Plantation Establishment Review

In 1988, China initiated an annual plantation establishment review—a monitoring program that complements the NFI—to meet the information needs for forest resource growth realised through plantation establishment. The review is also intended to help improve the performances of tree crops established in areas which have always or for a very long period been unforested (afforestation) and those tree crops established on forest land (artificial regeneration or reforestation). Specific goals of the review are to
- collect reliable data on the area of plantation establishment,
- review planting quality, and
- review tending and management activities of young plantations and collect data on plantation forests.

Review activities take place annually. Since 1992, inventory institutes in each province have reviewed plantations in the same year when the trees were planted; the four SFA inventory institutes have double-checked the assessments the following year.

Each year, about 2% of the reported planting areas in China have been reviewed. The county is the basic unit of review and the number of sample counties ranged from 247 to 326 in the 1990s, representing over 10% of total counties of the country. Sample counties were stratified based on their topography (mountain area, hilly area or plains).

Two indicators have been used to review plantation establishment performance. One is the actual area planted versus the reported area. Called *mianji-heshilu* in Chinese, this indicator is intended to generate reliable data on the area of planting. Achievement in plantation establishment has been used to assess the performance of local government chiefs, so there is an incentive for overestimating the tree-planting area in reports. Hence, the area planted is verified to address this problem.

The other indicator is area with a given survival rate of trees in the second year and the fourth year, respectively, which provides estimates of the potential for resource growth. If the seedling survival rate in a subcompartment is over 85% in the year after planting, and over 80% in the fourth year, then plantation establishment is considered successful. Lower survival rates are acceptable in six provinces in northwest China, because of the cold and dry climate. Area with an 85% survival rate of seedlings in the second year was designed to assess the quality of tree planting, while area with an 80% survival rate in the fourth year aimed to assess tending and management activities of trees after planting. The area with an 80% survival rate in the fourth year also indicates whether or not young plantations have been established, so these data are very useful for updating national forest resource statistics on an annual basis, as the NFI collects resource data at five-year intervals.

The plantation establishment reviews from 1988 to 1997 show that the review has been effective in (i) improving the reliability of planting area statistics, (ii) encouraging government chiefs at different levels to attend to plantation development, and (iii) improving both the planting quality and the tending and management of plantations (Li and Ke 1997).

Annual Wood Consumption Survey

In response to the decreasing volume of timber forest available for harvesting in the early 1980s, China tightened controls over the use of forest resources and accelerated forest resource growth by establishing plantations. The principle that the annual logging volume must be less than the annual growth volume of forests was incorporated in the *Forest*

Law of China (1984). A logging quota policy was formulated and implemented to control excessive logging. Reliable and timely data on wood consumption became essential to assess whether the policy was being rigorously implemented and to determine its effect on forest resources. A wood consumption survey was started in 1986 to collect data annually on volume and types of wood used. This survey is being adapted to survey compliance with the annual logging quotas allocated to the provinces, especially since the launch of the logging ban policy called the "natural forest protection program" (SFA 2003).

In each province (except Tibet) 10% to 15% of counties are sampled after stratification. This sampling is based on the annual logging quota which is in turn determined by the quantity of wood consumption, the economic circumstances, and the access to vehicle transport. A general survey is first conducted to identify consumption types and their characteristics, then surveys are conducted on fuelwood use and on-farm use of timber at county, township, administrative village, hamlet and household levels. Surveys on commercial timber, wood for fungi cultivation, fuelwood consumption by urban households, factories and sideline production enterprises, and losses for disasters are undertaken at the county level only. In 1997, there were 337 counties and logging enterprises sampled, involving 2,896 villages and 35,780 rural and urban households (MoF 1997).

County data on consumption volume are aggregated to generate provincial data that are further aggregated to generate national statistics. *Technical Regulations on the Survey on Forest Resources Consumption* was enacted in 1986 to control the quality of annual surveys and to ensure data reliability. The *Technical Regulations* was revised in 1991.

Data has been collected in the following categories since 1991:

- commercial timber: timber that circulates through market channels (including timber purchased by state timber trading enterprises from state logging enterprises and farmer households), timber exported to other provinces, timber traded within the province, and timber used by enterprises and other institutions;
- timber used on-farm;
- wood for fungi cultivation;
- fuelwood used by farmer households, urban households, and factories and sideline production enterprises;
- losses caused by forest fires, forest pests and diseases, and other disasters;
- other uses; and
- bamboo use.

