TIMBER TRADE AND WOOD FLOW–STUDY
Yunnan, China

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Abbreviations used

CFB County Forest Bureau
CWC County Wood Company
JV Joint Venture
MDF Medium Density Fibreboard
PoC Province of China
RMB Chinese Yuan
YPG Yunnan Provincial Government

Conversion factor used

A standard conversion factor of 50% was applied in all sawnwood and plywood production estimations.

Exchange rate used
USD 1 = RMB 8.5

Annexes

Annex 1  Literature Consulted
Annex 2  People met
Annex 3  Itinerary of the Consultancy
Annex 4  Assumptions for Demand–Supply-balance Projection, 1997-2025

1. Introduction

1.1 Background

The current study on wood demand and supply, and forest industries in Yunnan Province, China is a part of the Poverty Reduction and Environmental Management in Remote Greater Mekong Subregion Watersheds-project and the Timber Trade and Wood Flow-study. This study is one of six country studies – one for each project country produced during the project. A separate regional report studies the cross-border issues and opportunities in the whole of the subregion.

This report, like all of the national reports deals with three interrelated topics:

i.  general pattern of wood use, demand and supply in the province
ii.  timber trade to/from the province
iii.  forest industries and the role of forest industries in the industrial strategies

The study was prepared by two members of the project team of consultants between September and December 1998. Some additional data was collected and the report produced in early 1999. The team involved in the study consisted of

- Mr Wang Song Jiang, national consultant, School of Business Administration, Yunnan Polytechnic University, and Yunnan Institute of Environmental Science
- Mr Tuukka Castrén, Indufor Oy, international consultant

The work of the consultants was supervised and assisted by Mr Stephen Devenish, team leader for the project.

1.2 Data

Provincial data was collected (mainly by Mr Wang) through various provincial and national databases. Interviews were carried out with principal stakeholders in Yunnanese forestry. The list of people met is presented in Annex 2. The interviewees provided much valuable information for the study. The opinions and recommendations presented in the report are, however, entirely those of the consultant team.

The national consultant report (Wang 1998) consolidates a large number of official and other statistical sources that are not separately referenced.

A special characteristic in the case of Yunnan is the provincial status. For example, foreign trade statistics are collected at national, not provincial level. In the analysis, all exports from Lao PDR and Myanmar to China are thought to contribute to the wood supply in Yunnan. If such wood were destined to other provinces, they were presented in the Yunnan exports to other provinces. This potential source of statistical anomaly is effected by the lack of Yunnan import statistics. All foreign trade data had to be compiled from data sources in the exporting countries.
Five factors and institutional issues hampered the data collection:

- as a province, national information sources have not always been applicable in Yunnan
- sectors of the forest industries fall under the jurisdiction of various authorities, e.g. wood industries fall under Forest Administration while the pulp and paper industry falls under three bodies: the Ministry of Planning, the Economic Commission and the now defunct, Ministry of Light Industries
- market players are (over)sensitive in protecting business information they believe should remain confidential.
- forestry statistics are not collected and/or access to them is inadequate
- the value of concise forest statistics is not deemed high by the stakeholders.

There has not been a thorough provincial forestry inventory, growth modelling and sustainable yield assessment in Yunnan. This is one, but not the only factor contributing to overlogging, flooding and more recently, the natural forest logging ban (c.f. Chapter 3.4).

### 2. Forest Resources

#### 2.1 Natural Forests

Yunnan is one of the most forested regions in China, with a total forest cover of 11.4 mill. ha (natural forests 9.3 mill. ha and plantations 2.1 mill. ha). In total forests cover some 25% of the total land area. The forest area per capita is 0.29 ha including plantations. There is another 2.7 mill. ha (7.2%) of woodland with canopy cover of 10-30%.

The share of natural dense forests in the total forest cover is presented in Figure 2.1.

**Figure 2.1: Forest Area Distribution, %**

![Forest Area Distribution, %](source: Wang (1998))

The natural forests may be divided into five zones:

a. The north-west plateau. Main species include softwood *Abies, Picea, Larix, Tsuga* and *Pinus spp.* This is the main wood production area in Yunnan

b. Steep mountains, these are mainly protected areas. Main species include *Betula, Populus, Acer* and
Castanopsis spp.

c. The Central Plateau. Main specie includes *Pinus yunnanensis*

d. South-west Yunnan; sub-tropical coniferous forest; main species include *Pinus kesiya* and a variety of hardwoods

e. Tropical rainforest; small areas, largely cleared for rubber plantations

The protected area network covers 2.07 mill. ha or 18% of the total forest and woodland area.

### 2.2 Plantations

The total area of plantations is 2.1 mill. ha, *i.e.* 19% of the total forest area. Much of the plantations have been established in the past ten years and one third (580 000 ha) were established in 1996-97. Therefore, the stock in the plantations is very low, only 15 m³/ha.

Plantations are divided into four categories (Figure 2.1):

1. production/timber plantations (64% of total plantation area)
2. fuelwood plantations (5%)
3. protection forests (25%)
4. others (6%)

Ownership of the plantations is as follows:

1. communal 60%
2. state 30%
3. private 10%

The YPG has promoted the establishment of plantations in Yunnan with the provision of both financial and technical incentives. Schemes to increase the use of small-diameter wood have also been initiated. As a result, production of fibreboard, particularly MDF, has increased in the province.

