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Changing Ownership and Management of State Forest Plantations: China

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The conference was jointly organised and run by the Department of Water Affairs and Forestry of the South African Government, the UN Food and Agriculture Organisation and the UK Department for International Development. It is anticipated that this case study, together with several other country case studies and an overview, will be published as a book during 2004.

1. China

The China case study was prepared by Jintao Xu and William F. Hyde.

1.1 Introduction

China's forestry experience in general is interesting because 25 years of rapid economic growth have created great change in China's demands on its forest and considerable change in the forest itself. This experience is important because China is such a large actor in the modern world. In addition, and regardless of China's size, its experience is instructive for any country undergoing the transition from a poor agrarian economy to a diversified and developed economy, and particularly for any country contemplating or currently experiencing the transition in forest operations from central planning and public ownership to an expanded role for markets and private initiative. China's experience with forest plantations is additionally important because one-quarter of the world forest plantations are in China.

China began its remarkable transition with the introduction of rural reforms in 1978. The summary effects are well known: average annual growth in GDP regularly exceeding ten percent and more than a quadrupling of per capita income by the year 2000. The rural population was the first to benefit, and rural incomes have increased more than 6-fold over this period. As industrial, financial, and then trade reforms followed the rural reforms, nearly all sectors of the economy and all members of Chinese society have benefited. The market plays a greater role in both private enterprise and also the remaining state-owned enterprises. Nevertheless, many activities are still regulated and regulations of private forestry are particularly burdensome. Meanwhile, the public sector of China's economy remains substantial and many state-owned enterprises continue to absorb public financial support far in excess of their contribution to the economy. Reforms of the state-owned enterprises in general are the focus of government policy as China enters the 21st century, and the performance of the state-owned forest enterprises are an important feature in this paper.

China broadly organizes the administrative responsibility for its forests into two organized into two general categories, collective forests and state-owned forests. Collective forests are forests that were managed by local forest and agricultural collectives until 1978. Individual households and local market participation have played increasing roles in the management of these forests since then. The area under collective forest administration expanded from less than 48 million hectares in 1978 to over 67 million hectares by the mid-1990s. By the time of China's fifth official forest inventory in the mid-1990s, the collective forests accounted for about sixty percent of China's total forestland and individual households managed approximately eighty percent of that (SFA 1984-1998).

Collective forest management still has its problems. For example, taxes are much higher on forest products than on the products of competing land uses (Liu *et al.* 2002, Ruiz-Perez *et al.* 2002) and government procurement restrictions still limit private timber opportunities in most regions of the country. Nevertheless, the performance of China's state-owned forests is altogether more problematic, and this latter component of China's forests has become the greater focus of current forest policy.

The area under state-owned forest administration has expanded, although not as rapidly as the area under collective management—from approximately 51 million hectares in 1978 to 62 million hectares by the mid-1990s. Government investment in the state-owned forests expanded similarly over this period—at a 7.9 percent annual rate. Yet eighty percent of the state-owned forest enterprises (SOFEs) had exhausted their mature timber and more than one-half of them operated in financial arrears by the mid-1990s (Y. Zhang 2001, D. Zhang 2003). Meanwhile, the demands on these state-owned forests; for wood as a raw material, for fuel, and for environmental and recreational services; have continued to grow.

More recently the central government has banned most logging on these forests—in an effort to prevent a repeat of the vast floods and erosion along the Yellow and Yangtze Rivers in 1998. It has

also made reforestation of the upland watersheds a central component of its vast Western Regional Development Program.

The body of this paper discusses these developments in four sections of greater detail. The first reviews the basic statistics on forestry's role in China's economy. The second provides an historical overview concentrating on the quarter century following the introduction of rural reforms. The third examines the performance of the collective forests and household management, and the fourth reviews the status of the SOFEs, the continuing changes in their operations, and the remaining challenges facing them.

1.2 Basic Statistics and Future Outlook

The People's Republic of China is the world's largest country, with a population of 1.26 billion in 1999, about 22 percent of the global total. Its land area of 9.6 million sq. km. ranks third in the world, after Russia and Canada (FAO/UN 2001).

China's climate varies from tropical in the Southeast to cool temperate in the North and its annual precipitation ranges from 2000 mm. in the Southeast to 100-200 mm. in the arid Northwest. Its topography varies from mountains and high plateaus in the West to basins and plains in the East. Snowmelt from the mountains and high plateaus provides water for five of the world's great rivers, the Yangtze, Yellow, Mekong, Heilong, and the Indus.

This geographic and climatic diversity anticipates the diversity of China's fauna and flora. China is one of the more biologically diverse countries in the world with over 4,400 species of vertebrates (ten percent of the global total), including almost 500 mammalian species, 1,189 species of birds, more than 320 reptiles, and 210 amphibians. Its forests contain approximately 8,000 species of woody plants, among which are 26 genera of coniferous trees and 260 genera of broadleaves.

China's economy has grown rapidly over the last quarter century. Per capita GDP has grown at a real annual rate of approximately eight percent—quadrupling and lifting some 300 million people out of poverty. Farmers and the general rural population have benefited most (see Table 1.1.) This household economic growth is the most visible effect of the government's economic reform program. The reforms, beginning in 1978, promoted economic efficiency by introducing greater opportunity for private activity and expanding the role of markets in resource allocation. Private enterprise now accounts for about 33 percent of GDP, a share that is almost comparable to the 37 percent contributed by state-owned enterprise (Kynge 2000).

THE ROLE OF THE FOREST IN CHINA'S ECONOMY

China's land area is allocated as cropland (10.4 percent), permanent pasture (42.9 percent), forest and woodland including grassland and some unstocked wasteland (16.6 percent), and other (30.1 percent). Grasslands cover 400 million hectares, stretching 3,000 km. from the Northeast to the Southwest. The total area in forest is 154 million hectares. While this aggregate forest area is large, the fifth largest of any country in the world, it is small relative to China's population and relative to the economic demands placed on it. Per capita forest area is only 0.1 hectares, considerably less than the global average of 0.6 hectares per capita (FOA/UN 2002).

The growth of the forest sector has been more variable and, in some parts, not as rapid as growth in the general economy. Log production has increased only slightly since 1978, while lumber production has increased a moderate sixty percent in 23 years, or at a rate of approximately two percent annually. The paper industry, on the other hand, has kept pace with double-digit annual growth in the general manufacturing sector, expanding to almost five times its level in 1978. China's forests have not been able to keep pace with the expansion in manufactured wood products and imports have provided the difference (See Table 1.1) China is now the world's second largest importer of timber, and forest products in general are China's largest import commodity group (SFA 2000).

Forestry accounts for about one percent of China's GDP but the forests are an essential source of energy for forty percent of the rural population and they supply virtually all the wood used by the

construction industry. Their future role in commodity production is more difficult to predict, however. Surely they will continue to provide wood as a raw material, but the relative importance of this raw material to the economy is uncertain. The demand for paper products tends to be income elastic. That is, the demand for paper tends to expand more rapidly than the growth in income. Therefore, we can anticipate growth in this industry and in its demand for wood fibre as the country continues to develop. Other wood products tend to be less income elastic, and the demand for fuel wood may even decline for households above some level of income. The demands for these other wood products may be less imposing on China's forests over time.

On the other hand, we can anticipate that the demand for the non-consumptive environmental services of forests will surely grow with time—for at least three reasons. First, China suffers from some of the worst erosion and desertification problems in the world. Thirty-eight percent of the country is affected by soil erosion and 27 percent is desert, and this desert area is expanding by a quarter million hectares annually (SFA 2000). We can anticipate that both government projects and individual farmers will continue to plant trees to help control the problem (D. Zhang 2002, Yin and Hyde 2000). Second, the government embarked on a massive Western Regional Development Program in 2000 that includes major components to protect existing forests and add substantially to reforestation through the year 2010. Third, as economic development proceeds and household incomes continue to grow, the demand for forest-based leisure activities will also increase. China has already experienced an immense increase in forest-based recreation in the 1990s (Sayer and Sun 2003).