Wood consumption surveys show that at the national level, the combined commercial timber and the timber and fuelwood used by farmer households are well above 85% of the total consumption volume, so any policies to reduce wood use must focus on these three areas. Fuelwood represents a very high proportion of wood use (about 25% on average, up to 80% in some remote, mountainous areas), so measures for reducing wood use, such as the adoption of fuelwood-efficient cooking stoves and fireplaces and the use of other alternative energies (biogas, coal and electricity) should be introduced. The surveys also show wood consumption decreased significantly from 1988 to 1991, but since then levels have remained relatively constant.

Wood consumption surveys provide data on wood use annually, compared with once every five years by the NFI. For forest resources monitoring, the wood consumption survey complements the NFI and helps to formulate effective policies. Trends in wood use can also be a useful indicator to measure the effectiveness of strategies for combating fuelwood overuse as a threat to conservation targets.

Institutional Arrangements for Forest Resources Assessment and Monitoring

The Department for Forest Resources Management within the State Forestry Administration (formerly the Ministry of Forestry) administers the national forest resources assessment and monitoring. The department's responsibilities include:

- formulating technical standards and other regulations for forest resources assessment and monitoring and deciding inventory methods;
- arranging annual and mid-term assessment and monitoring plans and allocating funds to the inventory institutes affiliated to it and the provincial forestry administrations;
- supervising the implementation of the NFI, the annual wood consumption survey, and the annual plantation establishment review, including quality control; and
- releasing forest resources information.

A network of forest inventory institutes has been in place to conduct forest resources assessment and monitoring, requiring considerable financial resources and staff time. At the end of the 1980s, the network consisted of more than 40 forest inventory and design institutes in China that had about 9,600

employees, and the number has remained stable since then (MoF 1988; MoF 1990). Four of the institutes are affiliated to the Department for Forest Resources Management to conduct the NFI, the annual wood consumption survey and the annual plantation establishment review, in addition to serving as regional monitoring centers. They are:

- **SFA Institute of Forest Inventory** based in Beijing, responsible for seven provinces in northeast and north China
- **Northwest Institute of Forest Inventory** based in Xi'an, Shaanxi province, responsible for eight provinces in west China
- **East China Institute of Forest Inventory** based in Jinhua city, Zhejiang province, responsible for eight provinces in east and central China
- **Central-South Institute of Forest Inventory** based in Changsha, Hunan province, responsible for nine provinces in south and southwest China

The remaining institutes are affiliated to provincial forestry administrations. Usually one province has one inventory institute, although in some cases there are two. These provincial inventory institutes conduct the NFI, the annual wood consumption survey, and the annual plantation establishment review in their provinces, as well as the inventory for forest management planning and design.

The primary role of the four SFA-affiliated institutes is to supervise the provincial inventory institutes and to perform quality control assessments of their work. The SFA-affiliated institutes process and aggregate data collected by provincial inventory institutes; they adapt and develop forest resources assessment and monitoring techniques and methods; they also participate in the fieldwork of the NFI, though it is not their primary role. Provincial inventory institutions play a primary role in forest resources assessment and monitoring in their provinces. Under the supervision of the SFA institutes, they conduct fieldwork for the NFI, the annual wood consumption survey and the annual plantation establishment review. They undertake preliminary processing of the data before the data are forwarded to the SFA institutes for further processing and finalisation. The relationship of the SFA institutes and the provincial inventory institutes is shown in Figure 1.

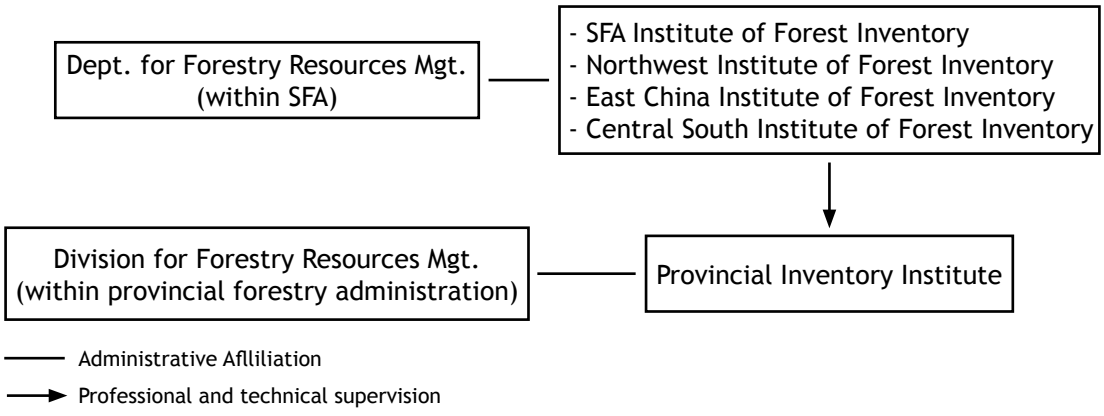

Figure 1. *Institutional Arrangement for Forest Resource Assessment and Monitoring*