Data on the current annual plantation establishment rate varies depending on the source. It may, however, safely be estimated that the area ranges from between 300 000 ha and 500 000 ha. Tree survival rate is reported as high as 85-90% after one year but in the long-term it could be lower. Low intensity methods like aeroseeding are gaining popularity; they have low unit costs but also low success rates. More labour intensive methods like planting, if properly implemented, can have higher success rates.

Recent rapid expansion of the plantation area is assumed to have put severe pressure on both seedling production and the organisational capabilities of the implementing organisations and communities. Experiences from other countries indicate that massive plantation establishment initiatives with vast objectives are not likely to succeed due to both technical and institutional hindrances (see the Viet Nam Country Report for a case study). No information was available on the institutional and technical actions taken to create an enabling environment in Yunnan.

It has been estimated that some 40% of the wood utilised by wood processing industries would currently originate from plantations.

### 2.3 Growth
There is no separate growth and yield information for natural and plantation forests. Due to the mountainous topography of the province, forests are poorly stocked. The annual net growth is 3.6 m³/ha (incl. woodlands). Total growth in production forests in the province is 42.9 mill. m³.

3. Utilisation of Forest Resources

3.1 Legal Framework

Since 1978, the People’s Republic of China has pursued a decentralisation policy. Administrative decisions are made at the lowest possible level of administration, based on the guidelines provided by central government.

The Ministry of Forestry in Beijing sets the annual national logging quota. The quota is divided into provinces based on the logging potential of each province. The provincial authorities are responsible for ensuring that logging is not above the sustainable level [i.e. the provincial quota]. The quota system covers both natural and plantation forests.

The county forest bureaux are in charge of implementing the provincial sustainable levels of logging. All logging operations require a license from these county forest authorities. The control covers both the volume logged and regeneration plans.

3.2 Forest Ownership

The state and communes own all land. They may issue land utilisation rights to private individuals and families. These utilisation rights may be sold, inherited, or used as collateral, etc. The main exception to actual ownership of the land is the limited duration of the land ownership. Title deeds are generally issued for a maximum period of 50 years.

In Yunnan there are three forest ownership categories: state forest farms, collectives [i.e. villages] and private ownership. Collective and private ownership is not separated in statistics. The private sector ownership is, however, relatively limited. (Table 3.1)

<table>
<thead>
<tr>
<th>Ownership category</th>
<th>Area (mill. ha)</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>3.1</td>
<td>33</td>
</tr>
<tr>
<td>Collectives and Private</td>
<td>6.3</td>
<td>67</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

The area of state forest farms in Yunnan is greater than average for the whole country. At national level the state forest farms manage 19% of the total forest area. This is only slightly more than half of the Yunnan level.

3.2.1 Public Sector Ownership

Public sector owned forest farms manage the production forests under state management. The majority of these farms are owned by county administration, while the provincial or prefecture administrations own only a small number of forest farms.

The forest farms are relatively independent in their management and are run along private sector guidelines. However, the managing director is selected by the county forest bureau. And therefore, the authorities have some indirect control over the farms.

On the other hand, farm profit is distributed among staff members. The state takes a share through profit based taxation. Employees - rather than the state owner – carry the financial risk.
Forest farms benefit from the forestland using two systems:

1. manage and harvest the land by themselves, or
2. separate tenure from utilisation rights by renting the land and only receiving part of the stumpage

### 3.2.2 Collective Ownership

In collective lands, the villagers make the management decisions. In all other respects, forests are managed as a private enterprise. Forestry officials are not entitled to give direct orders to the collectives. Like state forest farms, the collectives may rent part of their forestland to the private sector.

### 3.2.3 Private Forests

As mentioned earlier, there is no private forest ownership in China. Private forests are distributed through long-term lease contracts (transferring only the utilisation right). Lease contracts are usually for a maximum period of 50 years. If the terms of the contract are respected, contracts are renewable. The areas leased to the private sector are usually quite small and located on marginal lands.

State forest farms, collective and private owners have similar obligations within their logging licences. All logging has to be approved by the county forest bureau to ensure that a) sustainable yield is not exceeded, and b) regeneration is considered.

### 3.3 Harvesting

The Ministry of Forestry in Beijing stipulates an annual logging quota for the whole of China. The provincial Forest Departments advise Central Government on the sustainable yield and other factors affecting the quota. The national quota is then considered on a province by province basis, this quota is in turn then considered by the county forest bureaux when issuing logging licenses.

Three levels of management plan are prepared for the forest farms covering varying time periods and levels of detail. Typically, these take one or all of the following formats: i) master study covering five years. ii) annual plan covering the development work within the enterprise for one year and iii) implementation plans which contain the most detailed level of operational planning and also cover a period of one year.

The utilisation of forestry resources in China is decentralised. Once the authorities have approved the logging plans, the trade is a market-driven process. Prices are set freely in negotiations between the supplier and buyer. The forest owner may sell wood in three ways:

1. direct sale to the mills,
2. sale to the County Wood Company (CWC); each county has a specific County Forest Bureau (CFB) owned company trading in wood, or
3. sale to log terminal, i.e. a regional log trading company with its own log storage capacity. The terminal buys the logs from individual forest owners and sells them to the mills. Usually the terminals also provide the transport for the logs. Some 70% of log flow goes through the terminals, the remainder being sold directly to mills. (Figure 3.1)

**Figure 3.1: Wood Trade Pattern**
Sales can be initiated either by the buyer or the seller. The log terminals may also have long-term supply contracts with mills to provide raw materials. In order to fulfill their commitments the terminals have to find suppliers from within their province. For this, they co-operate with the CWCs.