THE FORESTS THEMSELVES

China organizes its official forests statistics by region and administrative responsibility. Table 1.2 identifies the land area under forest cover for 1978 and for 1998 in each of six principal geographic regions and as the forests in them are classified as either state-owned or collectively administered. The largest forests are in the Northeast and the Southwest. The South Central region is a third region with large forests. The map that is Figure 1.1 outlines the forested regions and the provinces within them.¹

The state-owned forests include about 135 state forest bureaus and approximately 3000 independently operating forest farms. The bureaus control their own forest farms and most control their own wood processing facilities as well. They were originally set up as logging operations for natural forests, although many of their natural stands are second growth. Many of the independent forest farms were originally set up to manage forest plantations. The reporting hierarchy for both institutions has changed several times. Both currently report to local or provincial governments for personnel and planning, but they continue to receive financial assistance from the central government, and they are subject to the forest management guidelines of the State Forest Administration (the Ministry of Forestry before 1998).

Collective forests are forests that were managed by local forest and agricultural collectives until 1978. Since then, individual households have gradually assumed long-term contractual responsibility for

¹ Some discussions modify the regional organization of table 2 to reflect management responsibilities more closely. In this case, the NE and SW are sometimes lumped (NSSFR) as the regions of predominantly state-owned forest and as China's major sources of industrial wood. The objective of these state forests has been to support employment in the local mills. Their standing inventory declined, as the procurement prices paid by the mills were too low to support reforestation. The Southern Collective Forest Region (SCFR, including the Southeast, South Central, and some of the Southwest from table 2) is the second most productive region. This region also suffered from procurement prices that are still too low to encourage reforestation without external financial injections. The North/Northwest Farm Forest Region (NNFFR) covers the remainder of the country. The western part of the NNFFR is a dry area that is not conducive to forests. The eastern part is a major agricultural area. The only significant forest interventions in this region have been government-supported shelterbelts. Agricultural and other rural policy reforms have affected the SCFR and the NNFFR but they may have had less impact elsewhere. They have led to vigorous agroforestry activities that have significantly altered the landscape in the eastern part of the NNFFR. More recent reforms of the SFA and the state forest bureaus plus a few large-scale government plantations may have had greater impact on the NSSFR.

more and more of the collective lands. About sixty percent of China's total forestland belongs to the collectives and individual households now manage about eighty percent of that.

The land areas in both state-owned and collective forests have expanded gradually, but the land area in collective forests is growing more rapidly in most regions. Nevertheless, the standing forest volume per hectare remains almost three times greater on the state-owned forests, even in 1998.² We would anticipate this rank ordering, as some state-owned forests are inaccessible and biologically mature while all collective forests are accessible. Therefore, the collective forests are almost certain to be harvested at younger ages and smaller volumes as they attain economic maturity and some state-owned forests are not likely to be harvested at any age. The standing volumes on the state forests of most countries exceed the volumes of their private counterparts for this same reason. However, a three-fold difference in volumes per hectare between state and non-state forests is remarkable. The reason for the difference in China may simply be due to the common difficulties of measuring the newest young growth in any forest inventory—as the collective forests support a disproportionate share of young stands; or it may be due to China's accounting system for forests which includes commercial tree crops like orchards that contain less standing timber volume per unit area and are almost totally concentrated on the collective lands; or it may be due to uncertainty and a range of other factors that discourage private investment. It will be interesting to observe whether the standing volumes in China's forests increase rapidly as the effects of the reform incentives for planting and management are more completely absorbed into the measurable growth that will be captured in future forest inventories.

The collective forests contain three times the total area and twice the total volume in plantations as the state forests, plus most of the economic and bamboo forests.³ See Table 1.3. These observations are not surprising—for reasons that are similar to the differences in inventory volumes just discussed. The state forests contain most of the remaining inaccessible natural forest, plus some managed stands and plantations, while most of the collective forests are managed and plantations account for a larger share of them. (Collectives and individual households have no incentive to possess and maintain economically inaccessible lands.) Moreover, the collectives and individual households manage the larger shares of economic forests (generally horticulture) and bamboo because the products of these forests are not within the normal responsibility of state forests.

1.3 Historical Overview

China nationalized all forestry enterprises and confiscated feudal forestland in the mountainous areas for redistribution to farmers in 1950, shortly after the Communist government assumed power. In effect, two systems of ownership were established, state-owned forestland under the management of the state-owned forest enterprises (SOFE) and individually-owned mountain forestland.

A new national policy of collectivization began three years later. The era of cooperatives and people's communes in mountainous and forest areas began in 1958. Private forests were eliminated, and the titles to mountainous forestland became less clear. Productivity declined. Subsequent periodic policy revision and improved management incentives failed to have permanent beneficial impacts. A quarter century of poor economic performance in general and a decline in the forest base in particular followed. It was reinforced during the Great Leap Forward and the Cultural Revolution during which forests were cleared for fuel for backyard steel production and forestland was converted to agriculture.

² In fact the inventories of the accessible state-owned forests were also drawn down severely. Of 131 state-owned forest bureaus in the Northeast and Southwest in 1978, 25 had exhausted their mature wood resource by 1993.

³ China's forest classification system includes three broad physical categories: natural and plantation forests, economic forests—largely horticulture and rubber, and natural and managed bamboo forests. Economic forests and bamboo forests comprise about twelve percent and four percent, respectively, of all collective forests. Their combined land area is approximately one-fifth of the total collective forest area.

REFORM: 1978-1984⁴

An extended period of reform began in 1978, starting in the agricultural sector in Southeast China and spreading, in a cyclic and variable manner, to other sectors and regions.

The initial period of reform (1978-1984) was characterized by decollectivization and a relaxation of the Unified Procurement Pricing System for agricultural products. Agricultural households regained land use rights (a policy known as the Household Responsibility System) and they were eventually able to sell most of their production at market prices. By 1984, agricultural land productivity had increased 225 percent.

Subsequently, households gained land use rights to collective forestlands as well (a comparable policy known as the Contract Responsibility System). This became the third component of the “three fix” policy for forestry: stabilizing the rights and ownerships of forests and mountains, identifying boundaries of household plots, and establishing a forest production responsibility system. Change was rapid and, by 1984, sixty percent or thirty million hectares of collective forestland had been transferred to 57 million households. Various forms of non-state forest enterprises (rural forest cooperatives, shareholding groups, joint venture firms, private forest farms, etc.) have emerged since then from this household-based forest system.

The SOFEs were largely unchanged during this initial period of reform, although some of them did return land to the collectives and to households as the ownership rights of forest properties, and also their boundaries, were re-established.

The central government maintained an active role in afforestation and reforestation during this period, but the role of individual households increased. Some households drew on their own resources to reforest (e.g. Yin and Newman 1997, Liu and Edmunds 2003). The central government also invested in programs like the massive Green Great Wall for erosion control and in the silvicultural activities of the SOFEs. However, the rural population was no longer a passive participant, only contributing mandated labor to many government afforestation activities. When local authorities looked for land to plant trees, they had to negotiate with the landholders—the local farmers—and the farmers had the right to demand compensation. In the aggregate, the area of collective forestlands increased by about one-fifth, while the area in state-owned forestland remained stable between the second and third national forest inventories, 1977-81 and 1984-1988, respectively (Table 1.2).

REFORM: 1985-2000

Subsequent reforms focused on the industrial and financial sectors in the urban areas and the development of non-agricultural enterprises in the rural areas. A manager responsibility system for state-owned enterprises (comparable to the Household and Contract Responsibility Systems) permitted managerial discretion over the use of variable inputs. Then, in the 1990s, the government permitted the sale of some state-owned enterprises (SOEs) and it permitted others to go out of business. In 1997, it permitted managers of SOEs to release redundant labour—and seven million workers were absorbed into the non-state economy (Hyde *et al.* 2003).

