

Mission Greening:
Strengthening Market Forces to
Develop Commercial Forests in China*

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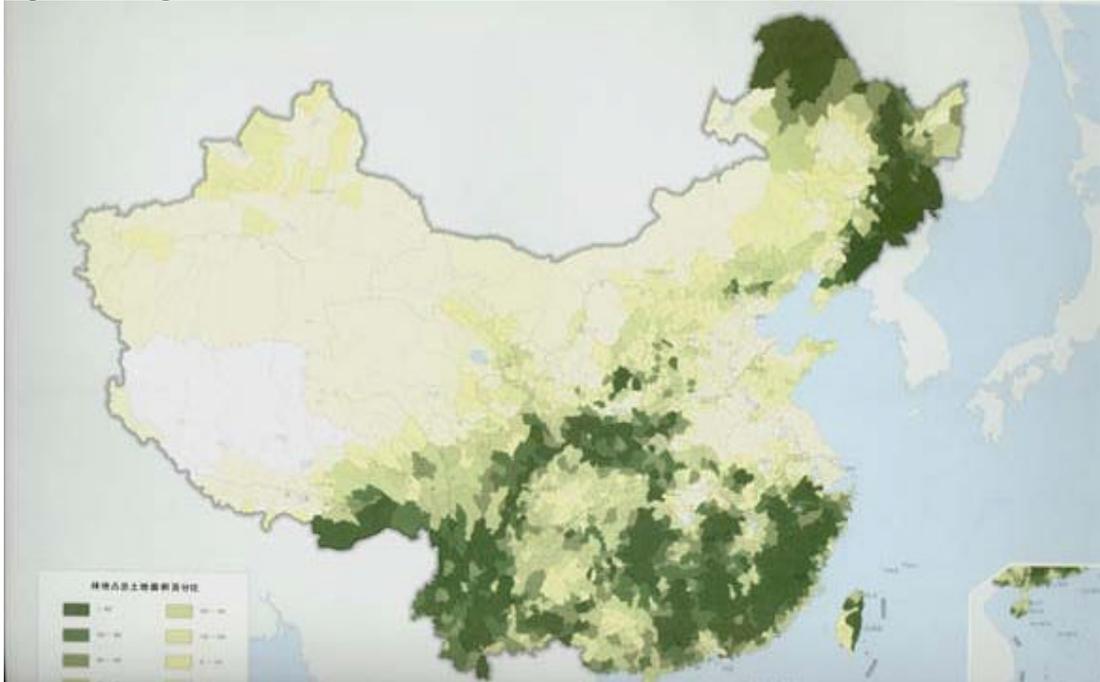
Abstract

On one hand, there are more than 100 million hectares of blank forestland suitable for planting and several hundred of millions of surplus rural laborers in China. On the other, however, forest resource is extremely scarce in China: the forest cover and volume per capita are merely 20% and 12% of the world average respectively; the absolute amount of mature forest has been falling. Based on the presumption of economic man, this paper explores how to encourage people to invest in forest plantation by providing economic incentive through the improvement of property rights to forests and the cut of the tax and fee on timber.

I. Status and Analysis of the Forest Resources in China

According to the National Forest Resources Statistics for 1994-1998 (China Green Times, 2000)¹, the status of the forest resources in China could be described as “Two Increases” (of forest cover and volume): when compared with five years ago, forest cover increased by 13.7 million hectares, with total forest cover 159 million hectares at the end of 1998 (Figure 1.0), which ranked 5th in the world and accounted for 16.6% of landmass; forest volume was 0.6 billion cubic meters more than five years ago, with total volume 11.27 billion cubic meters, which ranked 7th in the world.

Figure 1.0 Map of the Forest Cover in China

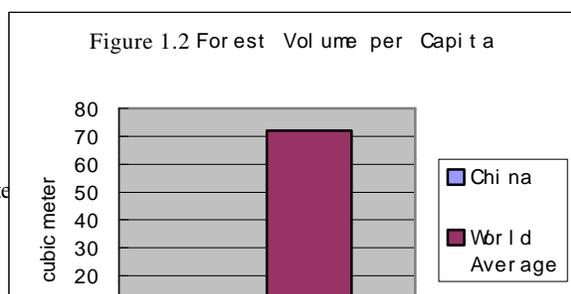


The “Two Increases” are great achievements, especially when it is taken into consideration that forest cover decreased during 1990-95 by 1.6% worldwide and 3.3% in developing countries (State of World’s Forests 1999).

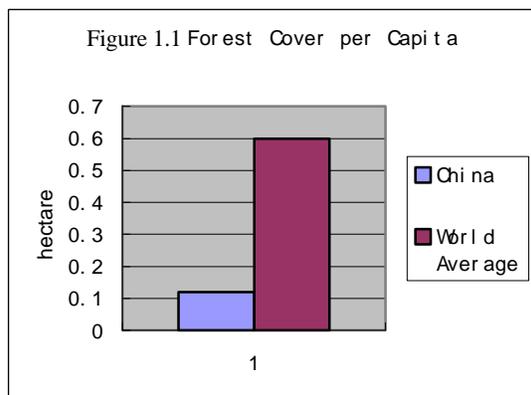
However, the picture is not encouraging from other viewpoints.

(1) China has a large population, which was 1.27 billion in 1999. When the total forest cover and volume listed above were divided by such a large population, forest

¹ Data in this section come from this source unless indicated otherwise.



cover per capita in China was as low as 0.12 hectares and forest volume per capita 8.67 cubic meters at the end of 1998. By contrast, the world average forest cover and volume per capita were 0.6 hectares and 72 cubic meters respectively. The forest is so scarce in China that its level per capita is lower than one fifth of the world average in both terms, while the per capita level of cultivated land, the symbol of natural resource shortage in China, is about one third of the world average.



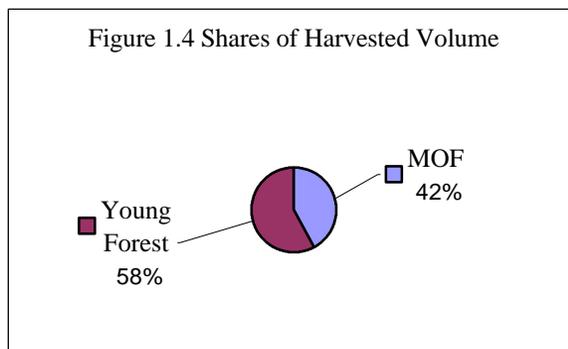
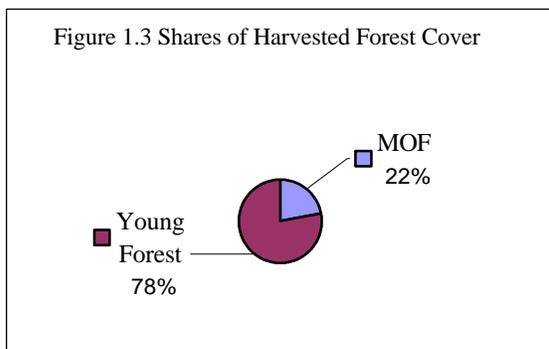
(2) The unit volume of China's forests, an important indicator of the quality of forests and the efficiency of forestland, was only 71 cubic meters per hectare at the end of 1998, 62.2% of the world average. Furthermore, the unit volume was lower than that five years ago because many young forests were planted during the recent years.

(3) The fraction of Mature and Over-mature Forests (MOF) was too low, and the proportion was falling. The cover of MOF accounted for only 25.6% of that of all timber forests, with a net loss of 172 thousand hectares during 1993-98. The volume of MOF kept falling even since the establishment of P. R. China in 1949. It lost a volume of 160 million cubic meters during 1993-98 and fell from 3.85 to 2.62 billion cubic meters, i.e. decreasing by 31.83%, during 1981-93 (Hou Yuanzhao, 1995). As an extreme example, the volume of MOF in Heilongjiang, a province that holds the richest forest resources in China, fell from 686 million cubic meters to 7.25 million cubic meters during 1949-96, which means 99% was lost (Kong Fanwen, 1998, 72pp).

As a consequence of the rapid consumption of MOF, young forests accounted for 74% of timber forests and 71% of all kinds of forests (including timber forests and other kinds of forests). When compared with MOF, young forests have a much lower volume per hectare, which is only half of that of MOF, produce less usable wood and

provide much less ecological value.

Since there were not enough MOF, young forests had to be harvested to meet the strong demand for wood. During 1994-98, the forest volume harvested from MOF was only 42% of all, and MOF accounted for only 22% of all harvested forest cover.



From the three perspectives above, the authors are cautiously pessimistic of China's forest status and differ from the "optimum" attitude of World Bank OED (World Bank OED, 2001).

How was the worrying status caused? To answer this question, the authors have a retrospect of the past half a century since the establishment of P. R. China and provide three explanations.

(1) The demand for wood soared due to the initiation of industrialization and population growth. China had a population of about 0.5 billion in 1949 when the P. R. China was founded, but the population increased to 1.27 billion in 1999².

As an example of the negative effect of industrialization on forests, China organized a nation-wide mass movement in 1958 to enlarge the output of steel and iron, which were regarded by the government as the sign of industrialization and the indicator of the general strength of a country. Steel and iron-making stoves were built in almost every village, and forests were harvested to an amazing extent for providing fuel wood.

(2) The price of wood was set quite low before the mid 1980s, stimulating more demand and less supply. To complete industrialization as quickly as possible, China chose the planned economy mechanism (Justin Lin, 1999), which set low prices for primary products and transferred economic surplus from agriculture and forestry to

² The population growth rate in China has decreased considerably. In 2000, it was only 0.88% and lower than that found in the US.

heavy industries.

(3) The supply of wood was constrained by institutional factors.

Low prices on primary products including wood couldn't be automatically accepted by producers if they were self interested, a basic presumption in economics. One way to change producers from self interested to non-self interested was to implement public ownership, which could be divided into two types: owned by all people in a country or collectively owned by people in a community (brigade, village or commune).