The Chinese wood market system is in principle market-oriented and transparent. Some shortcomings could be rectified in order to increase the functioning of the market system. The main recommendation is the disengagement of CFBs from all commercial activities. This would make them purely administrative and controlling bodies.

Disengagement of CFB business and administrative functions would also increase credibility and efficiency in the implementation of the logging ban (c.f. Chapter 3.4).

### 3.4 Logging Ban

China experienced devastating floods in 1998. A major cause of the floods was soon evaluated to be extensive over-logging and the consequent deforestation of upland watershed areas. This led to the introduction of logging ban in all natural forests in Yunnan, Sichuan and Gansu provinces. Most logging in natural forests was to be terminated by the end of September 1998. Some additional time was allowed for haulage. In some counties (providing up to 20% of logs) additional time was provided to alleviate the negative economic impact of the ban though even in these cases all logging will be gradually phased out in few years time.

Consequently, plantation forests will be the only legal local source of log supply and the wood trade pattern is likely to change as well. Currently much of the logged volume are being exported to other Chinese provinces. Local consumption of wood is clearly less than production; roughly half of logs are processed outside the province while the remainder is processed within the province.

At present, the average annual recorded harvest is 1.7 mill. m$^3$ with 0.9 mill. m$^3$ being processed locally. The current production potential of plantations (based on present utilisation of plantation wood) is 0.5 mill. m$^3$. This means that at present, plantations could not produce enough wood to feed processing plants in the province.

Several factors complicate the analysis on the dynamics of post-logging ban market:

i. location of processing industries vs. the location of plantations  
ii. species structure  
iii. plantation logs are generally smaller than natural logs. This effects the sawmill and veneer mill operations and leads to lower recovery rates and higher wood consumption per volume produced.  
iv. price elasticity of both demand and supply. Decreasing supply not only in Yunnan but also in neighbouring provinces should increase log price level in the region. The detailed impact of such a change depends on the parameters of economics of roundwood demand in Yunnan and the region as a whole.  
v. demand–supply-balance in neighbouring provinces
These factors may also impact on international trade. For example, import volume from Myanmar and Lao PDR is likely to increase (though these markets are influenced by the Asian economic crisis and other macro economic developments).

Forest plantations in Yunnan consist of both exotic and indigenous species. As logging will be allowed from plantations, controlling the ban will be a major task for the authorities. Methods need to be developed to verify the origin of alleged plantation wood of indigenous species. The authorities have not yet been able to develop any reliable solutions to this problem. The control could be based on the supposed variations in the appearance of plantation vs. natural wood, e.g. log size, wood material density, age.

In order to enforce the logging ban efficiently, more accurate methods for the verification of the chain-of-custody need to be developed. Other potential loopholes could develop around the import of logs from other provinces. An accurate system of labelling needs to be developed to ensure that Yunnan logs are not labelled as inter-country imported logs. The log terminal management staff interviewed claimed that they were fully able to verify the origin of the logs offered to them.

4. Forest Industries

4.1 Forest Industry Policies

The role of the Chinese central Government in provincial forest affairs has decreased in the past few decades. In Yunnan, the provincial authorities have declared their own objectives in forest sector development. The main one of these is to increase processing of small diameter wood through increased production efficiency and changes in production patterns.

Specifically, this has led to the following policy objectives:

- reduction of wood consumption
- replacing natural forestation with plantation wood [this is strengthened by the logging ban]
- wood utilisation at mill level needs to be made more efficient
- increasing general use of small diameter wood
- MDF should replace particleboard
- level of technology needs to be increased
- staff and management training should be upgraded
- private sector investment and joint ventures should be encouraged.

As production units are mostly out-dated and use inferior technology, these improvements could only occur with large-scale investment in modern production technology. The logging ban will cause a colossal fall in the legal raw material supply of logs from within the province (c.f. Chapter 7.3.2). This, combined with the remote location of the province may hinder such investments in the foreseeable future.

The policies are still quite vague and an implementation plan has not yet been designed. The YPG has stated in its policies a strong commitment to sustainable environmental management. Even at official levels, the possibility of the Yunnan forestry industry not being able to obtain its raw material from sustainable sources and its subsequent collapse has been considered as a possibility.

4.2 Industry Structure and Production Volume

Yunnan forest industry production pattern covers a wide range of products from sawnwood to pulp and paper. In total there are more than four thousand enterprises classified as forest, or pulp and paper industry entities. Most of the enterprises are in secondary processing. Unfortunately, the Chinese statistics are not designed to base analysis on turnover or capacity of the enterprises. (Table 4.1)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Enterprises</th>
</tr>
</thead>
</table>

Table 4.1: Forest Industry Enterprises
Most of the enterprises are small; a vast majority of the enterprises (73%) have working capital of less than RMB 300 000 (USD 35 000). In addition, the average value of annual output is small, \textit{i.e.}

- wood industries RMB 339 000 (USD 40 000)
- pulp and paper industry RMB 11.2 mill (USD 1.3 mill)

The production capacities by product are presented in Table 4.2. The average size of sawmills is extremely low, less than 500 m$^3$/year. Thus, their annual log intake is in the range of 1000 m$^3$.