In the rural areas, smaller non-state enterprises known as township and village enterprises or TVEs developed. These became the fastest growing component of China’s economy. Ninety percent of China’s papermills are now TVEs, and those papermill TVEs grew more rapidly than the state-owned papermills. Both sawmills and papermills more than doubled their production between 1978 and 1989. The papermills continue to expand their production to this day (Xu 1999).

Four factors had important effects on forestry during this period: auctions of wasteland, the liberalization of the Unified Procurement Pricing System for timber, general economic growth, and the liberalization of foreign trade. The government began auctioning barren forestlands (the “four wastelands”) for afforestation in 1993 and it allowed private operators to compete in these auctions. By 1996, the management of 3.7 million hectares had passed into private hands under this

⁴ This section and the next rely on the more extensive discussion in Hyde *et al.* (2003).

arrangement. The practice of selling forestland through public auctions has now extended to lands with juvenile and mature stands of timber.

The Unified Procurement Pricing System has been gradually relaxed until the government now accounts for less than ten percent of timber purchases (Y. Zhang *et al.* 1998, Waggener 1998). Nevertheless, government regulations on timber harvest levels and shipments remain strong and timber markets remain underdeveloped in some regions.

General economic growth, rather than any specialized forest policy, was responsible for some of the growth in forest management in this period. Papermaking is a good example. The demand for paper grows faster than per capita income in most economies. Paper production grew at a thirteen percent annual rate in China after 1984, a rate in excess of the 8-10 percent rate of annual growth in GDP. As a result, the industry's demand for wood fibre grew and that created a price incentive for expanding forest management. Two recent empirical assessments confirm the importance of growth in aggregate demand. Zhang *et al.* (2000) determined that a one percent increase in per capita GDP explained a 0.59 percent increase in plantation forest area in one province (Hainan). A one percent increase in timber price—which is also due to growth in general demand—explained an additional 0.61 percent increase in plantation area. The evidence of Rozelle *et al.* (2002) is not as precisely designed to relate GDP to plantation area but it does report a broader sample—all of China. Rozelle *et al.* determined that a one percent increase in the light industry share in the full economy was responsible for a 0.13 increase in forest land. This 0.13 is an underestimate of the impact on plantations because an additional share of plantations is necessary to make up for any harvests from the natural forests.

On the other hand, trade liberalization absorbed some of the increasing demand for woody raw material, and the new restrictions on logging beginning in 1998 assured that log imports would become even more important. Log imports nearly tripled (from 4.8 million m³ to 13.6 million m³) between 1999 and 2001 (China Customs Office 1999-2001).

In the aggregate, the area in collective forestlands increased by forty percent to 67 million hectares between the third and fifth national forest inventories (1984-1988 to 1994-1998). The area in state lands managed by the SOFES increased by twenty percent to 62 million hectares over the same period (Table 1.2). All of the increase was newly planted and all of it can be considered forest plantation. The total area in new plantations was even larger as additional plantations replaced some natural forests on cutover timberland.

PLANTATION HISTORY

We have reviewed the chronology of important policy change—for both the collective forests and the state-owned forest enterprises, and we have observed the overall effects on the forestlands within those two administrative management categories across China's six major forested regions. However, we have not yet traced the specific history of effects on new plantations.

China has the largest area in forest plantations of any country in the world, 46.7 million hectares, or approximately one-fourth of all plantations in the world (SFA 2000a, FAO/UN 2002). These plantations include 22.5 percent of China's forest stands and 30.4 percent of the country's total forestland including economic and bamboo forests. They contain a smaller share of the country's total standing forest volume (nine percent), partly because most of these plantations are younger than the remaining natural forest.⁵ Their younger trees are smaller—but they are also growing more rapidly than the trees in the natural forest. See Table 1.3.

The total area successfully planted since 1949 has been approximately 100 million hectares. A little more than fifty million hectares have been planted, then eventually harvested or converted to other and uses, without replanting. Almost fifty million hectares (46.7) remain in plantations today.

Existing plantations were harvested at an increasing rate between the fourth and fifth national forest inventories (early and mid-1990s) owing to economic growth and the increased demand for woody raw

⁵ Some plantations are in horticultural species or bamboo, which typically grow to smaller mature volumes than the volumes of either coniferous or deciduous forests.

material. However, afforestation in new plantations outpaced the harvests of existing plantations—even during this period of rapid timber harvesting. The total area in plantations rose 12.42 million hectares between these most recent two forest inventories. See Table 1.4.

Table 1.5 traces the pattern of plantation growth for the collective and the state-owned forests from the third to fifth national forest inventories. It is clear that the area in plantations is growing rapidly and that the collective plantations are a large (greater than seventy percent) and growing share of all plantations. This larger collective forest share should not be surprising because we have observed that the policies of the first fifteen years of reform had their greatest effects on private and household incentives. Households themselves were responsible for fifty percent of the investment in plantations by 1988 (Li *et al.* 1988), and they probably have been responsible for an even larger share since then.

The government has targeted a further ten percent increase in total land area devoted to forests, an increase from 16.6 percent in the fifth national forest inventory to 26 percent by the year 2050 (SEPA 1999). This means that the area in plantations will continue to grow. Furthermore, the government's 1998 ban on logging in natural forests makes plantation development all the more urgent—in order to serve the demands for woody raw material that can no longer be supplied by the natural forest. We can anticipate that the collective sector (mostly household managed) and those more market-oriented SOFEs will be responsible for the largest shares of these new plantations. Collective forests will continue to respond to market incentives, and the more-market oriented SOFEs will respond to the new management incentives given to managers in general in the late 1990s, as well as to the additional afforestation and reforestation assistance provided within the government's new Western Development Program.

1.4 Development and Status of the Collective Forests

Shortly after agricultural households began receiving HRS rights to agricultural land in 1978, they began showing interest in similar rights to the small remaining forestlands of the agricultural collectives. At the same time, households in the forest collectives began showing interest in similar rights to the lands of these collectives. As in agriculture, the local authorities recognized the advantages of the land transfers in the form of simpler administration. Households recognized the advantages of personal choice, and they rapidly obtained the advantage of increased productivity.

The gains from household forest management were similar to, although not as spectacular as, the gains in agriculture. The collectives transferred more than 31 million hectares to 57 million households by 1984. The households themselves began their own afforestation and reforestation activities, increasing the forested area of the collectives by 33 percent by the third forest survey (1984-1988) and by 86 percent by the fifth survey (1994-1998). By the fifth survey households managed 52 percent of China's total forest area. They managed 74 percent of China's forest plantations, plus 92 percent of its economic forests and 93 percent of its bamboo forests.

The distribution of forested land was egalitarian—following the similar pattern in agriculture. Forestland was first divided into plots according to species, age, density, site and soil quality, and distance from the village, among other criteria. The plots were redistributed such that households of similar family size received similar mixes of high and low quality forest, accessible and less accessible forest, and so forth (Sun 1992, Liu 2001). As a consequence, households received several tiny forest plots on different hills and different slopes of any mountain. Land on one slope was often distributed among many households in one village. The average household in southern and southwestern China obtained 4-5 plots totaling just 1-2 hectares. For example, the average household in Zhaizao township in Guizhou possessed fourteen plots with a total area of just 4.2 hectares in 1999. The largest plot in this township was 2.3 hectares, while the smallest was just 0.06 hectares. In the village of Yixiang in Jinggu County of Yunnan, 45 hectares were distributed in 169 plots that averaged 0.28 hectares per plot in 1999 (Liu and Edmunds 2003).