3. Forestry Products Statistics

Forestry Products in Statistical Tables

China collects and tabulates forestry statistics annually in a wide range of fields. Tree crops (tea, fruits, mulberry for silk raising, rubber, coffee, coconut, oil palm and cashew nut) are considered part of agriculture so the Ministry of Agriculture collects and tabulates data on them. The State Forestry Administration collects the following fields of forestry statistical data, covering almost all aspects of forestry (SFA 1998).

- Silviculture
- Forest industry
- Employment in forestry sector (excluding farmer households)
- Fixed asset investment in forestry sector
- Gross output value of forestry sector
- Diversified economy in forest regions
- Forestry education
- Forestry research
- Collective forest farms and shareholding forest farms
- Forest police and law cases of deforestation
- Forest fire control

- Natural reserves
- Costs and marketing of forest industry products
- Integrated rural development projects
- Production and sales of flowers
- Production of tree seeds and seedlings

This paper does not intend to cover the full range of fields; instead it focuses on forest products only. Statistics are presented for 11 non-wood forest products (NWFPs), for timber volume harvested by villagers (or wood removal by local people in *Global Forest Resources Assessment 2005: China Country Report* by FAO) and for seven forestry industry products. Data on most of these forestry products have been available since the early 1950s.

The NWFPs and villager-harvested timber are farmers' products. Accordingly, they are categorised as primary products. The NWFPs are: (i) raw lacquer, (ii) tung-oil tree seed, (iii) camellia seed, (iv) tallow tree (*Sapium*) seed, (v) gallnut, (vi) palm fibre, (vii) resin, (viii) bamboo shoot, (ix) walnut, (x) chestnut, and (xi) shellac.

Industrial logging, wood processing and forest chemical products are classified as secondary industry products in Chinese statistics. The Chinese Forestry Statistics covers the following forestry industrial products:

- Industrial wood removal, including sawn wood (see Appendix B)
- bamboo timber (see Appendix B)
- natural board and wood-based panels
- rosin
- processed shellac
- vegetable tannin extract

Institutional Arrangements for Forestry Products Statistics

Both the State Statistical Bureau (SSB) and the State Forestry Administration generate forestry products statistics. SSB, the central statistical bureau of China, was established in 1952 and has maintained an intensive network of offices throughout the country.

The Statistical Information Division (SID, *tongj-xinxichu*), created in 1954 within MoF, is a focal point for forestry products statistics. SID is responsible for

- developing reporting forms and statistical indicators, specifying methods to be used, and organising collection and tabulation of data and information;
- analysing and predicting the economic outlook of the forestry sector based on data collected;
- providing other departments of SFA with guidelines for statistics;
- publishing statistical information and providing information services to users; and
- improving the capacity for forestry statistics through training and equipment upgrading.

SID coordinates a countrywide network which includes the forestry statistics units, the statisticians of forestry administrations and all forestry enterprises at provincial, prefecture, county and township levels. The provincial forestry administration (the department or bureau) establishes a statistical unit, while the forestry administration (bureau) at prefecture level and at county level designate full-time or part-time statistician(s) depending on the workload. Currently, about 5,000 personnel are engaged in forestry statistics in China, mostly on a part-time basis. With respect to the broader range of forestry statistics, SID also coordinates other relevant departments of the SFA that are involved in the collection and processing of statistical data within their own fields or areas of responsibility. The institutional linkages are shown in Figure 2.

Statistical Methods

The reporting form system is the primary tool used to collect statistical data and information on forestry products. Generally, statistical data and information are collected and reported in a half-year report and an annual report.

In the case of NWFPs and villager-harvested timber volume, SSB and SFA jointly develop statistical reporting schedules, largely in the form of tables, but collect data respectively through their own networks throughout the country. Both SSB and SFA distribute the same set of reporting forms to field levels in their own networks. Staff members at the township level (SSB statistician and Forestry Station) collect data and information respectively, using the reporting forms, and report to their respective systems at the county level. The data and information are aggregated and synthesised at each level and the entire procedure ends at SSB and SFA in Beijing. The relevant staff of SSB and SFA at each level are required to interact to ensure the SSB and SFA data sets are consistent.