<table>
<thead>
<tr>
<th>Product</th>
<th>Capacity m$^3$/year</th>
<th>Average mill size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawnwood</td>
<td>420 000</td>
<td>494</td>
</tr>
<tr>
<td>Plywood</td>
<td>80 000</td>
<td></td>
</tr>
<tr>
<td>Particleboard</td>
<td>50 000</td>
<td></td>
</tr>
<tr>
<td>MDF</td>
<td>100 000</td>
<td></td>
</tr>
<tr>
<td>Other fibreboard</td>
<td>50 000</td>
<td>3544 wood-based panels</td>
</tr>
</tbody>
</table>

Production volume in Yunnan forest industries is not made public. The recent economic boom in China indicates that it is likely that the wood industry has been operating near full capacity.

4.3 Production Efficiency and Waste Management

There is only little information on waste management in the Yunnanese forest industries. The standard of the machinery is low and out-dated. Replacement investment has have not been made in recent years.

Productivity at the mills is low leading to both waste and a high level of harmful emissions. Most mills have not been equipped with wastewater treatment plants. Even in the mills that have such equipment, emission levels are high due to inadequate capacity, poor quality of the machinery and a lack of human resources.

4.4 Pulp and Paper Industry

For historical reasons ("The Great Leap Forwards") there were numerous utterly small pulp mills all over China; these mill were producing less than 10 000 mt/yr. of generally poor quality pulp and did not have any environmental protection systems to speak of. Most of these mills have been closed in order to alleviate to
notorious industrial pollution levels in China.

As a result, the Yunnanian paper industry has contracted greatly in the past decade. The remaining pulp mills in the province use generally straw, pine and eucalyptus as well as recycled fibre. Little information was available on this pulp and paper industry; capacities, production, level of technology and environmental systems.

International directories list only Yunnan Paper Making and Printing Industry Co that has two paper mills: in Kunming and Yuxi. The total annual paper and paperboard capacity in the mills is à 8000 mt. However, there apparently are also other mills at least in the Lake Erhin region near the city of Dali in Central Yunnan. In mid-1990’s a 100 000 mt/yr pulp mill was in pipeline Yangbi county. Pulp production in some older units was discontinued pending the commencement of the production in the new mill.

The environmental standards of the mills are low. Silvennoinen (et als. 1995) gives us a gloomy, even medieval picture of the pulp mills in Lake Erhin-area:

... the pulp and paper industry consist of small inefficient mills which are heavy users of energy and water and discharge large quantities of untreated pulping waste into Xier River. The mills are too small to be able to afford investment in efficient chemical recovery systems or end of pipe treatments. The equipment in the mills is old and inefficient. None of the mills meet the national environmental standards.

However, since then some mills have been closed.

5. The Role of the Forest Sector in the Provincial Economy

The provincial authorities have in the Ninth Five Year Plan identified four main areas of economic strength and potential in the province. These are:

- bio-based production (incl. food-processing, horticulture and forestry)
- mining
- tobacco
- tourism

Despite ample forest resources, the forestry sector is not considered to have major potential for economic development, especially in view of the recent logging ban on natural forests (c.f. Chapter 3.4). Even with the increasing rate of plantation establishment, there will be a major gap in the raw material supply if alternate sources of timber from neighbouring countries or provinces is not found. Other Chinese sources of supply are unlikely as the neighbouring provinces will have similar bans.

Despite being a part of the bio-based industry cluster, the forest industry does not play a major role in the Yunnan industrial structure. Its share of the total industrial production value is only 3%. Forest based industries provide employment to 25 000 people. An additional 55 000 are employed in actual forestry. This may be an underestimate however, as rural general labourers are also involved on a casual basis, e.g. during planting.

There is currently no arrangement to introduce certification of sustainable forest management schemes in Yunnan. Much of the market demand comes from the domestic Chinese market where environmental issues have yet to reach paramount importance among consumers.

6. The International Wood Trade and Trade to other Chinese provinces

6.1 Exports

Export markets – both for logs and sawnwood – constitute a large part of wood and wood product demand in Yunnan. The total volume of logs and sawnwood exported was 450 000 m³ and 150 000 m³ respectively in 1996. The total log volume produced for export would thus have been about 750 000 m³.

A vast majority of wood exports are destined to other provinces in China, with the biggest markets being Hubai
and Henan Provinces in the central parts of China. Only a small part of the produce goes to the better known dynamic business areas of Guangdong, Shanghai, etc. in the coastal areas. (Figure 6.1)

**Figure 6.1: Exports of Logs and Sawnwood – destination (1997, %)**

Exports outside of China are of a more moderate volume. Combined with other, non-named provinces they form only 20% of the total. However, the statistics underestimate the trade relations between Yunnan and other countries. Despite Yunnan having one of the smallest shares of international investment among China’s provinces it has a relatively high foreign-owned or JV component in forest industry enterprises. Because of this fact, there is a higher rate of [semi]-processed export wood products.

The YPG has a policy of negotiating more JVs with foreign companies. Some foreign investment in wood processing has come from Thailand, Hong Kong, Taiwan (PoC) and Italy.

### 6.2 Imports

Officially, Yunnan imports no wood from foreign countries. The vast forest resources of Yunnan should theoretically be able to satisfy all domestic wood demand. However, evidence from neighbouring countries does not support this.

ITTO (1998) reports, based on official Chinese statistics, state that China imported some 30 000 m$^3$ (1996) from Myanmar. The volume of imports from this country has been fluctuating widely. In 1994 it was 23 000 and the following year 511 000 m$^3$, i.e. a twenty-fold increase. Yunnan has a long border with Myanmar and all wood transported overland to China enters through Yunnan.