The objective was equity among households was achieved but the many fragmented and scattered plots increased the demands on the managerial resources of each household. Forest management itself requires greater input per unit of land area for smaller fragmented plots—and for either small

plantations or natural stands. Small plot size increases the difficulty and reduces the cost effectiveness of boundary marking, protection, and most other forest operations. Each household must allocate a family member to look after its many forest plots, while only one or two guards were necessary to protect an entire forest under collective management. For example, some households in Chuxiong in Yunnan, especially those with fewer members, have reported that providing daily protection from theft and fire is a burden. The problems of fragmented holdings are compounded with many unclear boundaries, also a consequence of the land redistribution process, and still a source of boundary conflicts today.

The reforms, as they were applied in China's collectives, were pragmatic and variable. They were adapted to local conditions and they varied with local interests, local authority nad, over time, with the changing economy. In some places, either the households or the collective authorities addressed the problem of many small plots and long boundaries for each household to manage with land transfers and consolidation of forested plots. In some places the pattern of fragmented holdings led to the development of shareholding agreements. After bouts with generalized inflation in the mid-1980s, some local authorities expressed their doubts about household management by rescinding some household contracts on forested land, re-imposing the restriction of government procurement, and increasing taxes. Gradually, however, many of the newer restrictions were reduced or eliminated and when the earliest contracts were renewed in the middle 1990s, the households responded with increased confidence in their ability to invest and recover the fruits of their investments from their forested lands.

LESSONS

Two crucial lessons have emerged from these experiences, lessons for China and lessons that are important for forest policy and private forest management around the world: a) When the economic conditions are ripe, farmers do invest in long-term investments like forest management and they invest even when the potential returns do not bring direct financial advantage. b) However, an uncertain policy environment is damaging to these investments and, faced with uncertainty about government policies, farmers are reluctant to make long-term investment in forest management. Yin demonstrated both of these points (Yin and Hyde 2000, Yin and Newman 1997).

Yin observed that, in the agricultural northern plains, forest cover expanded from about five percent in 1977 to eleven percent by 1988. The expansion was most apparent in shelterbelts, in intercroppings of trees with agricultural crops, and along the "Four Sides" of villages, houses, roads, and waterways. Farmers planted trees in these locations as a means of protecting against the region's severe problem with wind erosion. Yin used an agricultural production function to assess the effects of improved property rights (HRS), market liberalization, and the conservation investment in trees, as well as the standard agricultural inputs, on agricultural output. He concluded that improved property rights provided the stimulus for almost sixty percent of the increase in agricultural output between 1978 and 1984. Conservation investments in trees (themselves, a response to improved property rights) explained five percent of the increase in output through 1984, and a much larger twenty percent thereafter—as newly planted seedlings matured into larger trees and formed better protection against eroding and desiccating winds. In sum, private management provided a level of forest protection against the non-market effects of soil erosion in China's northern plains. Collective action was unnecessary—at least for lower levels of protection in this severely erosive but highly productive agricultural region—and farmers did invest in forest management.

The northern plains may have been an unusual example because agriculture was so much more important in that region that the authorities paid little attention to forests. Yin contrasted the experience of the northern plains with that of a part of the Southern Collective Forest Region just south of those northern plains. The South is a region of traditionally much greater forestry importance. This was the initiating region for both agricultural and forest reforms and it contains about 85 percent of China's collective forestlands. Land and tree tenure had changed three times over twenty years in the South, and southern households were cautious in their opinions of the durability of the new contracts for forest land use. Their doubts were confirmed when the authorities in some parts of the South rescinded some of those contracts. Yin showed that farmers in both regions responded rationally. As

market prices rose in the northern plains, farmers first harvested the trees on their new lands then, as prices continued to rise, they invested—and harvest levels continued to increase over time as a result. As prices rose in the South, farmers harvested their trees, but as prices continued to rise, they did not invest. They were concerned they could lose the fruits of their investments in future policy revisions—and, without reinvestment in forest management, harvests in the South declined over time. (Both the standing volume and the area of household management have increased in the South in every official forest survey since the late 1980s—as the policy has been more consistent and households have responded to the increasing certainty about their policy environment.)

INCOME DISTRIBUTION

Have the successes of household forest management in China improved household income? How have they affected the poorest rural households? Questions about forestry and the rural poor arise because extensive forest cover often occurs together with poverty and isolated human communities. We cannot testify to a measured effect of growth in the forest sector on China's rural households, although we do know that the incomes of rural households in general increased more than six-fold since the beginning of reforms in 1978. Undoubtedly, some of the increase came from forestry.

There is evidence, however, from the bamboo sector. Bamboo is a subsector of forestry in China, and bamboo and commercial timber are similar in their productive inputs. Both use rural labor and land and neither is a significant competitor for agricultural capital. Bamboo also competes in many of the same product markets as timber, providing raw material substitutes for timber in paper and various construction activities. Bamboo production has grown more rapidly than commercial wood—from 3.2 million ha. in production in 1980 to 4.3 million hectares in 1999, and from 4.4 million metric tons of output in 1980 to 14.2 million metric tons in 1999 (Ruiz Perez *et al.* 2001). Its more rapid growth is partly due to the absence of harvest quotas and shipment restrictions from bamboo and the much lower schedule of taxes and fees for bamboo than for timber. Taken together, these points mean that bamboo's pattern of development is suggestive of the pattern for commercial timber that would have occurred under more liberal market conditions. This contention was reinforced when China introduced a logging ban over large areas of the country in 1998. Bamboo prices immediately rose five-ten percent and the land area in bamboo plantations grew nearly seventeen percent in one year (CFIC 1998).

Ruiz-Perez *et al.* reviewed the bamboo experience for six counties along an east-west gradient from the Anji province on the Pacific coast to more remote inland parts of Hunan and Sichuan provinces. They observed that improving bamboo markets provided an alternative income source for many farm households and an opportunity for some households to diversify and specialize. They divided farm households by income group and observed that households in all income groups gained from rising bamboo prices and market opportunities, but middle and higher income groups gained relatively more. Bamboo opportunities were important, but off-farm employment opportunities were even more important sources of increasing household income, and middle and higher income households obtained more of these opportunities as well.

Bamboo production increased, but neither the number of farm households nor the land area devoted to bamboo production changed substantially in most counties. Rather, farmers tended to increase production by intensifying management on the same lands.

Those counties that continued to develop eventually diversified their economic base. More off-farm employment opportunities developed, and wages rose; as did the opportunity costs of land. The financial returns to bamboo production tapered off. Farmers who remained active in bamboo production, diversified, specialized, and intensified their productive activities in order to remain competitive in their use of land and their demands for labor.

In sum, bamboo production was a good starting point for early industrialization, particularly for counties with good access to larger markets. Bamboo offered a supplementary income opportunity for many households, but many poorer households remained poor and their gains from bamboo development were small.

We can hypothesize that commercial forestry will follow a similar pattern if China further liberalizes its forestry markets. Farm households will take advantage of the opportunity. They will supplement their incomes and diversify their production, and some will eventually specialize in particular forest products. The greatest opportunities will occur where market access is good, and we can anticipate that China's immense effort in the 1990s to improve rural roads and other infrastructure will be important for this opportunity. However, we can anticipate that the experience of China's poorest bamboo farmers will be duplicated as well. Poor forest households will improve their incomes, but these households are unlikely to be the primary beneficiaries of forest-based development and many will remain poor even after forest development.

1.5 Development of the State-Owned Forests

We cannot trace the development and performance of state-owned forest plantations directly. The data are not readily available. However, we can trace important developments in the overall investment and management of the SOFEs, and we can often separate forest management or silviculture, most of which is conducted on planted forest stands, from the other activities of the SOFEs. (Those "other" activities include logging, wood processing, and even some non-forest product activities.)

We can also separate government investment from the re-investment of the SOFE's retained earnings. The former has been crucial to the operation of the SOFEs because so many of them have suffered poor financial performance in recent years. By the mid-1990s, eighty percent of the SOFEs had exhausted their mature timber and half of them operated in financial arrears. Government investments have also been crucial for a number of large forest investment projects conducted for environmental reasons—and we will examine those as well.