Under public ownership, there were so many co-owners that no one was real owner, i.e. no one had sufficient incentive to protect and develop forests. For every owner, he/she must bear all the input of protecting and developing forests, but he/she could obtain only a negligible share of added output because his/her input into forests that were widely scattered couldn't be recorded accurately with acceptable costs and egalitarian became the only pattern of interest distribution.

Another factor that constrained the supply of wood was the heavy burden of tax and fee on wood. The detailed description and analysis can be found at Section III.

In addition, ten years of Cultural Revolution during 1966-76 was also a detrimental event to the supply of wood and the development of forests in China. In the Revolution, official organizations of government, law and legislation were totally abandoned, many officials were persecuted, normal policies and procedures in production were disregarded and education units were stopped teaching and recruiting new students (Forestry Ministry, 1999). As a result of these dramatic changes in administration and lack of supervision, forests were consumed rapidly. The volume of timber forests fell by 0.5 billion cubic meters during 1962-76 (Kong Fanwen, 1998, 5pp).

After price was liberalized, improvement on timber supply side is believed by the authors as the key to develop forests in China. So it is discussed in detail in this paper.

Low quality of forests (low volume per hectare) and falling share of MOF demonstrate that the supply side has no incentive to invest in plantation and daily administration of forest. But the problems on supply side cannot be better demonstrated than by the fact that on one hand China's forest resource per capita is extremely scarce and on the other hand there are a large proportion of blank areas that

are suitable for forest.

Within 9.6 million square kilometers of China's territory, 26.5% are potential forestry lands. Nonetheless, the forest coverage rate, though creeping up at an unbearable speed, is just over 16.6%, whereas the world average rate is 22%. The rate of utilization (i.e. the ratio of the area actually planted with trees to potential forestry lands) is merely 60%, while the rates in countries like America, Germany, Japan, Finland and Korea are over 90%.

To let people plant trees in potential forestry lands, there are several ways to choose. Besides moral edification³ and enforcement, the left way is to guide with economic incentives. Then people will act in light of the principle of self-interest, but they can benefit the society much better than other ways as Adam Smith pointed out. In the long run, only voluntary participation (though guided by economic incentives) can assure continuous input into and real sustainability of forests. As an opposite example, China's forest resources fell into worrying status because economic incentives were abandoned after the establishment of public ownership. How to provide economic incentives is the core question of this paper.

The rest of this paper is organized as follow: Section II provides a literature review and analytical framework for the discussion of the role of property rights in the development of forests and examines the practices of China; Section III explores the Internal Rate of Return (IRR), a direct indicator of profitability, of forest plantation projects and the burden of tax and fee on timber; the paper ends with description of social and external externalities of commercial forest at Section IV and a conclusion.

³ For example, planting trees is widely regarded as the responsibility of a citizen while destroying trees is considered as immoral behavior.

II. Property Rights

2.1 Literature Review and Analytical Framework

The theory of PRs is attributable to generations of philosophers and scholars. It was first discussed in the section of David Hume's *A Treatise of Human Nature* entitled "Of Property and Riches" and further developed by Alchian (1965a, 1965b), Demsetz (1966, 1967), and Alchian and Demsetz (1973).

PRs define relations among human beings and specify the norm of behavior with respect to scarce resources (Pejovich 1990). Specifically speaking, PRs determine the distribution of gains and losses, and resolve conflicts in the course of resource use (Alchian and Demsetz, 1973; Seitz and Hadley, 1975).

PRs can be said to be complete if they are comprehensive, exclusive and transferable (Randall 1975; Bromley 1989; Feder and Feeny 1991). Transferability requires that PRs must be transferable to another agent in a voluntary exchange. If so, the selling side will be able to adjust the structure of his/her wealth and resolve the problem of liquidity, which is very important for long-term investment that is enormous in scale. For the buying side, who is usually more productive than the selling side, transferability makes it possible for his/her to own the property and use it more efficiently.

Comprehensiveness implies that the property is secure from involuntary seizure or encroachment by other economic agents, including the state. Exclusiveness means that all benefits and costs pertaining to the use and/or disposal of property accrue to the owner. If PRs are comprehensive and exclusive, on one hand people cannot seize or encroach the property of others and have to put their efforts into production activities to get rich; on the other the owner is encouraged to accumulate property and to use and/or dispose their property in the best way. Besides these two ways to increase aggregate output, comprehensive and exclusive PRs also make people give up opportunism and start to cooperate.

In human history, the properties of people of low status were often encroached by those with privilege power. With such an unfair play, the history has been replete with violence and conflicts. So, the protection of PRs is not to cater to those with privilege, but really a common good for the whole society especially for the vulnerable groups and the prerequisite for the market system to emerge and for human society to step up into prosperity.

In reality, PRs face kinds of natural or factual constraints and may not be exclusive, let alone complete. For example, the right to ownership and the use right are often separated: the owner becomes a principal and forms a contract with an agent, who will manage the property and obtain some of its benefits. Such a kind of collaboration may be beneficial to both sides not only because their advantages in either property or management can complement, but also because each side has its own attitude towards risk. Some owners prefer not to bear the full risk of the production process and need agents to share it. Agents are willing to share the risk of the owners because they will be compensated with premium.

However, the separation of PRs also leads to the problem of transaction cost (there is no transaction cost if the owner himself/herself manages the property), which includes “the costs of discovering exchange opportunities, negotiating contracts, monitoring and enforcing implementation, and maintaining and protecting the institutional structure” (Pejovich 1995, p.84). One of the biggest problems in monitoring and enforcing contracts about the separation of PRs is incentive problem, i.e. the agent takes advantage of the principal’s difficulty to monitor his/her efforts in management and shirks his/her duties.

Another example of non-exclusive PRs is the existence of externality or spillover effects such as pollution or environmental conservation. Externality means that the total costs and benefits of the property are not symmetrically borne by the owner, who may either enjoy all the benefits but bear only a part of costs, or bear all costs but enjoy only a part of benefits. In the former situation, the owner may use this/her property in a way that is worthwhile to himself/herself but harmful to the society, while in the latter situation he/she may choose not to provide or provide less than optimal positive externalities.

The best way to meet the problem of externality is to internalize the externality by punishing or compensating specified behaviors. But government often deems that compensation is too expensive and ineffective in administration. So compensation is often replaced by direct regulation, which limit the freedom of the owner to use and/or dispose his/her property. However, regulation also entails cost, which is seemingly little but may be actually larger than compensation.

The final example of non-exclusive PRs is public ownership, under which the costs and benefits of the use and/or disposal of the property are very difficult to be

distributed symmetrically among co-owners as discussed in Section I. The types of PRs and their characteristics and implications for economic incentives are listed in Table 2.1.

Table 2.1 Types of PRs

Types	Characteristics	Implications for Economic Incentive
Private Property	Exclusive rights assigned to individuals	Strong incentives for conservation of resources and for investment as well
State ownership	Rights held in collectivity with control exercised by authority or designated agency	Creating opportunities for attenuation of rights; managers have incentives for personal gains
Communal Ownership	Exclusive rights assigned to all members of a community; approaching private property	Creating free-rides problem and low incentives for conservation
Free access	Rights unassigned; lack of exclusivity	Lack of incentives to conserve; often resulting in resource degradation

Source: Wang & G. Cornelis van Kooten, 2001, p. 15.

Even though PRs are complete, there are still 4 conditions for PRs to function well: properly acquired, clearly defined, strictly enforced and secure over the longer term. The sources of property are not paid much attention in the theory of PRs, which may be attributed to the fact that in countries where the theory of PRs was developed, the sources of property are primarily individual efforts, stable for a long time and are known by everybody. In developing especially transitional countries, however, PRs have undergone and are undergoing upside down transformations due to both individual efforts and macro-level changes. As a result, the owner may not give an absolute positive answer of “Yes” to the question “Is the property yours?”

The condition of “clearly defined” means that it is very easy to know the physical location and scope of the property and that the division of rights and duties of involved parties are specific. If PRs are not clearly defined, there will be a huge amount of conflicts and litigations, which are very expensive and zero-sum games from the viewpoint of economics. However, the process of defining cannot be done without cost. If the cost of defining is larger than the benefits, i.e. proper functioning of PRs, defining will be not worthwhile.

“No PRs, regardless of their degree of comprehensiveness, transferability and

exclusiveness, can be held without some assurance that there is proper enforcement of those rights by the state. That is, in a complex society, property rights only exist because the state permits them to exist. Without adequate enforcement, de jure private property rights become de facto open access, a scramble for the benefits from property that is open to all.” “Complete PRs are established in law. That is, de jure rights exist if PRs are given lawful approbation by formal, legal institutions – they are protected by law that is upheld by the state. Such de jure rights from the predominant system govern the land use in developed nations. In many developing nations, de jure rights either do not exist or are not upheld by the state. Thus, there is greater reliance on de facto rights, on what is not opposed and thus possible, although not necessarily legal or explicitly recognized by government.” (Wang & G. Cornelis van Kooten, 2001, p. 13-14)

The state has the power to enforce PRs, but the power can also be used to encroach or seize. In transitional countries, state ownership still accounts for a large proportion of the economy. So the state plays two roles. One is the owner of state-owned properties, and the other role is traditional, i.e. providing public goods and policies for the society. These two roles may be in conflict, and the former role may be superior to the latter one as it is directly related with bureaucratic individuals’ interests. So there is ownership bias and private ownership is discriminated.

Even there is no state ownership or ownership bias, the state may encroach or seize as well because the state is a huge organization and needs money to maintain and increase its scale. If collected tax is not enough, the state will increase tax rates rather than cutting expenditure if proper supervision and control by taxpayers are not in place. The extra tax is the encroachment of private property.