Other sources estimate the import rate as even higher, with the highest estimates being in the range of 200 000-300 000 m$^3$. Much logging is allegedly carried out by Chinese traders and logging companies in areas bordering Yunnan. This may explain the lack of reported official imports; the wood is smuggled into the country and disguised as domestic wood for the market.

Imports from Lao PDR have also been on the increase. There are two types of imports from Laos.

a. supply contracts from Lao companies to sawmills in Yunnan. The wood is usually medium-grade
sawnlogs. These deliveries are often payments for infrastructure projects completed by Chinese counterparts.

b. some valuable hardwood logs are being traded on a cash basis (spot deliveries) at Lao–Chinese border posts. These truckloads are generally destined for re-export to Hong Kong or coastal Chinese cities.

The trade volume has been fluctuating widely but the trend is that it is on the increase. Phongsaly, a province in northern Laos recently increased its annual logging quota from 1 000-1 500 m$^3$ to 20 000 m$^3$ in 1998 to meet the increased demand.

It may safely be estimated that at least anything up to 320 000 m$^3$ have been imported annually to Yunnan in the recent years. In the total supply the role of imported wood is marginal (only 1% of domestic wood supply). The logs imported are medium to high-grade saw and veneerlogs and are not substituting e.g. domestic fuelwood. Compared to commercial logging the imports form a notable increase in supply. The logging volume in 1997 was 1.7 mill m$^3$. Thus, imports increase commercial supply by upto 18%.

7. Demand–Supply-balance

7.1 Demand

Wood is being utilised by both industrial and household sectors. In the case of Yunnan, some additional demand comes from the exports as well. In volume terms most of the demand comes from the household sector while the unit value of industrial and commercial demand is by far larger.

7.1.1 Household and other Non-Wood Processing Use

The vast majority of wood use in the province originates from household use of fuelwood. The other main form of wood energy, charcoal, has traditionally had a relatively small role in Yunnan. Only some ethnic minorities in the southern parts of the province use charcoal.

The estimated annual consumption of fuelwood *per capita* is 0.77 m$^3$. Household fuelwood is mostly consumed in rural areas. In urban areas, other forms of energy, such as electricity, coal and gas, are used. Yunnan authorities aim to increase the use of non-wood energy sources in semi-urban and rural areas. The total use of fuelwood in the province is currently around 16.8 mill m$^3$ (Table 7.1).

Most fuelwood is collected as logging residue and from forests. However, almost half originates from the clearing of land for agricultural purposes.

Other important non-wood processing uses of wood are use of wood in rural house construction (9.9 mill. m$^3$) and tobacco curing (5.4 mill. m$^3$). Yunnan has a notable mining industry but it uses only marginal volumes of wood.

In total the bulk of wood utilised in the province are utilised outside forest industries which generate only 6% the total demand for wood in Yunnan.

<table>
<thead>
<tr>
<th>Table 7.1: Wood Demand Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- m$^3$-</strong></td>
</tr>
<tr>
<td>Fuelwood</td>
</tr>
<tr>
<td>- of which agricultural clearing</td>
</tr>
<tr>
<td><strong>export and wood-processing industry</strong></td>
</tr>
<tr>
<td>Log exports</td>
</tr>
<tr>
<td>Export sawnwood</td>
</tr>
<tr>
<td>Domestic sawnwood</td>
</tr>
</tbody>
</table>
Wood-processing Industries Demand

Traditional commercial wood-processing industries have only a small role in the total demand for wood in the province. In total only 6% of the wood flow is either processed or exported commercially. Tobacco curing alone consumes three times this amount of wood. (Table 7.1)

There are no production figures available for forestry industries in Yunnan. Therefore, the consumption figures are based on the production capacity of the mills. Yunnan province, like the whole of China, has an on-going construction boom and it may be assumed that the mills reach their actual capacity. This may, however, be well-below the installed capacity due to a lack of maintenance and replacement investment. Additionally, it is assumed that particle and fibreboards are produced from production residue from sawnwood and plywood production.

Most of the industrial demand originates from sawmilling industry (840 000 m$^3$) of which 1/3 is destined for exports and the remaining 2/3 for domestic markets. This is followed by pulp and paper industry (500 000 m$^3$). Some 450 000 is exported in log form. However, even this forms only 1% of the total demand.

7.2 Supply

Until recently the wood demand for the Yunnan wood-processing industry was met by both natural forest and plantation wood. Some logs have also been imported in the 1990’s from Myanmar and Lao PDR.

Growth in non-protected forests is estimated at 42.9 mill. m$^3$. This is the largest volume removable from forests outside protected areas while maintaining standing stock volume. Due to the large diversity in the Yunnan forests, not all the growth is commercially utilizable.

Prior to the logging ban, the annual allowable cut was estimated at 4.5 mill. m$^3$ - the volume of commercially attractive species available in the province. This included both natural and plantation forests.