Statistics on logging, wood processing, rosin, and processed shellac are the sole responsibility of the SFA statistical network. SID develops reporting schedules under SSB guidelines for the selection and development of economic and social development statistics. In developing schedules, SID works in cooperation with other relevant departments of SFA to ensure that the system will be able to deliver relevant information to decision-makers in

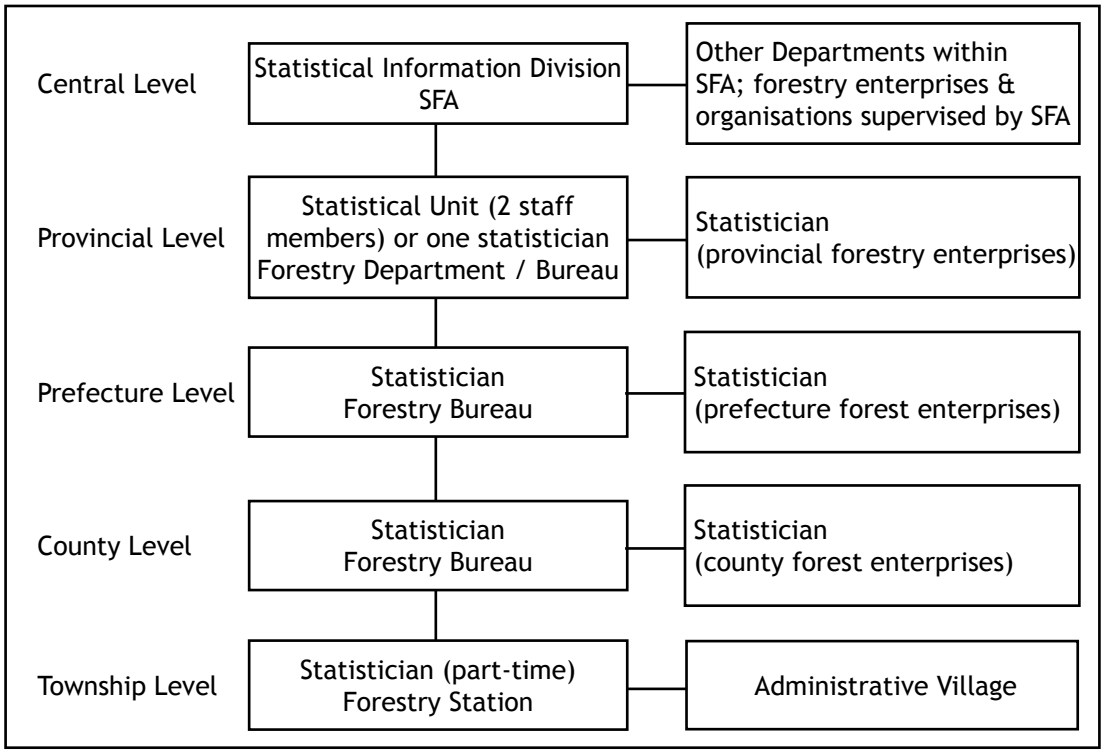

Figure 2. *China Forestry Statistical Network*

forestry and related sectors and won't meet any feasibility obstacles for field level staff. The reporting forms are distributed to the provincial forestry administration. Provincial forestry administrations can make slight modifications to the reporting forms to fit local circumstances, and the revised forms are distributed down to field level (see Figure 2).

Data reliability is still a concern within the reporting form system. Information flows through many levels, from local agencies to the SSB and SFA of the central government. Data may be manipulated when they are used as indicators for performance assessment of government chiefs—for example, logging volume may be underreported. In addition, relevant staff members of the SSB and SFA do not interact sufficiently, and there has been inconsistency between SSB and SFA data sets for some statistical variables.

4. Information Dissemination

Forestry statistics are mainly collected and compiled to inform policy formulation, strategic planning and other decision-making for the forestry sector and related sectors. Forestry statistics are also provided to other users through publications and sometimes in news conferences.

Information on forest resources is released in

- *China Forestry Yearbook*. First published in 1986, it covers highlights and achievements, including forest assessment and monitoring activities, by year, and data on forest resources from NFIs.
- *China Forestry Resources*. First published in 2005, it provides data from the sixth NFI.