The final condition is “secure over the longer term”. This is a very important condition since people need time to build their confidence on the stability of PRs and to form firm expectation about the future. If PRs are changed frequently, people will not believe that current PRs will continue as time passes by, and they will become opportunistic although PRs are complete, properly acquired, clearly defined and strictly enforced. For transitional countries, this condition is hard to meet because of rapid transformations.

2.2 Application of the Theory of PRs to the Forestry in China

2.2.1 Historical evolution and its implications

For more than 2000 years in China's history, most types of land including forestland had been privately owned and could be traded freely. Under such a pattern, forests were usually concentrated to the rich or the landlord as an apparent sign of income gap. Since no data about forest ownership were found, the data about farming land ownership is used here as a proxy. Landlords and "rich peasants", 9.4% of the population in rural areas, owned 52% of all farming land, while "poor peasants", 52% of the population in rural areas, owned only 14% of all farming land (Editorial Board of Ministry of Agriculture, 1999). The inequality was ascribed to the exploitation of the landlord. So the government took land including forestland and forests from the landlord for no compensation and allocated them except those huge forests to forest dwellers for no charge when the Republic of China was overturned by force and P. R. China was founded in 1949 (huge forests became state-owned and did not experience the transformation discussed as follow). However, peasants were so poor that they had few production means such as livestock and the plough, which led to the emergence of peasant cooperation groups. A group had about 6 households and exchanged production means that were privately owned.

During 1953-56, Socialist Transformation was organized by the government to spread public ownership and establish command economy. So the fraction of peasant cooperation groups increased. In addition, primary "artel", which had about 20 households, was experimented.

In the spring of 1956, local governments were urged to transform peasant cooperation groups and primary artels into advanced artels, which had about 100 households. Unlike peasant cooperation groups and primary artels, advanced artels abandoned private ownership to land and production means. Within one year during 1955-56, the fraction of advanced artels increased from 0.033% to 89.2% (Editorial Board of Ministry of Agriculture, 1999) through coercive policy.

In 1958, advanced artels were further transformed into communes, which had about 5,000 households. The results of these transformations were public ownership that had more and more co-owners: from 6 households to 20, 100 and even 5,000 households. The more co-owners, the more difficult to associate individual's efforts with income, the more serious of the drawbacks of public ownership. In addition, the transformations were completed in a very short time, under political pressure and

without accurate measurement and recording of assets and debt, making room for an enormous number of potential conflicts.

After market-oriented reform and opening-up were launched in late 1970s, communes were abandoned, and forests became owned by advanced artels or villages again. In most areas, however, the property rights to trees are separated from those to forestland, and the final ownership to forestland is separated from its use right as a compromise between privatization and pure public ownership. The final ownership to forestland belongs to villages (Currently, 55% of all forestland in China is collectively owned with 45% State-owned), while the use right to forestland and the property rights to trees are allocated equally for no charge to forest households, i.e. private forces, to encourage them to put efforts into forests. To be equal, the allocation will be organized every a few years to allocate forests to the newly added population. So forest households cannot manage a forest for a long time.

In Fujian and Guangdong Province, however, a new mechanism, Stock and Cooperation Mechanism, instead of separation of rights was implemented. The mechanism introduced “Do not Allocate Forestland but Stock! Do not Allocate Stands but Dividends”, under which forestland and stands remain collectively owned and managed by the collective organization of Forestry Stockholder Committee. Stockholders are forest households and get dividends as a return of their ownership. Meanwhile, they will be paid according to their efforts put into forest management. In 90s, however, this mechanism proved obsolete and will face separation of rights as well.

In 1992, a new policy was put into action in the Lvliang (or Luliang) County of the Shanxi Province and spread quickly across China. The policy was the auction of collectively owned Four Barrens (untreated but plantable barren hills, barren gullies, barren shoals, and barren land/desert). This market-oriented approach deserves applause. In some areas, however, Four Barrens also include a part of forestland whose use right and the property rights to stands on which have been already allocated to forest households. These households will lose their rights after auctions for no compensation.

In light of the theory of PRs introduced in Section 2.1, one can conclude from the description above that: 1) The acquisition of PRs to forests was not through individual efforts but through the allocation by the government, who seized the forests from

landlords and “rich peasants” by force. Both the seizer and allocation were not accompanied by monetary flow in the opposite direction as compensation or charge, and allocated forests seemed like free lunch for the new owners, who will have no reasons to complain if forests are taken away for no compensation in the future. 2) The changes of PRs have been frequent and fundamental and completed rapidly. As a result, it is hard to meet the two conditions for the owners to make long-term investment: “Clearly Defined” and “Secure over the longer term”. In contrast, the PRs to every forest in Germany have a record of more than 300 years (Xu Zairong, 2001).

2.2.2 Separation of rights: pattern and term

“The procedure for allocating the use right to forest land and stands to households was as follows: In Brigades with large areas of forest land and stands, all forested lands were divided into blocks according to different tree species, age classes and distance to villages. Each block was divided into several plots based on population and household size. Farmers chose their plots by ‘drawing lots’ (Kong Fanwen, 1998).”

Such a kind of allocation is usually within one village (i.e. a closed circle), equally divided per capita or per labor and at no charge. The closed-equal-free pattern has many drawbacks. The first one is the fragmentation of forestland, i.e. forestland managed by one household is scattered on several hills, or one hill is divided into many plots for many households. For example, one household with 3 persons was allocated one dozen of plots: the largest plot was 0.2 hectare with the smallest only 0.03 hectare; the plot with the longest distance was one dozen kilometers away. Fragmentation makes it difficult to specify the scope of responsibility and to protect, foster and harvest forests. (Forestry Bureau of Huizhou, 1987)

The other drawback is that the value of forestland cannot be maximized because those who have competition advantage over forest management cannot get more forest than those who do not have competition advantage.

In the 1990s, auction emerged as a way to allocate the use right to collectively owned forestland. Auction abandons free allocation. The required payment reduces the number of demanders, and thus average unit becomes much larger than under closed-equal-free pattern and fragmentation is avoided. In addition, forestland is concentrated to those who have competition advantage in forest management, and the value of the forestland increases. For example, there is a 13.3 hectares’ Hejiagou

Drainage Area in the Qujing village, Lan County, Luliang, Shanxi Province. The price of the area was set at 500 Yuan per Mu⁴ at the beginning of auction and rose to 1600 Yuan (Yao Xinzhang, 1993).

For those villagers who do not or fail to buy forests through auction, they will get money directly or indirectly that is paid by the buyers. For example, the fund collected through auction could be used for public goods such as construction of roads and bridges. They can also be employed by the buyers. So their interests are protected and increased due to the more efficient use of resource.

In many cases, however, the auction is still limited to be within a village in the name of providing preferential price to internal villagers, who are also owners of collective forests. Preferential price is lower than market price, so it transfers collective properties to contractors, encroaching the interests of other owners and triggering complaints from non-contractors about unequal allocation.

Besides the pattern of allocation, the term of allocation is also important. The natural and monetary cycle of the forest from plantation to harvesting is usually dozens of years. If the term of allocation is not long enough, it is impossible for the owners of the use right to forestland to make long-term investment into forestland improvement; instead, the owners will focus on exploiting forestland to the greatest extent at the expense of sustainability. According to the experiences of Canada, the term is better to be two natural cycles for timber forest.

For collectively owned forestland, one problem associated with long-term allocation with payment required should be considered. The payment is controlled by Villager Committees, the executive organizations of collective properties, which usually do not publish their accounts. Since villagers have little control of Villager Committees, they may be reluctant to see all forestland and stands be transferred at a long term, leaving no hope for the future. As a remedial measure, it is better to specify the maximum amount of forestland and stands that can be transferred within one term of a Villager Committee. Meanwhile, accounting transparency must be required.

2.2.3 Transferability (live-tree market)

The forest has a long production cycle, which not only increases the risks involved during the cycle but also reduces the liquidity of the capital invested. Furthermore, the “sunk capital” at the first year is so large that it accounts for half of

⁴ About 0.066 hectare

all investment. One effective way to deal with these problems is to set up a live-tree market in which a plot of living trees in any kind as well as any size can be traded at any time. Another significance of the live-tree market is to provide a price signal concerning specific species. Price signals can help the supply side to judge whether his/her projects are profitable and to adjust their investment accordingly.

Through transfer, the buyers can take advantage of their strength in capital and technology to manage forests better and realize increasing return of scale. For example, one does not need to increase the aggregate cost for road building, and averaged cost for road building will fall if the bought forest is located near his/her own.

Despite the live-tree market's importance, it hasn't developed well. Not until the 1990s did several provinces promulgated official regulations. In the Fujian Province, a regulation was passed by the Provincial Standing Committee of the People's Congress in 1997 and became the first local law about live-tree market in China.

Reasons of the retarded development include the forestry industry's lack of attraction caused by problems of property rights and heavy tax. It is not surprising at all that there are a few buyers but many sellers, leading to unsatisfactory prices for the supply side. Usually, buyers are State-owned forestry centers, the Forestry Ministry and wood-based companies. Ironically, many State-owned wood-based companies, such as the Yonglin Company investigated by the authors, are willing to buy live-tree just because they can enjoy preferential tax rate on timber. A small number of private businessmen are buying live-trees as well, but their buying is based not on current profitability, but on strong expectation about tax cut in the future.

2.2.4 Externality and freedom to harvest and sell

Before the reform era, state-owned agents distributed timber according to plans at an artificial price, which was usually very low. This pattern was partially broken when Two Track Prices appeared in 80s and timber was divided as planned timber and non-planned timber. The price of planned timber was lower than that of non-planned timber. The proportion of non-planned timber increased in the process of reform. In 1993, the proportion was 92.8% and reached 100% in 1998.

In 1985, timber in the Southern China Community Forest Area was able to be freely traded, and the price almost doubled when compared with 1984 (China Forestry Yearbook, 1949-86). The free-trade policy, however, was reversed in 1987 when the

State Council announced Document No.20 as a response to the over-harvesting that emerged after the free-trade policy. The document prohibited free selling and purchasing of timber and required all timber be purchased by an agent managed by Forestry Ministry.