INVESTMENT

Since 1978, the central government's funding has accounted for less than half of all investment in the SOFEs (including investment in logging and wood processing), but more than half of the investment in SOFE silvicultural activities. See Figure 1.2. (The differences are composed of provincial and local government expenditures and investments from the retained earnings of the SOFEs.) The central government's share of all investment in the forest industry has declined with industrial reform and the "hardening" of budgets for all state-owned enterprises. In contrast, the government's share of silvicultural investments has increased, especially since 1997, with its growing recognition of the importance of the environmental services provided by forests.

Total government investment in the SOFEs increased at a real average annual rate of 3.9 percent between 1979 and 1997. This is an aggregate rate that reflects a 7.9 percent average annual rate of increase for silvicultural investments but only a 2.3 percent average annual rate for investments in logging, wood processing, and other activities. The pattern shifted with recent decisions to leave the forest industry to the private sector and to improve the environment. In 1998 and 1999 the government's investment in silvicultural increased sharply, while its investment in logging, wood processing, and other activities of the SOFEs actually declined.

These aggregate measures mask the substantial impacts of a few large investments. The largest increases in state silvicultural investment occurred in 1979, when the Three North Forest Protection Project (the Green Great Wall) was established, and between 1996 and 2001 when the government responded to several large ecological disasters (the 1998 floods of the Yangtze and Songhua River basins, and the dust storms in northern China in 2000-2001) with a decision to restrict timber harvests from natural forests in some regions and to reforest and protect the upper watersheds. The large increase in state investment in the forest industry in 1987 was probably related to the costs of controlling the 1.14 million hectare fire that occurred in the northeast China that summer and the costs of reforestation following the fire. See Figure 1.3. Clearly, the government of China, like governments in other countries, responds to natural crises.

Figure 1.4 traces the pattern of state investments in selective silvicultural activities since 1990. It shows that investments in large environmental protection and restoration projects have been a rapidly increasing share of the budget. The five largest of these projects—listed in Table 1.6 along with their afforestation targets and achievements—continue today. The level of state investment in projects such as these increased more than six-fold in the 1990s.

EFFECTIVENESS

How effective were these investments? The level of state investment in forestry has been less of a problem than the effectiveness of the investment. In fact, the monies allocated for forest management do not all go to on-the-ground forestry activities. Some are dissipated in the allocation process. The forest departments at all levels of government, as well as the SOFEs, have their own interests and responsibilities. They use their revenues to support employment, transportation, and social services for their employees, as well as for on-the-ground forest management.

Once the funding is allocated to actual silvicultural activities, its effectiveness depends on the incentive structure for SOFE employees. As in other sectors of the economy, reforms are gradually replacing the more centralized and planned system of SOFE management with a more decentralized and market-oriented system. Under the old system, silviculture was vertically integrated with logging and wood processing, and silvicultural activities were conducted by individual farms within an SOFE or by the SOFE itself under a soft budget. (That is, with significant but varying annual financial assistance from the central government.) In the late 1980s, silviculture, logging, and wood processing were divided into separate operations. In addition, the large old forest farms were divided into smaller farms, or into land units now managed by individual households or groups of households.

For silvicultural activities within the SOFEs, the first reform involved wage payment. A few SOFEs began using a piece rate system in the mid-1990s. They contracted out silvicultural activities, and silvicultural wages became tied to the amount of work accomplished (for example, the number of seedlings removed from a nursery or the number of trees planted) rather than the prior system of payment for time involved regardless of output (Y. Zhang 2001).

Other experiments for wage payment are also being tried. A second common arrangement involves a contract under which individuals or small teams perform certain tasks in return for a fixed payment. Most contracts stipulate the required product such as required seedling survival rates, although there are many variations. In some cases, the forest farms provide materials and machinery. In others, the contractors possess their own material and machinery—previously purchased from the forest farms. In all cases, any profits belong to the contractors who are responsible for organizing the labor and materials, for site preparation and planting, and for tending the site for the first few years.

A third arrangement, similar to share-cropping in agriculture, was developed to transfer some state-owned capital equipment to former SOFE employees. In this case, individual workers obtain the use rights to the capital and share the income from its use with the SOFE. This arrangement was first implemented for vehicles and small sawmills. It has spread to silvicultural and agricultural operations within a few SOFEs.

A different procedure has been used for the transfer of land and resource use rights in a few northeastern SOFEs. These transfers are negotiated, or auctioned. The recipients of the new rights are usually limited to SOFE employees. Therefore, the land prices are not entirely determined by the market (Y. Zhang 2001). In recent years, a growing number of SOFEs have allocated lands as a substitute for salaries and pensions, as well as for severance pay for workers who have been dismissed. These payments are called “salary land,” “pension land,” and “employment land,” respectively (CAFU 1997, Lu *et al.* 2002).

Regardless of the specific contractual reform, the intention has been to link effort with reward, and the trend has been toward a responsibility system similar to those for agriculture and farm forestry. Y. Zhang (2001) assessed the improvements in economic efficiency due to these reforms. He concluded that the reforms resulted in reductions in labor shirking and administrative costs sufficient to improve efficiency in silvicultural activities by 25 percent in the forty SOFEs in Heilongjiang province. Shen (1991) showed that, with the reforms, the three-year seedling survival rate increased from 32 percent

in 1985 to 94 percent in 1990 on the Jile Forest Farm. Others (e.g., Teng and Xie 1991, Hong *et al.* 1992, Zhang *et al.* 1994) have reached similar conclusions: silvicultural activities organized in a decentralized system are less costly and achieve better results.

These observations are grounds for optimism. Nevertheless, room for improvement remains. A recent CCTV (2001) report shed light on the problems of monitoring silvicultural activities. The Shilinji Forest Bureau was devastated by the 1987 forest fire. Over the next ten years, the Bureau obtained some 27 million yuan of state funds to reforest some 9,000 hectares of land. The reforestation was completed in 1997. However, an audit found that only 2,250 hectares had been reforested. The CCTV report blamed official corruption, but there may be another explanation. The difficulties of monitoring within a multi-layer administrative structure and the location of the Bureau in the country's most isolated northern region might help local officials hide their real intentions and activities. For a more general example, the SOFEs have reported an accumulated planted area over the last twenty years that is greater than the area under their management. Yet some wastelands remain in the SOFEs. This means that either the reported number of planted hectares is inaccurate, or many newly planted seedlings have not survived, or both. Future reforms must consider how to improve on these large remaining inefficiencies.

In sum, we have reviewed the history of state expenditures and the course of reforms in SOFE management. Table 1.7 summarizes their effect on the forest inventory—after adjustments for timber harvest removals.⁶ It shows that the land area of the state forests has remained relatively stable for all regions over the course of China's reforms. This is not surprising. Transfers of state forests to other land uses are not generally permitted. The forested area and standing forest volumes on these lands have changed, however, increasing 21.6 percent and 35.6 percent, respectively, from 1988 to 1998.

REMAINING STATE FORESTRY ACTIVITIES

Timber production has been the primary objective of the SOFEs. However, the forests also provide a range of non-market environmental services, and the entire country has become more alert to their importance in recent years.

China is one of the most biodiverse countries in the world with 4,400 species of vertebrates (ten percent of the global total), including almost 500 mammalian species, 1,189 species of birds, more than 320 reptiles, and 210 amphibians. Its forests contain approximately 8,000 species of woody plants, among which are 26 genera of coniferous trees and 260 genera of broadleaves. However, 15-20 percent of these species are threatened with extinction. In 1994 approximately 200 species were estimated to have become extinct recently (SEPA 1998). Deforestation of the natural forest and the conversion of fragile lands for agricultural use are thought to be the most serious causes (Zhang *et al.* 1994).