Publications on forestry products include:

- *China Forestry Statistics 1949-1987*.
- *China Forestry Statistics*. Published annually since 1988, this publication has the most extensive forestry data.
- *China Agricultural Yearbook*. Published in both Chinese and English, this publication has data on forestry products contributed by SFA.
- *Rural Statistical Yearbook of China*.

The SFA provides data on forest resources and forestry products to FAO, and these appear as the "Global Forest Resources Assessment 2005: China Country Report" (FAO 2005) and in the *FAO Forest Products Yearbook*.

Although users now have access to statistical data that are released regularly, there are some difficulties in using the data due to their fragmentation in publications. The inappropriate grouping of data may be a problem—for example, all forest disasters (forest fires, diseases, pests, etc.) are grouped

into the field of silviculture. Also, data are published exclusively in the form of tables, and few are presented in graphs and/or charts.

5. Future Directions

This section briefly discusses how China's forestry statistical system may be improved to effectively serve national and international information needs.

Forest Resources Assessment and Monitoring

Although it has been evolving, China's NFI scheme needs further improvement and enhancement to meet the expanding need for information on forest resources expressed in the IUFRO's *International Guidelines for Forest Monitoring*. The NFI should expand its capacity to generate data on most (if not all) variables presented in the *Guidelines*, including biomass, biodiversity, and disturbances affecting forest health and vitality[1]. Active interaction of the leading forest inventory institutes and researchers in the area with their international counterparts, including the FAO and research organizations, will help enhance institutional capacity for resources assessment and monitoring, including the introduction, adaptation and application of variables and indicators that can be compared internationally.

The practice of conducting an inventory in one-fifth of the provinces in each year of one NFI needs to be revisited as it fails to generate up-to-date information. One option is to conduct inventories in all provinces in one or two years so that information on the forest resources of all provinces is collected in the same period. This has implications for programming the workload for inventory institutes nationwide, as they must do the work in one or two years that was completed previously in a period of five years.

Advanced technologies, especially remote sensing, GIS and GPS, need to be used more widely in NFIs. These tools will help to collect quality information and expand the scope of information in a timely way, while making forest resources assessment and monitoring more efficient. They will help the move from the dominant ground-sample-plot inventory to a combination of field survey and advanced tools, which has the potential to improve data quality and reduce inventory costs.

Forestry Products Statistics

While it cannot be replaced as a statistical method, the reporting form system should be improved to ensure data reliability. Using a sample survey as a complement to the reporting form system and cross-checking the information collected may improve results. Improved coordination between SSB and SFA in cross-checking the data they collect separately on the same forest products will also contribute to better forestry products statistics as it will help identify and explain data inconsistencies.

The scope of forestry products statistics needs to be expanded in response to the functions of forests identified in the past decade. These new information needs include important NWFPs other than those already on the statistical table, the contribution of NWFPs to rural people's welfare (to employment and income generation, poverty reduction and achievements in Millennium Development Goals, etc.) and the forestry-related employment of rural people. Selected edible wild mushrooms may be considered for addition to the statistical list of NWFPs. Nowadays these mushrooms are served in many restaurants. Their collection generates cash income for farmers. *Matsutake* is a mushroom of particularly high value, for export and for domestic markets. Medicinal herbs also generate significant cash income for villagers. Therefore, selected species of herbs could also be included in the statistical list of NWFPs.

Compilation and Publication of Information

General users now have increased access to data on forest resources and forestry products through publications. But SFA (and SSB) could make the data more accessible through their websites. Also, data could be grouped and released in a user-friendly way. Using graphics together with easy-to-read tables would help readers to better understand data and their trends.

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References[2]

Beijing Forestry University. 1986. *Forest Measurement*. Beijing: China Forestry Press.

Food and Agriculture Organization (FAO). 2005. *Global Forest Resources Assessment: China Country Report*. Rome: FAO (in English).

International Union of Forest Research Organizations (IUFRO). 1994. *International Guidelines for Forest Monitoring* (in English).

Li, Zhengpin and Ke Shanxin. 1997. Significant improvements (in plantation establishment) resulting from the annual plantation establishment review. *Central-South Forestry Inventory and Planning* 16 (1): 1-4.

Ministry of Forestry (MoF). 1986. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1987. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1988. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1989. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1990. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1991. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1992. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1994. *China Forestry Yearbook*. Beijing: China Forestry Press.

MoF. 1997. *China Forestry Yearbook*. Beijing: China Forestry Press.