Monopolized purchasing inevitably brings about low price of timber, income decrease and absence of devotion to forest plantation for forest households, the majority of whom live in mountainous areas and are poor. For example, the ratios of Purchasing Price (PP) to Selling Price (SP), regardless of the location, were usually lower than 50% and fell with time (Table 2.2). The ratio fell from 57% in 1985 to 40% in 1987 in Qiandongnan, Guizhou Province, and the ratio of Longjin county, Zhejiang Province also fell from 52% in 1987 to 44% in 1988. The falling of the ratio displayed that a considerable percent of the value of timber was shifted from those who planted and managed trees to those who monopolized purchasing.

Table 2.2 Timber purchasing prices and selling prices

Year	Place	Species	Purchasing Price (PP) ⁵	Selling Price (SP) ⁶	Ratio of PP to SP
1985	Qiandongnan, Guizhou province	average	148	259	57%
1986	Qiandongnan, Guizhou province	average	129	289	45%
1987	Qiandongnan, Guizhou province	average	184	460	40%
1987	Longjin county, Zhejiang province	fir log	419	806	52%
1988	Longjin county, Zhejiang province	pine log	143	324	44%
1994	Qianyang, Hunan province	fir log	170	530	32%

Source: Kong Fanwen, 1998

Along with monopoly purchasing, cutting quota was also strengthened. The quota is initially proposed by the Forestry Ministry at the county level or by State-owned forestry centers and finally approved by the State Council. The quota is set every five years, and the balance of the quota for a year cannot be moved to other years. As the supplements of the cutting quota, quotas in timber's transportation and processing are also implemented.

Quotas involve too many trifles, and their operational cost is too high. For

⁵ Price at which the Forestry Department purchases timber from forest farmers.

⁶ Price at which the Forestry Department sells purchased timber to local wood-based companies or local timber wholesalers.

example, whether or not it is for self-use, the harvesting of trees with a diameter of more than 5 cm should apply for a cutting quota, and where and how to harvest should be designed by specified organizations. Moreover, the transportation of timber, even used timber from a demolished house, should apply for a transportation certificate.

Besides high operational cost, the process of allocating the cutting quota is full of problems. In some areas, especially at the village level, the quota is allocated according to the number of people, and the households with little harvestable forests are allocated the quota too. In other areas, the cutting quota is allocated in a black box, and those who have a personal relationship with the Forestry Ministry and its divisions acquire a privilege (Cheng Shuigen, 1999). The selling of a cutting quota has also appeared, which fully displays the rent-seeking chance of a cutting quota. For example, the Forestry Bureau of the Ji'an county, Jiangxi Province allocated a cutting quota of 20 thousand cubic meters of timber to the Forestry Merchant Company, which sold the quota to households or timber mongers at a price of 40 Yuan⁷ per cubic meter (Liu Mingyan, 1993). The selling of quota is more efficient in deploying resources than any other means of allocation, but a large amount of money is transferred from producers, thereby adding production costs.

Despite these flaws of monopolized purchasing and quotas, someone may argue that the regulations can conserve forests and provide positive externality and are worthwhile to the whole society. Such an argument is weak at two points. Firstly, are not there other regulations that can conserve forests but respect the owner's freedom to harvest and sell as much as possible? For example, Germany specifies the maximum hectares⁸ of forests that can be harvested at one time and requires that all harvested forestland should be re-forested timely, otherwise reforestation will be organized by Ministry of Forestry and paid by the owner (Xu Zairong, 2001). These two policies can conserve forests but do not cause the encroachment of the interests of forest owners or high operational cost as did by monopolized purchasing and quotas.

Secondly, monopolized purchasing and quotas maybe can conserve existing forests very well, but they make forest plantation extremely unattractive to market investment and thereby few new forests are formed. By contrast, there is no monopolized purchasing and quotas on bamboo, and its growth rate is much faster than that of timber forest.

⁷ 8.3 Yuan is equal to one U.S. dollar.

Table 2.3 Comparison of the Growth Rates of bamboo and overall forest⁹: 1973-93

	Total growth of covered area	Annual growth of covered area ¹⁰	Total growth of volume	Annual growth of volume
Bamboo	27%	1.2%	49%	2% ¹¹
Overall forest	5.5%	0.27%	0.8%	0.04%

Source: Zhong Maogong, 1999

Any other reason to advocate for monopolized purchasing and quotas? Yes. The government may need monopolized purchasing to collect tax and fees easily and need quotas to create rent-seeking. Such considerations will not be put on the table, but they work in reality and can show who advocates monopolized purchasing and quotas.

2.2.5 Externality and classification of ecological and commercial forests

The forest has a distinctive feature, i.e. it can provide both ecological and commercial values. The former is positive externality or public goods, which should be provided by the government; the latter is private goods and can be adjusted by the market mechanism.

The two values are complementary in the growth progress of the forest, but are in conflict when it comes to whether forests should be exhaustively harvested¹² or selectively harvested¹³. The conflict can be partially resolved by classifying forests into two types based on the dominant value: ecological and commercial forests. For ecological forests, exhaustively harvesting is not permitted, but commercial forests are given freedom on decisions about harvesting. This policy of classification was adopted by China's Forestry Ministry officially in 1995 (Wu Xuezhong, 1999), but its implementation hasn't made breakthrough except in a few provinces.

Compared with regulations like maximum harvesting area and timely reforestation, the separation of ecological forest from commercial forest is applicable to the areas where natural conditions are so harsh or existing forest resources are so precious that exhaustively harvesting cannot be done. Ecological forest will be financially supported and closely monitored by the government to provide stable

⁸ 1 hectare on ordinary occasions and 4 on special occasions

⁹ The main part of which is timber forest.

¹⁰ The numbers in this column are adjusted to be consistent with numbers in the preceding column.

¹¹ The numbers in this column are adjusted to be consistent with numbers in the preceding column.

¹² Exhaustive harvesting means there is little vegetation after harvesting, and reforestation is needed.

¹³ Selective harvesting means harvesting those unpromising trees to help the left grow better.

supply of positive externality, while commercial forest will be exposed to market forces with a fluctuation of the supply of positive externality.

Ecological forests cannot be exhaustively harvested. As a consequence, the owner cannot fully benefit from those forests and thus have the right of being compensated. Such a right is included into relevant laws in China, but the existing problem is that the compensation may be less than enough.

The compensation must cover the economic loss of abandoning exhaustive harvesting and can be calculated as follows. In 1998, China had 159 million hectares' forests and consumed 370 million cubic meters' standing stock (China Green Times, 2000) or 222 million cubic meters' logs¹⁴. So 1.4 cubic meters' logs were provided by a hectare. The price before harvesting was estimated 400 Yuan¹⁵.

If a hectare of forest was classified as first class ecological forests¹⁶, the economic loss of abandoning exhaustive and selective harvesting in 1998 would be 560 Yuan, i.e. 1.4 cubic meters multiplied by 400 Yuan per cubic meter. For second class ecological forests¹⁷, the economic loss in 1998 would be estimated 448 Yuan (80% of 560 Yuan) per hectare with a small net income from selective harvesting. These economic losses (500 and 448 Yuan) are lower than the level of compensation (630 Yuan) proposed by Liang Xingquan (2000), but far higher than the level of 150 Yuan (Chen Genchang, 1999)¹⁸.

A nationwide compensation level has not been set, but the Guangdong Province led the process by setting its province-wide level: 37.5 Yuan per hectare per year with further addition by the government at county level. In addition, a compensation level of 45-75 Yuan per hectare per year has been proposed to the central government.

The real economic loss (500 or 448 Yuan calculated in this paper) is much more higher than that to be compensated. Such a sharp gap means that the interest of forest households is seriously encroached.

If 30% of all 159 million hectares' forestland is classified as first class ecological forests and another 30% as second class (Chen Genchang, 1999), the aggregate economic loss will be 48.1 billion Yuan for one year according to the level calculated in this paper. But the aggregate compensation will be only 14.3 billion Yuan according

¹⁴ The percent of turning standing stock into log is set 60% here.

¹⁵ The economic loss of abandoning exhaustive harvesting does not include harvesting cost.

¹⁶ For these forests, neither exhaustive nor selective harvesting is permitted.

¹⁷ Exhaustive harvesting is prohibited, but selective harvesting is permitted.

¹⁸ Chen Genchang is the director of Policy Bureau of Forestry Ministry of the Central Government.

to the level proposed by Chen Genchang.

III Profitability and the Burden of Tax and Fee¹⁹ on Timber

It is not enough for forest plantation to attract market investment solely by providing sound property rights. Another indispensable condition is that forest plantation is profitable, otherwise nobody would pay the cost of resolving the problems of property rights, letting alone investment.

Little attention is paid to tax and fee on timber in this research's proposal. During the authors' field trips, however, tax and fee were found to be vital in determining the profitability of forest plantation. The cut of tax and fee is one of the two most urgent requests of forest farmers in addition to the deregulation of harvesting.

3.1 Profitability of forest plantation: the calculation and comparison of the Internal Rate of Return (IRR)

IRR measures the interest rate at which the total monetary cost is equal to the total monetary return of a project. This approach is weak in dealing with social and environmental cost and return. But IRR is still chosen as the approach to calculate the profitability of forest plantation in this paper due to two reasons. Firstly, the measurement of non-monetary cost and return of forest plantation hasn't been able to be accurate yet. Secondly, non-monetary cost and return can be internalized through the adjustment of tax and fee and integrated into the IRR.

There are few papers discussing the IRR of forest plantation in China. Chen Hong (1998) claimed that the IRR of the forest plantation project of World Bank was "higher than 16%" but did not show detailed data. Such a high rate is doubted by some experts. According to the Forestry Bureau at Zhanjiang County, Guangdong Province, the IRR of its project was 11.6%, a rate with adequate competition power in attracting market investment (Table 3.1).