An awareness of the need to set up nature reserves for biodiversity conservation has led to the rapid and continuous growth of protected areas in China. China set up its first national forest park, the Zhangjiajie Forest National Park, in 1982. Others followed rapidly. Many of the first reserves were set up specifically for conservation of the national treasure—the giant panda—but these were quickly followed by other reserves established for their scenic, wetland, or ecological values, or to conserve other species. By the end of the 1990s, 1,118 nature reserves had been established. They covered 86,410,000 hectares or 8.6 percent of the national territory. The eventual target is an even greater ten percent of all land (BWG 1997, SEPA 1998, FAO/UN 2001, Harkness 1998). These reserves are managed by institutions at all levels of government.

The expansion in nature reserves might be expected to yield significant benefits for biodiversity, and for ecotourism and watershed benefits as well. In general, these activities grow rapidly with increasing

⁶ In fact, table 7 reflects impacts of all investment on state lands, including voluntary private investment and international donor investment. However, the latter two have been small in comparison with state investment, and investment by foreign donors has also been recent. Therefore, the government and the retained earnings of the SOFEs have been responsible for the vast bulk of direct impacts on the state forestlands through the period of China's fifth forest inventory.

personal income, and that has been the experience in China. The general tourism data for China show 777,710 person-visits in 1982 (China Statistics Yearbook 2002) rising to 83 million person-visits for forest parks alone in 2001 (State Forest Administration 2002). By 2001, these visits to forest parks contributed 37.3 billion yuan of gross revenue (an increase of 25 percent in only one year) and accounted for 3.5 million jobs.

This is explosive growth, and management problems have come with it. The management focus on these lands has been on revenue generation instead of environmental protection, and some of the protected areas now suffer from pollution and other damage. The information on the management of these protected areas is itself limited or anecdotal, but there is evidence that the quality of management is highly variable and generally poor (MacKinnon *et al.* 1995, SEPA 1998). One of the major problems is that, while central government finances have been released for reserve development, they are usually “once-off” investments that do not provide funding for on-going management operations. The work units responsible for management in each area are encouraged to develop their own economic ventures to meet continuing operating costs. As a result, many types of economic ventures have been established within the protected areas. These include breeding endangered animals for sale, the development of zoos, the establishment of amusement parks, the selling of mounted specimens of rare species, illegal cutting and cultivation of timber, poaching of wildlife, and uncontrolled ecotourism. All can assist in bringing financial resources into the system, thereby helping to finance the objectives of protected area management. On the other hand, many conflict with the declared objectives of protected natural reserves.

Finally, there is watershed protection. In the wake of widespread flooding of the Yangtze and Yellow Rivers in 1998, the SFA proposed the Natural Forest Protection Program as a large scale scheme to protect over 95 million hectares of natural forest by 2010. The program has two central components, natural forest protection and afforestation. The State Council has committed 96 billion yuan (US\$13 billion) over ten years to finance the program. Its success can only be determined with time.

1.6 Conclusions and Prognosis

China began its transition from a planned economy to a market economy in 1978. In the quarter century since then private participation has increased in all sectors of the economy. For the forestry sector the management patterns of the collective forests and the state-owned forests were very similar before 1978. The state provided the majority of investment, and it controlled the procurement and distribution of forest products from both classes of forest. Reform and deviation between the management patterns of the two classifications of forests began when rural households were allowed to contract for the collective forestlands in the late 1970s and early 1980s.

The central government’s role in the management of the state-owned forests continued, and its financing of these forests even increased through the mid-1990s. Reform in the state-owned forest sector began with the separation of wood processing and forest management. The wood processing industry is now largely privatized. It had to privatize in order to compete with more efficient TVE wood processing enterprises.

Reform in the state-owned forests themselves is still experimental, restricted to only a few bureaus. The one bureau in which general reform has occurred is still seeking state endorsement of its changes. Auctions of wastelands to private individuals, the increased discretion allowed managers of SOEs regarding, first, variable capital inputs and then labor, and the decreasing financial contributions of the central government for capital stock—all occurring since the mid-to-late 1990s—provide opportunity for greater reform in the state-owned forests. However, the financial difficulties of most state-owned forests, and the willingness of the central government to continue its financial support for silvicultural activities, have delayed any substantial reform.

The responses of private households to reforms in the collective sector were rapid. First the area of forestland and then the volume of standing forest expanded—and the expansions were substantial. The area and volume of state-owned forests expanded as well, but more slowly, to a lesser extent, and only where there were significant financial inputs from the central government. China’s successful experiences with household forest management since 1978 should be a lesson for all those countries

that are considering some level of transfer of the rights for forest management from the state to local land managers. The lesson is that farmers can and do manage trees and forests. In China's experience, farmers manage for both commercial and environmental values once the government removes some of its interference with farm forest operations and once it provides a stable policy environment and the prices rise to a level that will support forest investment.

The rural landscape improved in many places (although removals from the natural forest continued in others), but the impact on rural welfare is difficult to assess. Rural incomes grew more than six-fold in twenty years—but agricultural reforms and the development of smaller private and quasi-private TVEs were the primary sources. Little is known about forestry's contribution to rural incomes. However, the evidence from the bamboo sub-sector of forestry suggests that, where there was an effect, forestry income generally was a supplement to greater household income from other sources. Households at all income levels benefited from forest development, but better-off households obtained the greatest absolute benefits and middle income households obtained the greatest proportional benefits (Ruiz Perez *et al.* 2002).

The larger unresolved questions for the future have to do with the state-owned forests. Their reforms came later and they are still in an experimental stage. They are the larger focus of current policy and they are also closer to our responsibility in this paper to examine the increasing private role in the activities of state forests.

There are two crucial issues for policy for state-owned forests over the next few years and one broader issue for China's full forest sector. The first has to do with making the state-owned forest more market responsive and with allowing them to participate to a greater extent in China's market driven growth. The central government has promised financial assistance to the SOFEs through the year 2010 while they restructure to become more competitive. It must also allow greater devolution of responsibility to local managers—with fewer constraints on the harvest, sale, and shipment of timber.

The second has to do with large-scale forest investments by the central government. The government has shown it can develop and promote projects like the Green Great Wall and the more recent Western Regional Development Program (WRDP) and the Natural Forest Protection Program (NFPP). Whether these are intended to have direct effects on smallholder forestry operations or only on state-owned forests is unclear. In fact, whether programs like these are well-designed to accomplish their objectives is another matter. Can the WRDP improve rural welfare in the West? Can its reforestation activities and the logging ban correct serious problems of erosion and downstream sedimentation? The answers are not clear at all. In fact, it is not clear that the targets of the WRDP are either the most important sources of erosion or a reasonable means for sustainably improving western household welfare. The government needs to develop the policy analytic skills to examine its policy alternatives before embarking on such large projects.

The broader issue has to do with trade and imports of wood and woodfiber. As the NFPP reduces domestic production, China will need to address an imbalance between domestic demand and supply. That imbalance could reach 25 percent by 2010 (Zhang *et al.* 1997). This could cause increases in imports, encourage wood substitutes, act as an incentive to improve production efficiency and, ultimately, reduce consumption as prices rise. Whatever its impact, however, an effective NFPP will project substantial future changes in the sources of China's woody raw material.

Table 1.1 Economic growth, 1978-1998

	1978 ^a	1998	% change
GDP (1978 monetary value)			
Aggregate	362	2,312	538
GDP per capita	379	1,869	390
Rural GDP per capita	133	945	610
Forest products			
Production (thousand cubic meters)			
Logs	51,673	55,557	7
Lumber	11,055	17,876	62
Wood-based panels	1,017	10,563	939
Paper and paperboard	4,390	21,256	385
Imports (thousand cubic meters)			
Logs	1,870	4,820	158
Lumber	75	1,679	2,139
Wood-based panels	258	1,977 ^b	666
Paper and paperboard	767	5,760	651
Exports (thousand cubic meters)			
Logs	28	63 ^b	125
Lumber	13	255	1,862
Wood-based panels	10	598	5,980
Paper and paperboard	229	250	9
Forest Cover			
Area (million hectares)	115	154	35
Volume (million m ³)	8,801	10,086	15

a. Imports for 1981, exports for 1983.

b. 1997 data.