Persson, R., and K. Janz. 1997. Assessment and monitoring of forest and tree resources. In *The proceedings of the XI World Forestry Congress, October 1997*, 17-29. Ankara, Turkey (in English).

Sayer, J.A., J.K. Vanclay and N. Byron. 1997. The technologies for sustainable forest management: challenges for the 21st Century. CIFOR Occasional Paper No. 12. Bogor, Indonesia: Center for International Forestry Research (in English).

State Forestry Administration (SFA). 1998. An overview of China's forestry statistics work. Unpublished paper. Beijing.

SFA. 2002. *China Forestry Yearbook*. Beijing: China Forestry Press.

SFA. 2003. *China Forestry Yearbook*. Beijing: China Forestry Press.

SFA. 2005. *China Forest Resources*. Beijing.

Tibet Forestry Bureau and Central-South Institute of Forest Inventory. 1993. A study of establishing the continuous forest inventory system in Tibet. Changsha: Central-South Institute of Forest Inventory.

Wang, Jinzhi. 1996. Technical issues related to successive forest inventory in Jiangsu Province. *Forest Resource Management*, no. 3:21-23.

Wardle, P. 1995. The evolution of forestry statistics from 1945 to 2000. *Unasylva* 46 (182): 69-75 (in English).

Yuan, Yunchang. 1996. A brief account of contemporary China's forest resources. Beijing: Ministry of Forestry.