The authors investigated two cases. One case is the project of a specialized household at Zengcheng County (Table 3.2), Guangdong Province, and the other is the project of a State-owned forestry center in Fujian Province (Table 3.3).

Table 5.1 The IRR of a Rapid Growth Eucalyptus project at Zhanjiang County, Guangdong Province (data of one hectare of forest, Yuan as currency unit)

¹⁹ Fee is collected and used by the departments of Central Government, local government or villages. The amount and process of collecting and using are not censured by any other organization.

year	1	2	3	4	5	6	7
planting, fostering and protecting cost	3000	300	300	300	300	300	0
forestland rent	0	0	0	0	0	0	0
harvesting and collecting cost	0	0	0	0	0	0	9900
tax and fee	0	0	0	0	0	0	11880
revnue	0	0	0	0	0	0	29700
annual net profit	- 3000	- 300	- 300	- 300	- 300	- 300	7920
Internal Rate of Return	11. 6%						

Source: Forestry Bureau at Zhanjiang County, Guangdong Province.

- Notes: 1, Tree species: Rapid Growth Eucalyptus
2, Natural cycle: 6 years.
3, Timber produced: 99 cubic meters
4, Price: 300 Yuan per cubic meter
5, Harvesting and collecting cost: 100 Yuan per cubic meter
6, Overall tax and fee burden: 40% of the revenue.

Table 3.2 The IRR of a Rapid Growth Eucalyptus project of a Specialized Household at Zengcheng County, Guangdong Province (data of one hectare of forest, Yuan as currency unit)

year	1	2	3	4	5	6	7
planting, fostering and protecting cost	4500	150	150	150	150	150	0
forestland rent	225	225	225	225	225	225	0
harvesting and collecting cost	0	0	0	0	0	0	12600
tax and fee	0	0	0	0	0	0	12600
revnue	0	0	0	0	0	0	31500
annual net profit	- 4725	- 375	- 375	- 375	- 375	- 375	6300
Internal Rate of Return	- 0. 9%						

- Notes: 1, Tree species: Rapid Growth Eucalyptus
2, Natural cycle: 6 years
3, Timber produced: 105 cubic meters
4, Price: 300 Yuan per cubic meter
5, Harvesting and collecting cost: 120 Yuan per cubic meter
6, Overall tax and fee burden: 40% of the revenue.
7, Forestland rent: 225 Yuan per year.

Table 3.3 The IRR of a plantation project of a State-owned forestry center in Fujian Province (data of one hectare of forest, Yuan as currency unit)

year	planting, fostering and protecting cost	harvesting and collecting cost	management cost	tax & fees	revenue	annual net profit	IRR
1	3750					-3750	
2	450					-450	
3	300					-300	
4	165					-165	
5	135					-135	

6	135					-135	
7	135					-135	
8	135					-135	
9	135					-135	
10	135					-135	
11	135					-135	
12	135					-135	
13	135					-135	
14	135					-135	
15	135					-135	
16	135					-135	
17	135					-135	
18	135					-135	
19	135					-135	
20	135					-135	
21		13200	4950	8800	50710	23760	7.5%

Notes:

- 1, Tree species: Fir
- 2, Natural cycle: 20 years
- 3, Timber produced: 110 cubic meters
- 4, Price: 461 Yuan per cubic meter
- 5, Harvesting and collecting cost: 120 Yuan per cubic meter
- 6, Management cost: 45 Yuan per cubic meter
- 7, Overall tax burden: about 17% of the revenue (This is much lower than those of Table 3.1 and 3.2 because State-owned forestry centers enjoy preferential tax rates and pay few fees)

There are several problems in calculating the IRR of forest plantation in China. (1) How to eliminate the impacts of the price fluctuation of input and/or output? One way is to collect annual data for a long time and make averages. In reality, however, these data are not available from forest farmers. The projects of FDI may have such data, but the FDI companies contacted by the authors either disappeared or declined to cooperate due to the consideration of commercial confidentiality. So the timber prices and production costs shown in Table 3.2 and 3.3 are rough average levels according to the experiences of the past several years. (2) The time and budget do not permit large-scale investigation, and only several cases can be chosen for detailed analysis. How to choose these cases to represent the diverse geography, climate and tree species of China? In this paper, the investigated cases are located in Southern China Community Forest Area, which hosts the majority of commercial forests in China and has the same climate, structure of property rights (i.e. community forest) and popular tree species (Eucalyptus and Fir). In the Area, Fujian Province and Guangdong Province

lead in market-oriented reform and have the most forest resources²⁰. So one case comes from each province to display the possible highest profitability of forest plantation in China. (3) The role of forestland is confusing. Since all forestland is publicly owned and allocated to state-owned forestry centers or internal villagers for no rent, the use of forestland seems costless (only when forestland is leased is there nominal charge, which will be recorded in the cost). Furthermore, the opportunity cost of forestland is low because it can rarely be utilized for other uses and its transfer is nearly impossible. So comes the problem of whether the use of forestland incurs cost or not. In this paper, the use of forestland bears cost only if rent has to be paid. (4) Whether should labor input of forest farmers themselves be calculated as cost? In this paper, labor bears cost only if it is employed.

When compared with Table 3.1, the IRR calculated in Table 3.2 (-0.9%), is far below 11.6%, while the tree species, natural cycle, the price of timber and the overall burden of tax and fee are the same. The gap of IRRs lies in (1) planting cost in 1st year (Table 3.1, 3000; Table 3.2, 4500); (2) forestland rent (0; 225) and in (3) harvesting and collecting cost per cubic meter (100; 120). If there is forestland rent in Table 3.1 (225 Yuan per year) with the others unchanged, the IRR will fall to 6.4%.

The IRR in Table 3.3 is as high as 7.5% due apparently to preferential tax rate. If the overall tax rate rises to 40% of the revenue and forestland rent (225 Yuan) is charged, the IRR will fall to 0.6%.

According to the IRRs of the two projects investigated by the authors, forest plantation is not profitable with the IRR around 0%. By contrast, a fixed term deposit for one year provides an interest rate of around 2%, the return rate of matured long-term public bond is about 3% (these two rates have no risk), and it makes sense for commercial investment to have an IRR as high as 12%. So forest plantation is not competitive in attracting market investment.

Someone may argue that it is impossible to reach a conclusion about the profitability of forest plantation in China since there are only two cases investigated by the authors and their IRRs differ significantly from those founded by Chen Hong and Forestry Bureau at Zhanjiang County, Guangdong Province. In fact, it is easy to see whether it is profitable to invest in forest plantation. If forest plantation is as profitable as founded by Chen Hong and Forestry Bureau at Zhanjiang County, forest

²⁰ The forest cover of Fujian Province is over 60%, and Guangdong Province has no barren hills.

farmers will be enthusiastic to invest and the newly added forest cover will be enormous and increasing. However, the newly added timber forest cover in 1997, 1998, 1999 and 2000 was 1.47, 1.46, 1.42 and 1.22 million hectares respectively with a trend of falling. (China Forestry Statistical Yearbook, 1998, p.10 and China Forestry Statistical Yearbook, 1999-2000, p.8). In addition, the absolute decrease of MOF can also demonstrate the continuous lack of investment in forest plantation.

One point should be noted. The data in Table 3.2 come from a specialized household, who manages much larger forests than ordinary forest farmers, leases forestland and employs labor. So the cost in Table 3.2 covers the use of forestland and labor input in fostering and protecting forests after the first year, both of which are costless for ordinary forest farmers. If the two are costless, the IRR will rise to 5.8%. Therefore, an accurate conclusion about the profitability of forest plantation in China is that it is not profitable for commercial investment and it is slightly profitable for ordinary forest farmers with no cost for labor and forestland. If these ordinary forest farmers plan to invest more than their forestland and labor such as buying high quality but expensive trees, conducting forestland reorganization and frequent fertilization and insuring forests against fire and pests, however, the rise of input will outpace the increase of output due to lack of increasing return of scale under current separation of rights (fragmentation) and burden of tax and fee. If so, forest plantation will become non-profitable.

3.2 The Burden of Tax and Fee on Timber

In Table 3.2, the burden of tax and fee accounts for 40% of the revenue, lower than the 50% founded in other provinces of Southern China (Wang Guang, 2000, p.35; Li Mingfeng, 1999, p.56; Investigation Group on Forestry Tax and Fee in Hunan province, 1999, p.27; Peng Zeyuan, 1999, p.66). The burden of tax and fee has been one of the most frequently discussed issues about forests in China for more than a decade. In almost every issue of the two authoritative periodicals about forests: *Forestry Work Studies* and *Forestry Economy*, one can find articles discussing or mentioning the burden of tax and fee on timber. These articles use data of different areas but their conclusions are the same: the burden of tax and fee on timber is too heavy. Such a view is accepted by the authors based on considerations from three perspectives: (1) the IRR in Table 3.2 and the calculations done by the references mentioned above show that forest farmers earn nothing regardless of management

skills or time, which can be attributed not to inefficient management or market demand fluctuation, but to heavy burden of tax and fee on timber; (2) the tax rate on timber is only 2-5% in countries such as Indonesia, Brazil and New Zealand (Chen Wanji, 2000); (3) Section IV will show the social and environmental externality of forest. In reality, however, the burden of tax and fee on timber is so high that it can be comparable to that on tobacco. That there is no compensation but tax and fee discrimination on timber is entirely inconsistent with the contribution of forest in providing positive externality.

The heavy tax and fee on timber stems from fiscal hardship at county level²¹. “Economies at county level, especially those at mountainous and forestry areas, can hardly find any industry that has added value large enough for providing satisfying tax and profit. They still rely on forestry industry. One third or higher of the total fiscal revenue of counties at forestry areas comes from forestry industry²².” Meanwhile, fiscal hardship happens at local governments especially governments at county level. On such an occasion, “every level and department of government consider the collection of tax and fee as the major indicator of the performance of officials and the No. 1 task in order to continue the operation and stability of the government. Every level and department of government has no choice but to collect tax and fee with any (reasonable or not, lawful or not) means” (Wang Guang, 2000).