Sources: China Statistics Yearbook, 2000, SFA 2000

Table 1.2. Forestland area (forest stands in millions of hectares)^a

<i>Region</i>	<i>1977-1981</i>	<i>1984-1988</i>	<i>1994-1998</i>	<i>% change</i>
Northeast				
State-owned	21.37	20.55	23.50	9.97
Collective	2.33	3.96	4.20	80.26
Total	23.70	24.51	27.70	16.88
Northwest				
State-owned	2.48	5.30	5.78	133.06
Collective	1.96	2.80	3.19	62.76
Total	7.24 (4.44) ^b	8.10	8.97	23.90 (102.03) ^b
Southeast				
State-owned	1.32	1.73	2.49	88.64
Collective	10.84	12.01	16.55	52.68
Total	12.16	13.74	19.04	56.58
Southwest				
State-owned	n.a.	8.15	9.42	
Collective	n.a.	12.24	17.39	
Total	23.53	20.39	26.81	13.94
South Central				
State-owned	1.78	2.18	2.55	43.26
Collective	10.32	14.92	22.44	117.44
Total	17.35 (12.10) ^b	17.10	24.99	44.03 (106.53) ^b
North China Plains				
State-owned	13.26	13.11	14.18	6.94
Collective	1.55	2.13	3.43	121.29
Total	14.83 (14.81) ^b	15.23	17.61	18.75 (18.91) ^b
All China				
State-owned	n.a.	51.01	62.01 (57.93) ^c	
Collective	n.a.	48.06	67.19	
Total	98.81	99.07	129.20 (125.12) ^c	30.76 (26.63) ^c

Source: SFA (Forestry Statistical Yearbook) various issues.

^a China's forest survey divides "forests" into "economic forests", "bamboo forests" and "forest stands". "Economic forests" are tree crops like orchards and rubber. "Forest stands" are what most of the rest of the world calls "forests", and they are what we have reported in this table.

^b In China's second inventory (1977-1981), the data from some smaller provinces were included in the total but not in the disaggregation into state-owned and collective lands. The first entry in our "total" row for three regions is the total reported to the national inventory. The entry in parenthesis is the sum of recorded state-owned and collective lands for the larger provinces in those three regions.

^c The entries in parentheses are the sums of our regional data. The larger entry is the official national aggregate.

Table 1.3. Forest resource distribution between state forests and collectives, fifth national forest inventory (1994-1999)

<i>Tenure</i>	<i>Total forest</i>		<i>Forest stands</i>				<i>Economic forests (million ha.)</i>	<i>Bamboo forests (million ha.)</i>
	<i>Million ha.</i>	<i>Million m³</i>	<i>Total</i>		<i>Plantations</i>			
			<i>Million ha.</i>	<i>Million m³</i>	<i>Million ha.</i>	<i>Million m³</i>		
State	63.89 (42%)	7,641 (68%)	62.01 (48%)	7,124 (71%)	7.70 (26%)	378 (37%)	1.59 (8%)	0.29 (7%)
Collective	89.75 (58%)	3,665 (32%)	67.19 (52%)	2,961 (29%)	21.44 (74%)	635 (63%)	18.63 (92%)	3.93 (93%)
Total	153.63	11,306	129.10	10,085	29.14	1,013	20.22	4.21

Source: Lu *et al.* 2002

Table 1.4. Change in Plantation Area (million.ha)

	Area of Closed Plantation	Net Increase Between Inventories
1 st Inventory, 1973-76	23.69	NA
2 nd Inventory, 1977-81	22.19	-1.50
3 rd Inventory, 1984-88	31.01	8.82
4 th Inventory, 1989-93	34.25	3.24
5 th Inventory, 1994-98	46.67	12.42

(Between the period of 4th and 5th inventory, an area of 1.75 million ha. of plantation forests were degraded to open forests, shrubs, or barren land, and 1.66 million ha were converted for other types of land use. The estimated loss in plantation area was 6.69 million ha, 1.34 million ha per year. This was more than offset with 19.01 million ha. of new plantation)

Table 1.5. Plantation Development and Growth

Gross Plantation Area	Total	State	Collective	Share of Collectives
1984-88	18.74	5.48	13.26	0.71
1989-93	21.37	6.24	15.13	0.71
1994-98	29.14	7.70	21.44	0.74
Volume of Plantation				
1984-88	529.85	213.20	316.65	0.60
1989-93	711.98	295.27	416.71	0.59
1994-98	1012.99	378.33	634.66	0.63

Source: SFA 2000a

Table 1.6. Overview of main afforestation programs since the 1970s

Name of program	Years	Coverage (area)	Targets	Achievements to date
National Greening Campaign: the National Compulsory Tree-Planting Campaign	1987-current			1987-1997, 27.9 billion trees planted
Three-North Forest Protection Program	1978-2050	551 counties in 13 provinces; 40.6 million hectares (50 per cent northern China)	Afforestation of 35.08 million hectares by 2050	25.67 million hectares planted by 1999
Shelterbelt Development Program along the Upper and Middle Reaches of the Yangtze River	1989-2000	271 counties in 12 provinces	Afforestation of 67.05 million hectares	1989-1999, 4.8 million hectares planted
Coastal Shelterbelt Development Programme	1991-2000	195 counties in 11 provinces	Afforestation of 3.56 million hectares	1991-1999, 1.08 million hectares planted
Farmland Shelterbelt Development Program in Plain Areas	1988-2000	918 counties in 26 provinces	Set standard	1988-1999, 850 counties reached standard
Taihang Mountain Afforestation Program	1990-2010	110 counties in 4 provinces	Afforestation of 4 million hectares	1990-1999, 3.28 million hectares planted
National Program on Combating Desertification	1991-2000	598 counties in 27 provinces	Control desertification in 7.186 million hectares	1991-1999, desertification controlled in 8 million hectares
World Bank Loan National Afforestation Project	1990-1997	306 counties in 16 provinces	High-yield fast-growth timber forests	1.39 million hectares of new plantation

Source: Adapted from D. Zhang 2002

Table 1.7. Timber resources on state forestlands: 1981 to 1998

	1981	1988	1993	1998	1988-93	1993-98	1988-98
	<u>Forested area (million ha.)^d</u>				<u>% Change^d</u>		
Northeast	21.4	20.5	21.5	23.5	4.6	9.4	14.4
Northwest		5.3	4.9	5.8	-6.7	16.9	9.0
Southeast	1.3 ^a	1.7	2.0	2.5	16.1	23.8	43.7
Southwest		8.2 ^c	12.1	13.5	48.3	11.7	65.7
South-central		2.2	2.3	2.5	6.8	9.7	17.1
Northern	13.3 ^b	13.1	13.5	14.2	2.8	5.3	8.2
Total		51.0	56.3	62.0	10.4	10.1	21.6
	<u>Forest inventory (million m³)</u>				<u>% Change</u>		
Northeast	2102.8	1980.9	2070.0	2151.9	4.5	4.0	8.6
Northwest		550.6	558.0	618.7	1.3	10.9	12.4
Southeast	79.1 ^a	110.4	140.7	175.3	27.5	24.6	58.8
Southwest		1594.5 ^c	2818.0	2961.7	76.7	5.1	85.7
South-central		156.1	182.7	191.7	17.0	4.9	22.8
Northern	880.1 ^b	901.7	936.1	1024.9	3.8	9.5	13.7
Total		5294.3	6705.6	7124.2	26.7	6.2	34.6

Sources: SFA 2000a

^a Excluding Shanghai.

^a Excluding Tianjin.