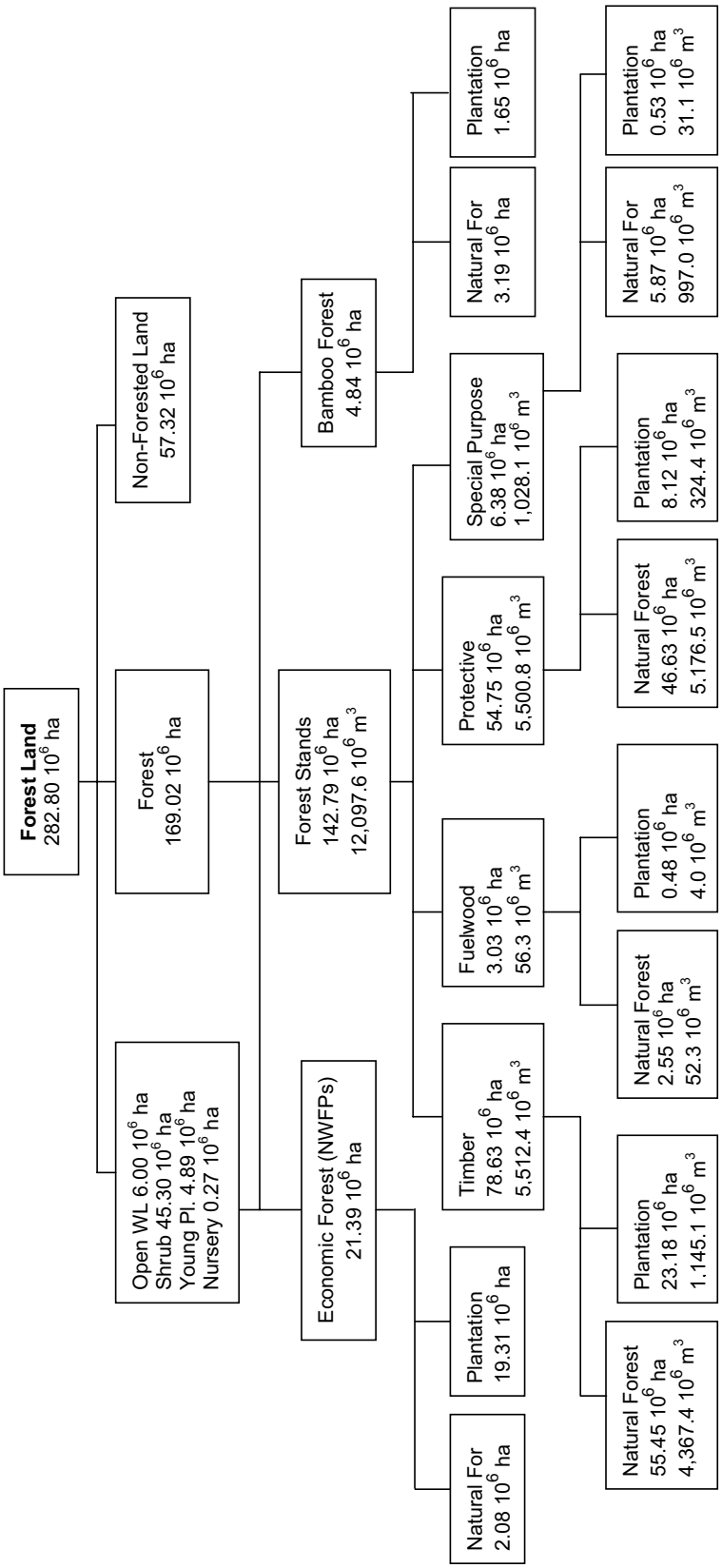
Endnotes

[1] A study on expanding the NFI system into a more broad monitoring system for forest resources and its ecological viability or integrity will be initiated by SFA in late 2006.

[2] All references are in Chinese, unless indicated otherwise.

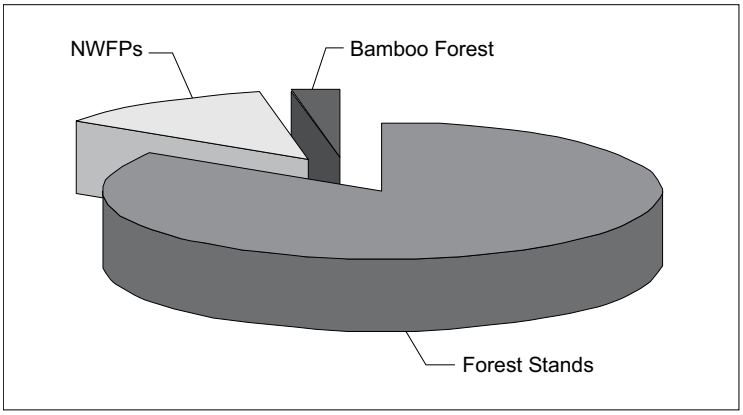
Appendix A. China's Forest Resources

Figure A.1 Forest Land and Growing Stock



Source: SFA 2005, China Forest Resources (data from the 1998-2003 NFI).

Figure A.2 Forest Area by Type

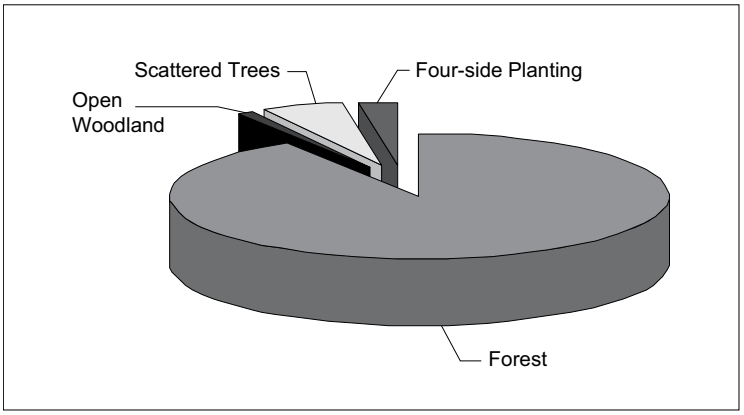


Original Data

Forest Types	Area (million ha)	% of Total Forest Area
Forest Stands	142.79	84.5%
NWFPs	21.39	12.7%
Bamboo Forest	4.84	2.9%
Total	169.02	100.0%

Source: SFA 2005, China Forest Resources (data from the 1998-2003 NFI).