Due to the poor access to information on the Yunnan forest sector, there are no annual observations on logging volume in the province. However, some figures are available. Recorded logging has been declining since 1987 and volume has been below 2 mill. m$^3$ since 1993. During the same time, log exports have also been declining, however, this reduction in numbers has not been rapid enough to compensate the fall in harvesting. Consequently, the total domestic supply has declined from 1.9 mill. m$^3$ in 1987 to 1.3 mill. a decade later in 1997. (Table 7.2)

<table>
<thead>
<tr>
<th>Plywood</th>
<th>160 000</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulp and paper</td>
<td>500 000</td>
<td>1%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>1 950 000</td>
<td>6%</td>
</tr>
<tr>
<td><strong>other industrial use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>9 910 000</td>
<td>29%</td>
</tr>
<tr>
<td>Tobacco production</td>
<td>5 316 000</td>
<td>16%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>15 226 000</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33 966 000</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plywood</th>
<th>160 000</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulp and paper</td>
<td>500 000</td>
<td>1%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>1 950 000</td>
<td>6%</td>
</tr>
<tr>
<td><strong>other industrial use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
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<td>45%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33 966 000</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 7.2: Log Supply 1987-97

<table>
<thead>
<tr>
<th>Year</th>
<th>Harvesting</th>
<th>Log Export</th>
<th>Domestic Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>2 770</td>
<td>853</td>
<td>1 917</td>
</tr>
<tr>
<td>1990</td>
<td>2 448</td>
<td>763</td>
<td>1 685</td>
</tr>
</tbody>
</table>
Much of the forest plantations in Yunnan were established in the 1990’s. Thus, they will have a role in the wood supply only later. The current supply from plantations is 40% of industrial supply, *i.e.* 514 000 m³. This corresponds to 60 000-80 000 ha of currently mature production plantations.

7.3 Balance

7.3.1 Pre–Logging Ban

Prior to the logging ban Yunnanese forestry was theoretically sustainable, and potential sustainable supply was more than demand. The validity of the analysis is, however, limited by several methodological issues, *e.g.*:

1. species distribution in supply and demand are most likely not to match
2. there is no indication on the sustainability of forest utilisation in various parts of the province
3. the volume of illegal logging is not available
4. growth may be underestimated

The demand–supply-balance in Yunnan forestry is presented in Table 7.3. An additional assumption concerning illegal logging is made. Experience from neighbouring countries indicates that some 20-50% may be added to recorded logging statistics to cover illegal logging. Anecdotal information from Forestry Stations indicates that illegally logged volume could be comparable to almost 10% of construction wood demand, *i.e.* up to 1 mill. m³.

Table 7.3: Demand–Supply-balance

<table>
<thead>
<tr>
<th></th>
<th>- thousand m³ -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
<tr>
<td>Natural Forests</td>
<td>42 386</td>
</tr>
<tr>
<td>Plantations</td>
<td>514</td>
</tr>
<tr>
<td>Imports</td>
<td>150</td>
</tr>
<tr>
<td>Supply</td>
<td>43 050</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td></td>
</tr>
<tr>
<td>Fuelwood and other industrial</td>
<td>39 826</td>
</tr>
<tr>
<td>Export and wood-processing industry</td>
<td>1 950</td>
</tr>
<tr>
<td>Illegal logging</td>
<td>991</td>
</tr>
<tr>
<td>Demand</td>
<td>42 767</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>283</td>
</tr>
</tbody>
</table>

The sustainable supply is only 1% above demand. The margin is very small and sensitive to in inaccuracies in the data. If the natural forest growth estimate is overestimated or demand underestimated by less than 10% the forest utilisation becomes unsustainable. (Figure 7.1)

Figure 7.1: Demand–Supply-balance, Sensitivity Analysis
Another way of assessing the situation is to derive a separate demand–supply-analysis for commercial logging. The Yunnan forest authorities have estimated the sustainable commercial yield to be 4.5 mill. m³. Current commercial logging is well below that, even after a 30% adjustment for illicit removals. (Table 7.4)

Table 7.4: Demand–Supply-balance, Commercial Logging

<table>
<thead>
<tr>
<th></th>
<th>- thousand m³ -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
<tr>
<td>Sustainable yield</td>
<td>4 500</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td></td>
</tr>
<tr>
<td>Wood harvesting</td>
<td>1 735</td>
</tr>
<tr>
<td>Illegal harvesting</td>
<td>521</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td></td>
</tr>
<tr>
<td>Wood harvesting</td>
<td>2 256</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>2 245</td>
</tr>
</tbody>
</table>

For commercial logging the level of removals is at a more sustainable level than for forest utilisation as a whole. The sustainable yield will have to be more than halved or illegal logging (excl. fuelwood collection) would have to be 160% of the recorded logging for commercial logging to be unsustainable.

7.3.2 Medium to Long-term Prospects

The recently introduced logging ban cuts most of the supply from the market. Currently only 2% of wood supply originates from plantations or imports. The Yunnan plantations have been established quite recently but after only one decade, a notable increase in the supply of plantation wood may be assumed.

The Yunnan authorities have initiated massive plantation establishment campaigns in order to alleviate the foreseen wood deficit in the province. However, plantations need at least 15 years before any removals can be made. Two projections have been made to estimate wood demand in Yunnan until year 2025; a) radical YPG initiated reduction in household and tobacco production wood demand and b) more conservative estimate on the reduction pace. Only one projection was made for supply as the current figures were deemed optimistic though realistic.

Based on the ambitious planting objectives and moderately declining demand it may be estimated that there
will be a persistent wood deficit in the province until year 2015 (Government Plan) or 2020 (Conservative Scenario). (Figure 7.1, basic assumptions for both supply and demand are presented in Annex 4)

**Figure 7.2: Demand–Supply-balance Projection, 1997-2025**

Yunnan forestry will be entirely dependent on either imported or other wood sources for a long period of time. In the model, only in years 2006 and 2010 (Government Plan and Conservative Scenario, respectively) will self-sufficiency reach 30%. Due to the rapid plantation establishment, 50% self-sufficiency would be reached only four/three years later.