Some examples of their means are listed here.

(1) The exaggeration of the price of timber and thus more taxation. The process of specifying taxed prices can be described as follows. The Fiscal Department at the county level sets the aggregate amount of budgeted expenditure for the coming year. The expenditure must be financed, i.e. the expenditure is rigid. So the fiscal income is set too, and a certain share of the income will come from timber. After the aggregate taxation on timber is specified, the average tax on per cubic meter of timber can be worked out with the allocated cutting quota. Then, the price of timber is determined to collect sufficient tax according to the given tax rate. The process of collecting fees is almost the same (Investigation Group on Forestry Tax and Fee in Hunan province, 1999).

²² The fees levied by forestry department account for half of the burden of tax and fee on timber. The collected money was estimated 6 billion Yuan in 1998, while the total governmental appropriation should be 5 billion but was actually 3.4 billion Yuan that included 1.6 billion in public bonds in 1998 (China Forestry Statistical Yearbook, 1998, p. 407).

Table 5.4 Real price and assigned price for collecting tax in Chenxi County of Hunan province (Yuan per cubic meter)

Species	Size	Real Price	Assigned price for collecting tax	Ratio of column 4 to column 3
Fir bar	14 cm x 5 m (length)	200	296	148%
Fir bar	16 cm x 5 m	230	332	144%
Fir bar	18 cm x 5 m	260	380	146%
Fir bar	20 cm x 5 m	350	452	129%
Fir log	8-12 cm x 2-3.8 m (length)	170	248	146%
Fir log	14-18 cm x 2-3.8 m	240	356	148%
Fir log	20-24 cm x 2-3.8 m	340	500	147%
Fir log	26cm (or larger) x 2-3.8m	450	536	119%

Source: Wang Guang, 2000.

Table 5.5 Assigned price for collecting tax and fee of fir log 8-18cm x 2m (or larger) in Chenxi County of Hunan Province in Yuan per cubic meter

Year	Assigned price for collecting tax	Assigned price for collecting fees
1992	50	180
92	68	160
94	150	250
95	150	250
96	200	250
97	200	300
98	300	420
99	325	450

Source: Wang Guang, 2000.

Table 3.4 and 3.5 show the gap between the real prices and assigned prices for collecting tax and fee. Assigned prices for collecting tax are usually 150% of real prices, while assigned prices for collecting fee are much higher than those for collecting tax.

(2) Collection of tax and fee before the process of harvesting and trading. The normal cycle of monetary flow is broken. Forest farmers, who are too poor to have much money in liquidity and face the very primitive money market in China especially in rural areas, have to make difficult arrangements to pay tax and fee in advance. In some areas, forest farmers have to apply to loans (Investigation Group on Forestry Tax and Fee in Hunan province, 1999).

(3) Collecting “Special Local Product Tax” twice, one on the purchasing side and the other on the selling side, not as hinted in State Council’s document that it is levied only once. The dual collection is used by local government to maintain the same fiscal revenue after Product Tax was repealed in the tax mechanism reform in 1994 (Zhang Chunxia, 1997).

The higher rate of tax and fee, the less incentive to manage forests, the less supply of timber, the less aggregate fiscal revenue and the higher rate of tax and fee. This is a vicious cycle.

3.3 A proposed plan to cut the burden of tax and fee on timber

3.3.1 Precedence of classification of forests and reform of property rights

Classification of forests as ecological and commercial forests will assure environmental conservation through the construction of ecological forests. Unnecessary regulations or external supervision on commercial forests will be abolished to attract market investment or to some extent replaced by internal supervision by forest farmers themselves. So the expenditure of forestry department for external supervision will be reduced, which will make room for the cut of tax and fee on timber.

The precedence of reform on property rights also paves the way for the cut of tax and fee on timber, otherwise the cut of tax and fee on timber will not result in the increase of investment in forests but excessive harvesting with the absence of sound property rights to forests and lack of long-term expectation (Investigation Group on Forestry Tax and Fee in Hunan province, 1999).

3.3.2 Steps

Theoretically, there are three steps for the cut of tax and fee on timber as listed according to the sequence of easiness: to make the IRR of forest plantation competitive in attracting commercial investment; to realize optimal tax rate at which the collection of tax and fee is the most efficient and to compensate the positive externality of forests. The optimal tax rate is lower than the tax rate to compensate the positive externality of forests, but higher than that to make forest plantation competitive in attracting commercial investment. The current tax and fee rate on timber is higher than any of the three rates.

In practice, there are two specific and practical steps. The first one is to cut the tax and fee rate of timber to be 15% of the price, a preferential rate currently provided to FDI forestry companies. The second step is to cut the tax and fee rate of timber to be 5% of the price as did by countries with advanced management of forests.

3.3.3 Quick fix and fundamental reform

Two measures can be taken to cut the tax and fee on timber. One is a quick fix, i.e. the higher level of government especially the central government appropriates

sufficient funding or forces those who collect tax and fee on timber to cut. To cut the tax and fee on timber forever, however, fundamental reform has to be implemented to change the current supervision mechanism and centralized political regime under which the higher level of government supervises the lower level of government, i.e. the number of supervisors is smaller than that of those who are supervised. When the higher level of government is concerned with one issue (e.g. the burden of tax and fee on timber), the lower level of government will take quick actions to resolve the issue; when the higher level of government changes its attention, however, the lower level of government will either stop its actions and let the issue emerge again or transfer the issue to other areas. Only when the political regime is decentralized, the taxpayers can express their voices and the number of supervisors is larger than that of those who are supervised can extra expenditure and tax and fee be cut once and for all.

3.3.4 External financial assistance

As discussed above, the heavy tax and fee itself is the cause of a vicious cycle. To break the cycle, there are two choices: one is to let it go until it arrives to the condition that “suicide” is foreseeable, and the other is to introduce external forces such as financial assistance. The assistance can come from the society in the form of public bonds, or from foreign countries or international organizations in the form of loans or grants. The introduction of external financial assistance can maintain the normal expenditure of the government, and reduce tax and fees at the same time to avoid the lose/lose pattern for both parties. After tax and fee are cut, more forests are planted and managed in more efficient manner, timber supply will increase and aggregate amount of tax and fee may be enough to pay back the external financial assistance and maintain the governmental expenditure in the future.

However, the introduction of external financial resources needs a condition: the tax base must increase quickly enough after the cut of tax and fee on timber. Otherwise, the introduction of external financial resources will lead to indebtedness and finally bankruptcy.

4. Externalities of Forestry Industry

Besides environmental and social externalities discussed below, the development of the timber industry in China will reduce the amount of import²³ and help keep foreign exchange savings. The savings can be regarded as the externality on national economy. Such an externality, however, does not matter too much in China due to two reasons. Firstly, China's exports continue to exceed imports, and the source of foreign currency is stable. Secondly, the domestic timber can hardly replace the imported timber because they differ greatly in variety and quality.

4.1 Environmental externalities

Forests play a major role in sustaining life. They provide humankind with many products such as timber, flowers, fruits, resins, medicines, and fuel wood for cooking and heating. Forests also provide many services such as stabilizing soil against erosion from wind, water and sand and renewing and cleaning the air we breathe. Forests are also the principal habitats for the world's diverse plants and animals and for visitors who are keen on having a "forest bath".

Commercial forests perform all of the functions above with various degrees. The two most important functions in addition to providing timber are carbon absorption and increases in precipitation. Carbon absorption means that CO₂ can be stored in the standing stock of forests, and the pace of Greenhouse Effect will be slowed down. In fact, forests conduct both photosynthesis and respiration. Photosynthesis is conducted during the day to produce carbohydrates by absorbing sunlight and CO₂, and respiration is conducted to decompose carbohydrates and emit CO₂ to provide energy needed by metabolism. The amount of emitted CO₂ is less than that absorbed, so there is a net gain of CO₂ stored in the standing stock.

In 1999, the Norwegian Forestry Company announced a forest plantation program to be implemented in Tanzania. The program is designed to plant 15 thousand hectares of forests, which is promised to store more than one million tons of carbon by 2010.

The increase in precipitation is performed by forests in three ways. Firstly, as Otterman and Charney pointed out, forests can reduce the reflectivity rate, i.e. the rate of reflected sunlight, and air temperature (Table 4.1). Secondly, Schnell and Vail

²³ In 1998, the imported timber and wood-products aggregated to \$4.9 billion, second only to oil and oil-products. (China Statistical Yearbook, 1999)

found that organic motes produced by decomposed trees would become the core of a raindrop. Without the core, precipitation cannot happen. In areas with rich organic motes, precipitation is rich (Jing Ai, 2000). Both of the ways above are beneficial to a precipitation increase in a local area.

In a field trip to the Xining City, Gansu Province in Northwestern China, the authors found that the forests there did work in increasing precipitation and made the areas around Xining City comparable to the beautiful Southern China. Another example is Aohanqi, which is located in the eastern part of the Inner Mongolian autonomy region and had suffered from desertization since the Qing dynasty. Many efforts have been put into forest plantation since the 1960s, and the forest cover increased by 10-20 hectares annually. Accordingly, precipitation has kept rising (Table 4.2).

Thirdly, if forests are scattered evenly, they will form a relay of vapor. Vapor is the source of precipitation and comes from oceans. Precipitation occurs easily in forested areas, as showed above. Forests can store water and let it not flow into river and back to oceans but vaporize later. The new vapor, the baton of the relay, will float inland where otherwise vapor is scarce. The process is displayed in Figure 4.1.

Table 4.1 Reflectivity rates of different vegetation statuses

Statuses of vegetation	Reflectivity
Taiga	0.13-0.15
Broad leaf forests	0.15-0.17
Shrub	0.16-0.18
Field	0.15-0.20
Grassland	0.20-0.25
Quasi-desert	0.25-0.30
Desert	0.25-0.35

Source: Jing Ai, 2000.