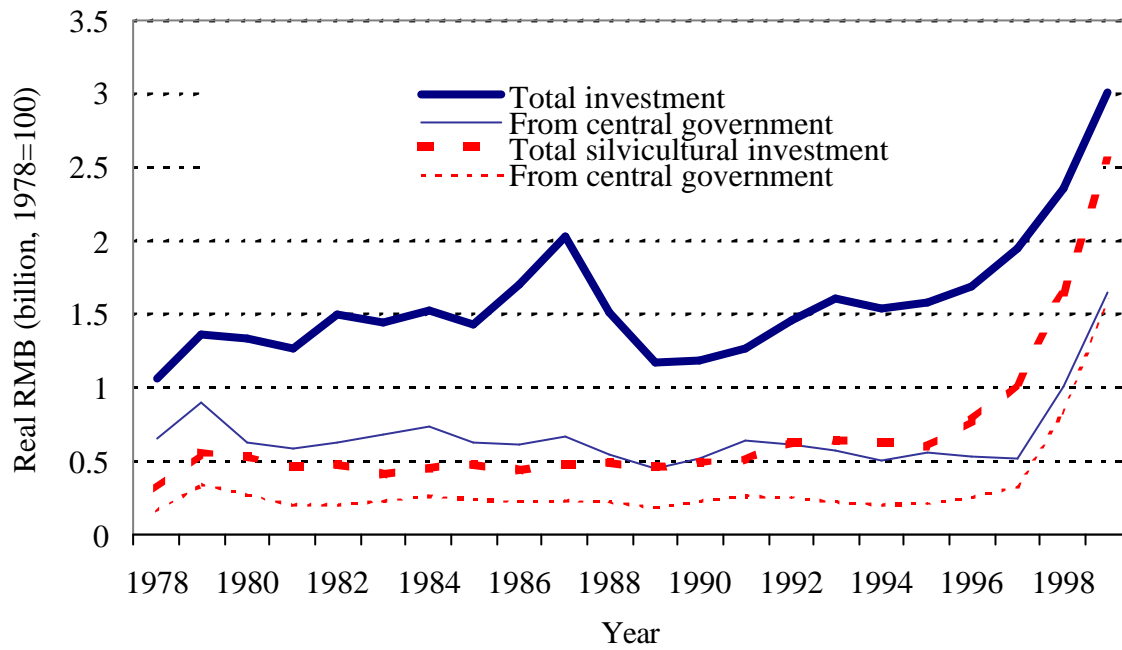
^c Excluding Tibet.

^d Note that the standard for forested land was changed from 30% to 20% forest coverage in the 1998 survey. This change accounts for some of the increase in forested area between 1993 and 1998 but it has no effect on the measure of standing forest volume.

Figure 1.1. China and its Provinces

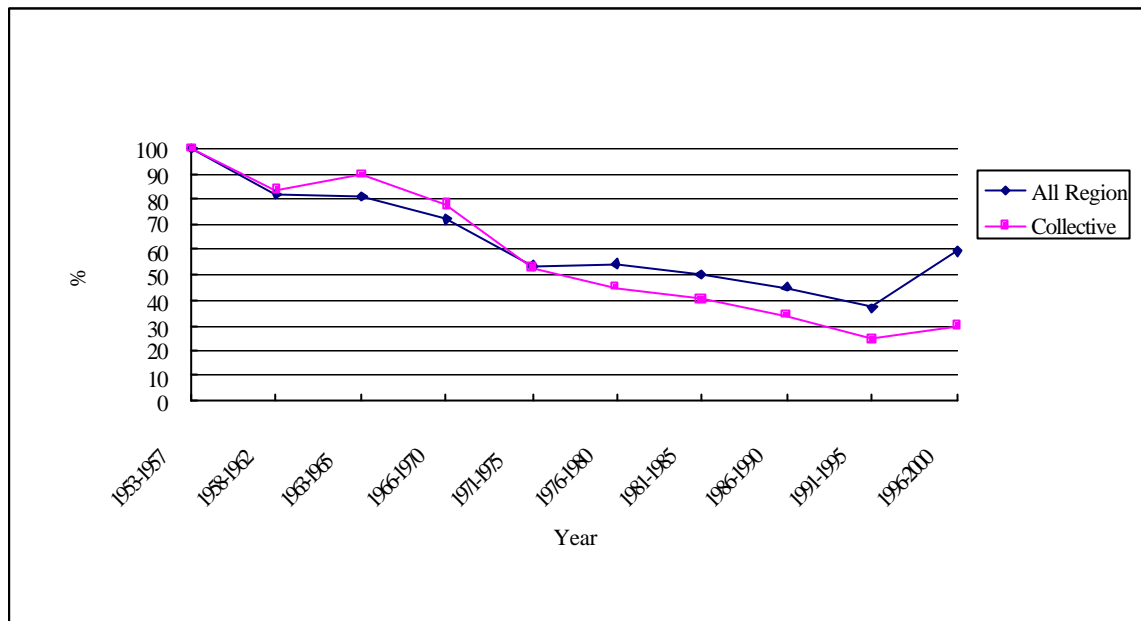


Figure 1.2. State investment in state-owned forestry enterprises



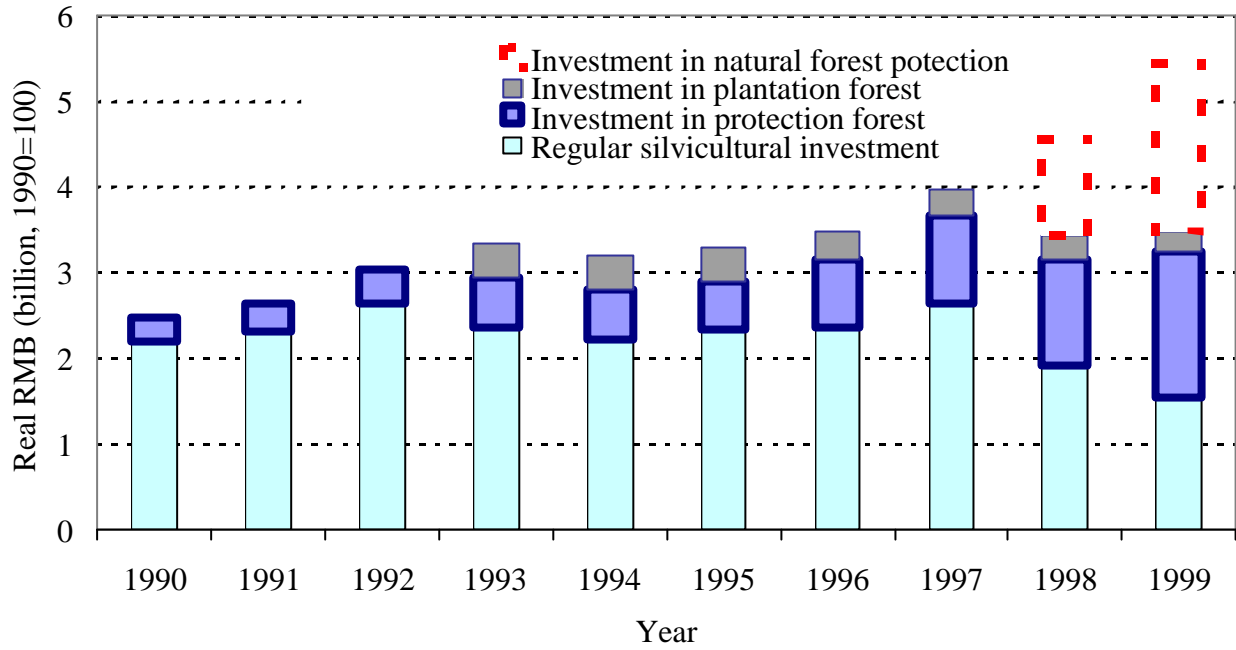
Source: China Statistical Yearbook 2000.

Figure 1.3. Share of central government investment in afforestation



Source: SFA 1949-87, 1987 to 2001

Figure 1.4. Regular state silvicultural investment, and project-based investment (in billions of real 1yuan)



Source: SFA 1987-2001