Imports cannot fully solve the deficit problem. Most of the wood demand is low unit value household wood that a) does not have international markets, and b) would be too expensive to import, transport costs would increase the price beyond the reach of ordinary Yunnanese people. Only with higher-grade saw and veneerlogs, and pulpwood is increased imports a realistic option to replace the downfall in domestic supply. The increase in regional demand would also be notable. The current saw and veneerlog demand in Yunnan (processing and exports) would consume more than 40% of the combined hardwood logging in Lao PDR and Myanmar – the neighbouring countries to Yunnan.

Due to a) small areas of mature plantations and consequent dependence on natural forests, and b) a high demand for low-value, almost non-tradable household consumption wood demand in Yunnan, it is evident that the logging ban cannot be effectively implemented. Fuelwood collection will most likely continue from the natural forests as before. Even if new energy sources in households were promoted, it could be only a gradual process. The majority of the population will depend on fuelwood even in the long-term.

Legal industrial utilisation has so far been sustainable in the province on average. Sustainable forest management is in the interests of the wood processing industry as it guarantees a steady raw material flow.

In an attempt to safeguard valuable watershed areas a more realistic approach would be a three-stage strategy:

1. realistic regulatory framework and management plans developed (incl. logging bans in fragile watersheds)
2. improved institutional capacity in the implementation and control of the regulation and management plans
3. policies and schemes to strengthen demand-supply-balance through:
   - increased supply (plantations)
• decreased demand by more efficient production methods in industry and household. Introduction of alternative, renewable energy sources to households

Fully implemented sustainable utilisation of the forest may in the long-term lead to better environmental results than an infeasible total logging ban. Particularly with household demand as it is to a large extent an exogenous variable in the forestry policy matrix; its volume cannot be influenced through policy interventions. However, if the demand, and corresponding supply, is directed away from the most fragile areas there is a genuine possibility of success. If all guiding interventions are prohibited, as is the case in total logging ban, the inevitable demand is met from undesirable sources. A realistic second best–option is better than the unrealistic first–option.

8. Conclusions and Recommendations

8.1 Current Situation

Forests play a crucial role in the economy of the province and the lives of its population. Until recently the province has over-exploited the forestry resource leading to notable environmental damage and economic loss; not only within the province itself but also in other provinces through flooding. In order to overcome these problems the provincial and national governments have co-operated in setting up new policies and mechanisms to protect the fragile watersheds through trying to achieve reduced demand and increased supply from the plantations. This policy has culminated in the logging ban introduced in October 1998.

Household demand for wood, both for fuelwood and construction, forms a bulk of the wood demand in the province. Curtailing this type of demand is difficult as it is: a) often part of subsistence economy and will continue if no substitutes are found and b) it is exogenous, non-market demand that is difficult to be influenced through traditional forest policy interventions. The government has initiated programs to limit household wood demand considerably, and though successful in some other provinces, the outcome is still to be seen and objectives may be over-ambitious.

The main issue in the Yunnan forest utilisation policies in the coming years will be how to guarantee a wood supply both to households and industry in an economically and environmentally sustainable manner. The current (pre-ban) demand–supply-balance is on the edge; even a small increase in demand or decrease in supply would make it unsustainable even at a provincial level, in some areas in the province overexploitation is evident. Plantation establishment in the province has been vigorous in the 1990’s but these will only ease the situation in the long-term. Plantation establishment is a complex process and it cannot be increased without thorough techno-socio-environmental feasibility studies and community involvement.

Imports from neighbouring countries are part of the solution but may only help in the commercial logging sector and should not introduce deforest-thy-neighbour-policies.

As for the administrative set-up in forestry, the province, like the whole country, has gone through decentralisation policies in the past two decades. This has increased the independence of the various forest sector enterprises and administrative units. There still are some linkages between the administrative County Forest Bureaux, the commercial County Wood Companies, and the State Forest Farms. The Forest Bureaux are the administrative and promotional institutions that cover all the players in forestry; state, communal and private. Disengaging administrative units from business activities would increase their neutrality and credibility.

The forest sector in Yunnan lacks transparency, which may be one reason behind the shortcomings of forest policy implementations. This may be, in addition to administrative structures, also due to the inadequate access to forest statistics and other information.

8.2 Recommendations

In order to address the development needs recognised in this report the consultant team recommends three short-term programmes. All the recommended actions require more institutional rather than financial inputs and hence could, and should, be started soon, within a year or two.

Information Services
A programme should be initiated to collect and disseminate relevant forestry, forest industry and related social, environmental and economic information. This would be made possible by:

a. naming one independent body, *e.g.* a research institute or provincial Forestry Department, responsible for forest related information services. The institute would have a right to collect all relevant wood market and forest resource information in Yunnan.

b. the same institution or another would also be provided with resources to carry out a large-scale forest inventory in Yunnan and to keep it updated.

The institute would publish the information in such a way that no information from a single market player would be disclosed. Also findings of the forest inventories to be carried out should be made available in a feasible manner. This project could be co-ordinated with other GMS countries in order to achieve harmonised nomenclature in the statistics.