Figure A.3 Growing Stock

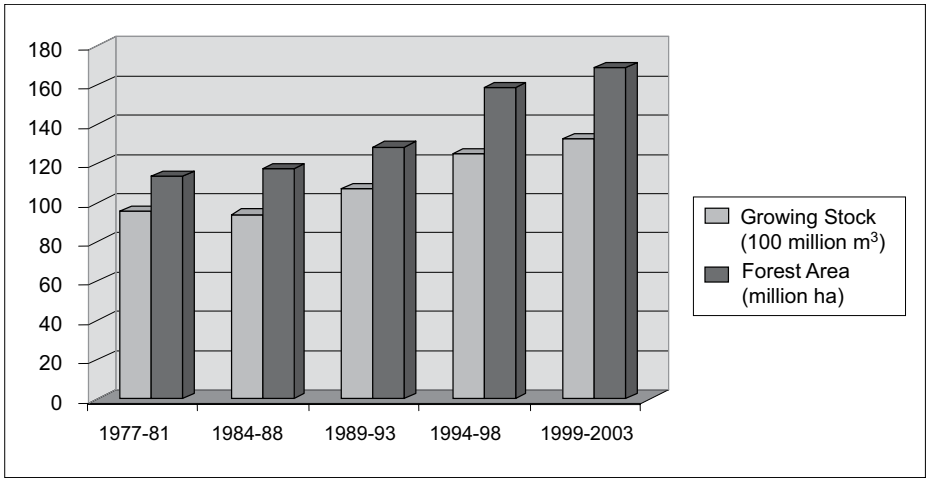


Original Data

	Growing stock (billion m^3)	% of Total Stock
Forest	12.098	91.24%
Open woodland	0.128	0.96%
Scattered trees	0.710	5.36%
Four-side plantings	0.323	2.44%
Total	13.259	100.0%

Source: SFA 2005, China Forest Resources (data from the 1998-2003 NFI).

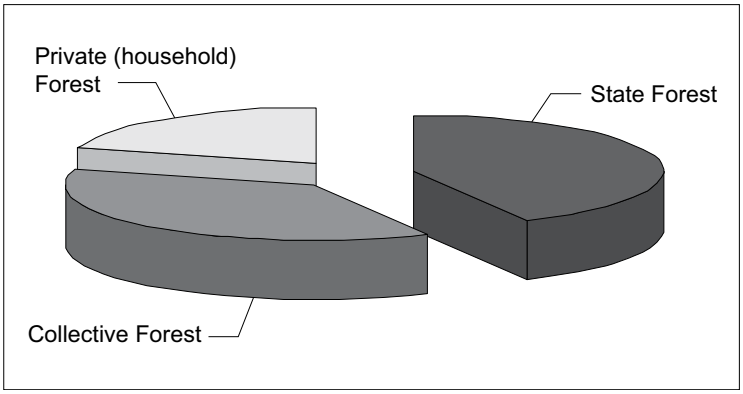
Figure A.4 Trends in Forest Resources 1977–2003



NFIs	Forest Area (million ha)	Growing Stock (billion m³)
2nd NFI (1977-81)	113.6	9.571
3rd NFI (1984-88)	117.5	9.418
4th NFI (1989-93)	128.5	10.736
5th NFI (1994-98)	158.9	12.488
6th NFI (1999-2003)	169.0	13.259

Source: MoF 1989 (p. 115); MoF 1994 (pp. 85-86); SFA 2005, China Forest Resources

Figure A.5 Forest by Ownership



Note: Forest ownership here refers to tree ownership rather than forest land ownership. In the latter case, there are only two types of ownership in China: state and collective

Original Data

	Area (million m³)	% of Total Area
State Forest	72.85	42.16%
Collective Forest	64.84	37.52%
Household Forest	35.10	20.32%

Source: SFA 2005, China Forest Resources (data from the 1998-2003 NFI).

Appendix B. Timber Output and Bamboo Timber

Year	Timber Output (million m^3)	of which, Sawn Wood (million m^3)	Bamboo Timber (millions of bamboo plants)
1949	5.67	-	-
1950	6.64	-	-
1955	20.93	6.78	59.0
1960	41.29	16.23	88.7
1965	39.78	11.60	70.3
1966	41.92	11.18	69.9
1967	32.50	11.57	72.2
1968	27.91	9.09	66.0
1969	32.83	10.04	66.2
1970	37.81	11.00	69.6
1971	40.67	11.05	75.4
1972	42.53	9.58	76.3
1973	44.67	9.93	114.9
1974	46.07	10.09	99.5
1975	47.03	10.69	90.7
1976	45.73	10.01	104.4
1977	49.67	11.25	108.0
1978	51.62	11.05	111.8
1979	54.39	12.71	105.1
1980	53.59	13.69	96.2
1981	49.42	13.01	86.6
1982	50.41	13.61	101.8
1983	52.32	13.95	96.0
1984	63.84	15.09	91.2
1985	65.23	15.91	56.4
1986	65.02	15.05	77.2
1987	64.08	14.72	118.6
1988	62.18	14.68	262.1
1989	58.02	13.93	152.4
1990	55.71	12.85	187.1
1991	58.07	11.42	291.7
1992	61.74	11.19	404.3
1993	63.92	14.01	433.6
1994	66.15	12.94	504.3
1995	67.67	41.84	447.9
1996	67.10	24.42	421.8
1997	63.95	20.12	449.2
1998	59.66	17.88	692.5
1999	52.37	15.86	539.2
2000	47.24	6.34	561.8
2001	45.52	7.64	581.5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