Figure 4.1 transporting water: a relay played by forests

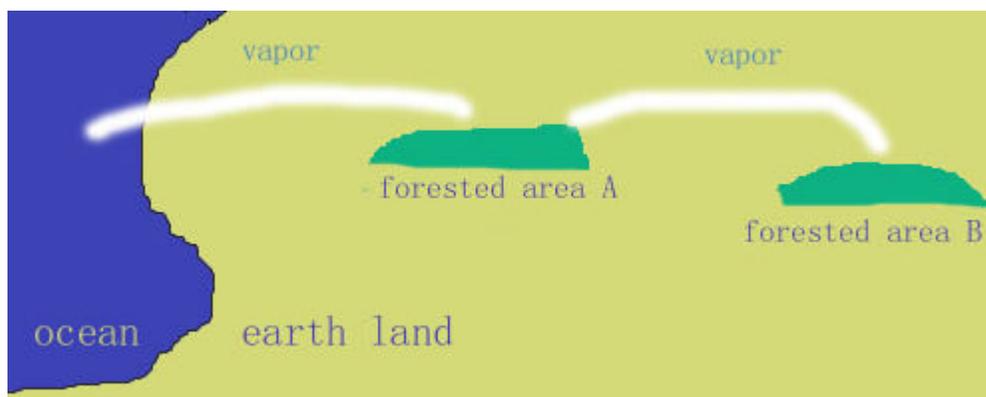


Table 4.2 the precipitation of Aohanqi along with the increase of forest cover

	1957-1960	1961-1970	1971-1980	1981-1990	1991-1999
Average annual precipitation	373 cc	419	418	438	487

Source: Jing Ai, 2000.

In addition to carbon absorption and increase in precipitation, there is another, indirect way for commercial forests to provide environmental externalities by meeting the demand for timber and mitigating the pressure on Ecological Forests.

4.2 Social externalities

The income disparity has become one severe and knotty problem in China and challenge the long-term stability seriously. The ratio of citizens' nominal income to farmers' increased from 1.7 in 1983 to 2.6 in 1994, and Gini coefficient among farmers increased from 0.338 to 0.416 (Lishi, 1999). Some areas falls into the vicious cycle of poverty and the exhaustive utilization of natural resources.

To develop commercial forests will increase the output of current forests and encourage forest plantation in barrens. Both of the ways can increase forest farmers' income and help reduce the income gap between citizens and farmers²⁴ and the income gap among farmers²⁵.

The development of commercial forests can also keep laborers in their native land instead of looking for employment thousands of miles away. This makes the vulnerable individuals such as the aged and children taken better care of.

Lured by the salary level in cities, many laborers in rural area leave their homes and go to cities searching for temporary jobs (it is hard to migrate into cities because of current household registration system and discrimination in China). They have to suffer from loneliness and miss family members, i.e. they bear the Emotional Cost (EC), which should be deducted from the Net Salary, NS, (salary earned in cities subtracted by salary earned in the hometown) to calculate the Net Benefit (NB) from out-working. $NS - EC = NB$. If NB is positive, it is rational to pursue employment in cities.

Other family members, especially aged parents and young children, also bear

²⁴ Forestry areas are often mountainous and poor.

²⁵ High-income farmers rely usually on non-forestry job as the main source of income.

emotional cost. For example, it is very painful for aged parents to worry about their relatives working in a strange city, and for young children to be deprived of their parents' frequent love and instruction. However, their emotional cost may not be fully perceived by out-workers and transformed into the EC of his own. With insufficient communication, the decision of out-working will probably become irrational for the household as a whole when all emotional cost is taken into consideration, while it is rational for out-workers who can perceive only a part of the emotional cost borne by other family members.

The development of commercial forests will increase the salary earned in hometowns and attract some out-workers to come back. So the aged and young family members will not suffer from their relatives' out-working with the social welfare improved.

Conclusion:

China has extremely scarce forest resources, and the core of forest resources, Mature and Over-mature Forests (MOF), are disappearing. Young forests have to be harvested to meet the strong demand for timber, and the fall of economic efficiency and environmental degradation are unavoidable.

The current worrying status of forest resources in China can be attributed to the more than doubled population, the burden of tax and fee on timber and command economy mechanism under which the price of timber was set quite low and public ownership to forests made room for free riders.

Policy recommendations:

- (1) Any change of ownership to forests (including the constraints on ecological forests) must be accompanied by monetary flow in the opposite direction to fully cover the loss of the previous owners and be recorded carefully.
- (2) Replace the closed-equal-free pattern with market-oriented ones to more efficiently allocate the use right to forestland and the property rights to stands.
- (3) Make the term of the allocation above long enough.
- (4) It may be necessary to specify the maximum amount of forestland and trees that can be transferred within one term of a Villager Committee.
- (5) Abandon monopolized purchasing and quotas and adopt the regulation of timely reforestation and the maximum hectares of forests that can be harvested at one time.
- (6) Implement classification of forests and reform on property rights before the cut of the tax and fee rate of timber.
- (7) The cut of the tax and fee rate of timber can be taken in two steps: 15% and 5% of the price.
- (8) Both quick fix and fundamental reform are needed.
- (9) Use external financial assistance if applicable.

The development of commercial forests can bring about carbon absorption and increase in precipitation. In addition, it will narrow the sharp income gap in China and benefit those vulnerable individuals suffering from their relatives' out-working in cities thousands of miles away.

References (All in Chinese except otherwise indicated):

- Alchian, A.A. 1965a. Some Economics of Property Rights. *Il Politico* 30: 816-829.
- Alchian, A.A. 1965b. The Basis of Some Recent Advances in the Theory of Management of the Firm. *Journal of Industrial Economics* 14 (December): 30-41.
- Alchian, A.A. and H. Demsetz, 1973. The Property Right Paradigm. *Journal of Economic History* 33 (1): 16-27.
- Bromley, D.W. 1989. Economic Interests and Institutions. *New York: Basil Blackwell*.
- Cheng Shuigen, 1999. "Current Condition, Problems and Solutions about Community Forest Area Forestry Administration in Kaihua County", *Forestry Work Studies*, Issue No. 6.
- Chen Genchang, 1999. "Analyzing Several Hot Topics in Forestry Reform and Development from the View of Economics", *Forestry Work Studies*, Issue No. 1.
- Chen Wanji, 2000. "Suggestions on Development of Forestry Industry in China", *Forestry Work Studies*, Issue No. 2.
- Cheng Hong, 1998. "Exploitation and Practices on the Development Model of Modern Commercial Forest Plantation ---- Review on 'National Plantation Project' Supported by World Bank in China", *Forestry Economy*, Issue No. 2.
- China Forestry Statistical Yearbook, 1998. Beijing: China Forestry Press.
- China Forestry Statistical Yearbook, 1999-2000. Beijing: China Forestry Press.
- China Forestry Yearbook, 1949-86.
- China Forestry Yearbook, 1998.
- China Green Times, 2000. "Continual Two Growths of Forest Cover and Volume in China", June 14, 2000.
- Demsetz, H. 1966. Some Aspects of Property Rights. *Journal of Law and Economics* 9: 61-70.
- Demsetz, H. 1967. Toward a Theory of Property Rights. *American Economic Review* 57: 347-359.
- Dong Qichang, 1999. "'98 Flood Highlights Forest", *China Forestry Press*.
- Editorial Board of Ministry of Agriculture, 1999. China Rural Economy: 50 Years. <http://www.agri.gov.cn/Agri50/ncjj50/>
- Feder, G. and D. Feeny. 1991. Land Tenure and Property Rights: theory and

implications for development policy. *The world Bank Economic Review* 5(11): 135-153.

Forestry Bureau of Huizhou, 1987. "Investigation Report about Two Important Forestry Policies", *Forestry Work Studies*, Issue No. 9.

Forestry Ministry, 1999. *Fifty Years of China's Forestry*.

Forestry Ministry Policy Bureau Investigation Group, 2000. "Investigation Report on Classification and Separate Administration of Forests in Yunan Province", *Forstry Work Studies*, Issue No. 11.

Hou Yuanzhao, 1995. "Study on Assessment of Forest Resource in China", *China Forestry Press*.

Investigation Group on Forestry Taxation and Fee in Hunan province, 1999. "Investigation and Study on Forestry Taxation and Fee---Hunan Case Analysis", *Forestry Economy*, Issue No. 6.

Jing Ai, 2000. "Cases and Reasons about Forest's Impacts on Earth land Cloud Development and Precipitation", *Forestry Work Studies*, Issue No. 11.

Justin Lin, 1999. "China's Miracle: Development Strategy and Economic Reform", *Shanghai People Press and Shanghai Sanlian Press*.

Kong Fanwen, 1998. "Evaluation of China's Forest Resources Management Policies", *GCP/RAS/158/JPN, CSA Paper No. 2 (1997-1998), China*. English version.

Liang Xingquan, 2000. "Problems and Solutions about the Establishment of Ecological Forests in Guangdong Province", *Forestry Work Studies*, Issue No. 2.

Li Mingfen, 1999. "Problems and Solutions about Taxation and Fee on Timber in Guangxi", *Forestry Economy*, Issue No. 1.

Lin Hengmao, Xue Xieming, 1994. "Tentative Analysis of Forestry Stock Cooperation Mechanism", *Forestry Work Studies*, Issue No. 3.

Lishi, Zhaorenwei, 1999. "Research Anew on Distribution Individual Income in China", *Economic Study*, Issue No. 4.

Liu Mingyan, Liu Zhenchang, 1993. "Current Condition of Forest Security in Anhui, Jiangxi and Fujian Provinces", *Forestry Work Studies (Information Special)* Issue No. 6.

Peasant Daily, 2000. "China's Forest Plantation No. 1 in World". June 14, 2000.

Pejovich, S. 1990. *The Economics of Property Rights: towards a theory of comparative systems*. *The Netherlands: Kluwer Academic Publishers*.