Institutions

Currently the double role of the CFBs both as an administrator and a business entity put the private and communal forest owners in an inferior position. In the recommended institutional restructuring business and administration would be separated in a credible manner. The restructuring would involve:

i. transfer of the CWCs from the CFBs to market orientation or divestiture.
ii. transfer of forest farms to market orientation
iii. other possible actions to improve neutrality and transparency would be:

   o information on wood prices provided in the forest information system to be established
   o strengthening of co-operation among non-state forest owners, *e.g.* through forest owners’ associations

Watershed and Forest Management Policy Development

The logging ban was decided as an emergency action after the serious flooding in lowland provinces. It is evident that only a little research or analysis was made on the effects of the ban prior to the decision. In order to achieve sustainable results the ban should be redesigned to address the core problem: inappropriate watershed management practises.

It is recommended that a policy design process is initiated to re-evaluate the ban and its impacts. The current design of the ban is not feasible, as there will be a huge gap in the demand–supply-balance that needs to be filled. A more feasible solution would incorporate strict watershed management policies and their implementation with sustainable management, and utilisation, of other natural forest resources. This would also need intervention at community level through joint management of the resources and raising of awareness. The objective would be to create an enabling legislative and management framework.

ANNEX 1

Literature Consulted


Economist, The. London


For personal communications see separate list of people met (Annex 2)

ANNEX 2

People met during the mission

Only people specifically interviewed have been listed. Many more people, who go unlisted, also provided their valuable advice and comments.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Da Jie Zhuang Log Terminal Company</td>
<td>Li Xi Zhong</td>
<td>Deputy Manager</td>
</tr>
<tr>
<td>Yunnan Polytechnic University</td>
<td>Zhang Xue Zhong</td>
<td>Associate Professor, Director</td>
</tr>
<tr>
<td>Yunnan Polytechnic University</td>
<td>Yang Simai</td>
<td>Dean, Professor</td>
</tr>
<tr>
<td>Yunnan Province Forestry Department</td>
<td>Tian Zhong Xian</td>
<td>Deputy Director</td>
</tr>
<tr>
<td>Yunnan Province Forestry Department</td>
<td>Wang Zhe</td>
<td>Deputy Director</td>
</tr>
<tr>
<td>Yunnan Province Forestry Department</td>
<td>Cheng Rong Gui</td>
<td>Chief of Division</td>
</tr>
<tr>
<td>Yunnan Province Forestry Department</td>
<td>Yili Qi</td>
<td>Vice Division Chief</td>
</tr>
<tr>
<td>Yunnan Provincial Planning Commission</td>
<td>Li Qin</td>
<td>Associated Researcher</td>
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ANNEX 3

Itinerary of the Consultancy

<table>
<thead>
<tr>
<th>1998</th>
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<tbody>
<tr>
<td>June 1</td>
<td>Arrival of Mr Devenish (the Team Leader) to Vientiane</td>
</tr>
<tr>
<td></td>
<td>Commencement of the Project</td>
</tr>
<tr>
<td>July 30</td>
<td>Arrival of Mr Castrén (the International Consultant) to the project HQ in Vientiane, Lao PDR</td>
</tr>
<tr>
<td>July 31-</td>
<td>Literature studies and initial meetings in Vientiane</td>
</tr>
<tr>
<td>September 6-11</td>
<td>First visit to Kunming by Mr Castrén Mr Wang commences work</td>
</tr>
</tbody>
</table>
**ANNEX 4**

**Assumptions for Demand–Supply-balance Projection, 1997-2025**

- average removals on mature plantations 6 m³/ha
- first commercial removals 15 years after planting
- plantation establishment as follows (thousand ha). The first figure represents productive, net plantations and the latter gross planting with relatively high 65% long-term survival rate

<table>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>logged volume</td>
<td>1221</td>
<td>921</td>
<td>900</td>
<td>675</td>
<td>450</td>
<td>225</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- gradual decline in natural forest logging, thousand m³

- log exports are to be discontinued. Exports are restarted on a small-scale once 35% self-sufficiency is reached.
- due to a log shortage, price increase, and a slowing down in construction activity sawmilling and plywood production decline 60% in 1999-2001. After that, production volume increase annually by 1%. The pulp and paper industry declines 20% and remains stable at that level.

**Household and Other Industrial demand in the two projections**

For commercial logging the two scenarios are identical.

**Conservative Scenario**

- due to the wood deficit demand also declines. Non-forest industry use declines annually 2% in the first five years and 1% thereafter due to switch to other household energy sources and decline of wood use in tobacco industry.

**Government Plan**

- poverty alleviation and mountain development will help poor rural people out of poverty at an increasing pace towards the turn of the millennium. In this case, in rural house construction wood will be substituted with other materials. It is estimated that rural construction wood demand will decrease 40-50% by the year 2001 (more optimistic limits used in the projections)
- rural energy saving projects, such as introducing fuel-efficient stoves and switching to other energy sources, biogas, coal, etc. will reduce fuelwood consumption by 30-40% by the year 2001. Yunnan is rich in hydroelectric power and is exporting energy. This abundant electricity may be utilised in the rural electrification drives. Electric cookers are relatively cheap and with increasing rural incomes more
affordable. A high quality rice cooker may be purchased at as low a cost as RMB 120 (USD 15). More than 80% of rural areas are reached by the electricity grid in Yunnan.

- due to reduced tobacco demand and trade barriers by other provinces production, and wood consumption, will decrease by 15-20% by 2001 in the tobacco industry
- awareness building on nature conservation and community development by both the government and rural communities should contribute to the implementation of the logging ban.