Pejovich, S. 1995. *Economic Analysis of Institutions and Systems*. Dordrecht, The

Netherlands: Kluwer Academic Publishers

Peng Zeyuan, 1999. "Adjust Interest Distribution and Realize Sustainable Development of Forests", *Forestry Economy*, Issue No. 1.

Randall, A. 1975. Property Rights and Social Microeconomics. *Natural Resources Journal* 15: 729-747.

Research Group on Supply and Demand of Timber Market in China, 1999. "Study on Aggregate Amount and Structure of Timber Supply in China", *Forestry Economy*, Issue No. 5.

Ross, S. 1973. The Economic Theory of Agency: the principal's problem. *American Economic Review* 63: 134-139.

Seitz, W.D. and J.C. Hadley, 1975. Changing Natural Resource Property Rights: an overview. *Natural Resources Journal* 15: 639-642.

Song Zongshui, 2000. "Implementation of Virgin Forests Protection and Solution of Meeting the Timber Demand in China", *Forestry Work Studies*, Issue No. 12.

State of World's Forests 1999, 2000. FAO web site.

Surveying Group of China Agricultural and Forestry Union, 1999. "Forced Vouching, Unlimited Trouble", *Forestry Work Studies*, Issue No. 2.

Tian Yun, 1995. "Analysis on Factors Influencing the Development of Forest Insurance", *Forestry Work Studies*, Issue No. 10.

Wang S. & G. Cornelis van Kooten, 2001. *Forestry and the New Institutional Economics: an application of contract theory to forestry silvicultural investment. Ashgate Publishing Limited.*

Wang Guang, Liu Jinlong, Xiangdong, 2000. "Investigation on Taxation and Fee on Timber in Huaihua", *Forestry Work Studies*, Issue No. 9.

World Bank OED, 2001. "The World Bank Forest Strategy: Striking the Right Balance" with case study of China "China: From Afforestation to Poverty Alleviation and Natural Forest Management". *World Bank web site*. English.

Wu Xuezhong, 1999. "Forestry Classification and Seperate Reform should Choose the Right Entrance", *Forestry Work Studies*, Issue No. 3.

Xie Niankui, 1998. "Investigation on Mechanism Transformation of Three Orchards in Gannan", *Forestry Work Studies*, Issue No. 3.

Xu Zairong, 2001. "Policies, Laws and Experiences of Forest Resources Transfer in Germany", *Forestry Work Studies*, Issue No. 5.

Yang Hongqiang, 2000. "Analysis on Trade and Competitive Power of Timber

Productions in China”, *Forestry Economy*, Issue No. 5.

Yao Changtian, 2000. Explanation to Forestry Statistical Terms in China, *China Forestry Press*.

Yao Xinzhang, 1993. "Argue on Theories and Policies about Four Barrens Auction", *Forestry Work Studies*, Issue No. 6.

Zhang Chuanxia, Huang Pingying, 1997. "Study on new taxation system", *Forestry Economy*, Issue No. 1.

Zhang Lei, Wu Zhongze, Zhu Fuhua, 2000. "Encourage Land Deployment through Market and Realize Forestry Sustainable Operation", *Forestry Economy*, Issue No. 4.

Zhong Maogong, 1999. “Retrospect and Prospect of Bamboo Industry in China”, *Forestry Economy*, Issue No. 3.

Zhou Bingbing, 2000. Value of Forest Resources in Beijing, *China Forestry Press*.

ANNEXES

Report of the Visit to Fujian

Tang jie

General Process

From Nov 13 to Nov 20, a visit to Fujian province was made by a team composed of Prof. Mao Yushi, Prof. Jin Xizhu, Mr. Jin Zhengdao and Mr. Tang Jie. Prof. Mao Yushi and Mr. Tang Jie are from Unirule Institute of Economics, with the other two from Economic Research Center of Forestry Bureau.

At first, the team went to Fuzhou City, the economic and political center of Fujian province, and had warm discussions with officials from the provincial government. Then the team went to Yong'an County of Fujian province. At Yong'an, discussions were held with managers of Yong'an Forestry (Group) Joint-Stock Co. Ltd., officials from local government and with peasants.

Topics

Before the visit, the team designed a plan, in which 3 topics are highlighted. The first topic, foreign direct investment (FDI) in forest plantation in China, was chosen because these projects are most likely to be profitable due to their large scale and preferential rate of tax and fee. It is assumed that forestry industry is capital-intensive and has increasing return of scale and that the heavy burden on tax and fee on timber is one of the major constraints on the development of forests.

Another topic is live-tree market. The topic is important because it is a way of withdrawing from the industry and reorganization within or beyond the industry, which is very relevant since forestry industry has been shackled by command economy for so many years. In addition, the selling of live-tree requires the exact division of property rights, which is one fundamental mechanism of market economy.

The last topic is forestry's positive externalities, two of which are environmental conservation and the creation of job. These externalities can be best perceived in the real environment.

Introduction to the Forest Resources in Fujian

Fujian province has the highest percent (60.5%) of forest cover in China, 66.3 million acres' timber forest, 12.3 million acres' bamboo and 13.3 million acres' economic forest.

90% of Fujian's forestland and 80% of forest reserves are collectively owned by villages in the name of "collective forest", and the others are owned by the central government. Peasants do not directly own forestland.

Fujian is located in the Southeast of China and has a warm and rainy climate. It is fairly easy for tree to grow there. So the percent of forest cover is very high. Forest's function of environmental conservation is undoubtedly important, especially in areas along the sea, but it is not a problem of life or death.

Findings

a. Foreign direct investment (FDI)

Even though Fujian province has several foreign plantation projects, these projects are too small in scale, making a big difference with the flourishing FDI in forestry industry in Guangdong province, one province bordering Fujian. The difference above can be explained partly by the climate difference between Fujian and Guangdong. Guangdong's climate makes it possible to lumber eucalyptus after 5 or 6 years' growth. Recently, eucalyptus is also adopted to Fujian where traditional tree types have cycles as long as 25 years, but the temperature was too low in last year and caused widespread death of eucalyptus. Difference in natural cycles means difference in returns.

Another explanation is that Guangdong's hills have a slope of smaller degrees and allow the use of machines and the fall of labor cost.

From the view of officials from Fujian provincial government, however, heavy tax burden on timber in Fujian is the main reason why Fujian's FDI lags behind that of Guangdong.

b. Live-tree market

Generally, live-tree market is rare across China, but Fujian is an exception. The team's findings on this topic are far beyond expectations.

Live-tree market is called forest reserve (including the use right to forestland and the property rights to live tree) market in Fujian. This market dated back to early 80s, but it was not until in 1997 that official regulation was published by the local legislation organization and became a local law. At present, forest reserve can be traded like common goods everywhere in Fujian.

One key step for successful trade is the determination of the price of forest reserve. In Fujian, the trade price is based on the appraisal of specified agents, which

must be recognized by the provincial government. According to the law, trade price can be higher, not lower, than appraisal price. But in fact, trade price is generally appraisal price. There is only one recognized agent in Fujian.

Appraisal price consists of two parts: the rent of forestland, which is paid annually, and the price of live-tree, which is paid for one time.

Generally, buyers of forest reserve are enterprises, especially enterprises in wood industries. For example, Yong'an Forestry (Group) Joint-stock bought 200,000 acres in 1999. Several other enterprises bought some forest reserve as well due to the newly published policy for offering loan at interest low than market.

Unquestionably, buyers can benefit from purchasing some forest reserve. At present, however, the benefit is not the value added by the buyers through sound management, but the result of "external forces". In the case of Yong'an Forestry Joint-stock, it is a SOE and the tax on its wood is lighter than that on wood from collective forests. Collective forests will become State-owned and enjoy lower tax rate after being bought by Yong'an Forestry Joint-stock's. So the company can utilize the difference of tax burden to make money.

In Yong'an, more and more farmers began to buy forest reserve as a response to a policy recently launched by the local government. The policy aimed at reforming the property rights structure and introducing responsible owners to avoid illegal lumbering, one serious phenomenon caused by heavy taxes on wood from collective forests. In the implementation of the policy, however, a small number of people dominated the process and bought forests at prices lower than market prices. In the case of one village the team visited, collective forests were sold to one-fifth households at prices apparently lower than market prices.

The sellers of forest reserve are usually villager representative committee. The committee has the right to deal with collective forest. Income from selling the forest generally does not go into the wallets of villagers, but is used to support locally public goods or paying loans. Both of the ways cannot be supervised easily. Furthermore, the prices of forests may be too low at present because of heavy tax burden. So some even many villagers are opposite to the trades.

In early 80s, some provinces announced a policy: "dividing the collective forest to peasant families", which was similar with the selling of forest reserve to forest farmers. This policy, however, caused serious over-lumbering of forest because

peasants couldn't believe the policy's stability and chose to lumber the forest before the policy was abolished. Will the same phenomenon happen in Yong'an after the selling of forest reserve to forest farmers? The answer is No according to the local government. The government divided bamboo to peasant families more than ten years ago and hasn't ever changed this policy. So farmers are quite confident on the stability of policies now. The confidence can be extended to the policy of selling forest reserve to forest farmers and over-lumbering of forests will be avoided.

The trade of forest reserve is conducive to the emerging of large-scale forest management, which makes it acceptable to adopt new tree species, build roads and collect information on markets.

c. Forest insurance

Originally, forest insurance is considered to be very important because it can reduce risks greatly. But the visit to Fujian made an impression on the team that forest insurance does not matter so much in Fujian where atmosphere is full of moisture and forest is almost always green throughout one year. Forest fire, the most dangerous forest disaster, happens only at small scopes. Furthermore, insurance fee is not cheap, and there are no responsible owners since most forests are collectively owned.

After the reform of property rights to forests and tax on timber, more and more people will be concerned with the risk of forest. Only at that time can forest insurance advance quickly. The experience of Yong'an Forestry Joint-stock is an example.