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A Profile of the Chilean Forestry Sector

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A PROFILE OF THE CHILEAN FORESTRY SECTOR

by

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CHAPTER I

INTRODUCTION

Chile is located in the southern part of South America between latitude 17°30'S, the South Pole, along 70°W longitude. The country is bounded on the north by Peru, and by Bolivia and Argentina to the east.

Chile's continental area is 75.7 million hectares and it is about 4,500 kms in length and 160 kms average width. In the Antartic, Chile controls an additional 125 million hectares.

In 1987, Chile's population totaled 12.4 million, a density of 6.1 people per hectare. The population growth rate is moderate, about 1.6% annually. The population is concentrated in the younger age groups. Literacy is reported at 92%.

Most Chileans live in urban areas, with over 40% in the capital, Santiago. As a result, administrative, finance and marketing services tend to be centralized in Santiago. Region VIII, where many of the radiata pine forests are concentrated lies 200 km. south of the capital area.

Chile's culture has a strong European heritage, and its social structure is formal. The official language is Spanish and the currency is the Chilean peso.

The country is divided into 13 administrative Regions (I-XII plus the Metropolitan region of Santiago). The locations of the regions and their capitals are shown in figure 1 which also shows the distribution of the country's forest resources.

Chile has been governed by a military junta (Junta Militar de Gobierno) since September of 1973. The new constitution approved in 1980 provides for a presidential plebiscite late in 1988 and parliamentary elections are scheduled for 1990.

Chile's Economy

Chile's economy has had a free market orientation, particularly since 1973. Like all countries of the Third World, huge external debts and high interest rates are the major factors constraining future development. However, the economy of Chile is considered the most promising within Latin America by the international financial community (15).

With a nearly 5.5% increase in gross domestic product (GDP), 1987 marked the Chilean economy's fourth consecutive year of growth. Foreign investments and exports were the two key factors behind in this expansion (5). Recent estimates of GDP for the first quarter of 1988 released by the Central Bank of Chile point to the continued expansion of the economy (13).

Total foreign debt at the end of 1987 was about $17.5 billion. Conversion mechanisms known as Chapter XVIII and XIX of the Central Bank and lower negotiated interest rates have allowed Chile to reduce its external debt by about $2.8 billion dollars in the last two and a half years. The current trade surplus enables foreign payments to be maintained on foreign debt (5,16).

The trade surplus is expected to reach a new record in 1988 of approximately $1.4 billion. Copper prices and increasing growth of the forestry and fruit sectors are the major explanatory factors. The structure of Chile's international trade is shown in the following table for 1987.

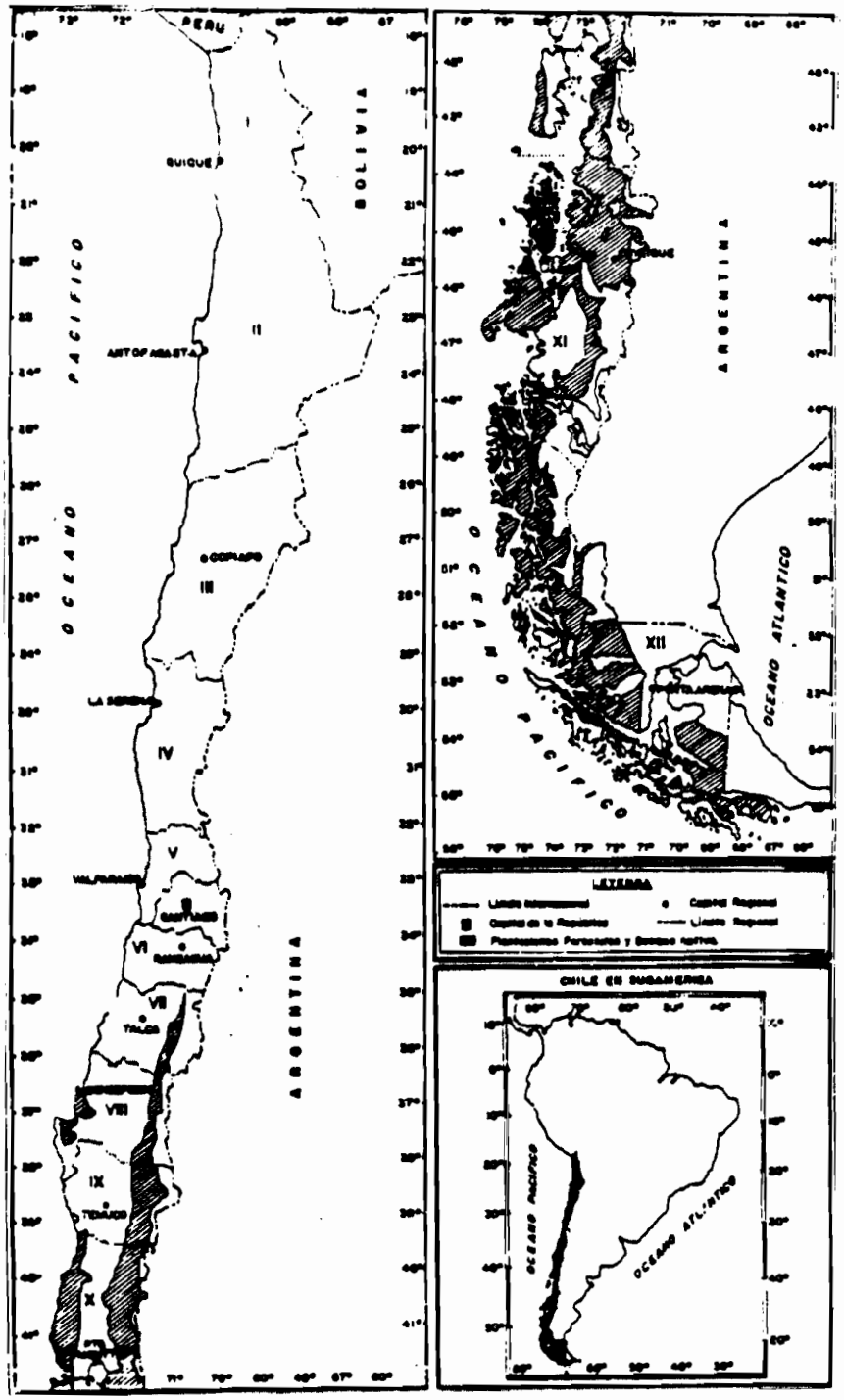

Figure 1. Map of Chile and its location in South America.

Table 1. Imports and exports in millions of U.S. dollars.

Exports (FOB)		
Mining	$ 2,745.8	
Agr. and Fishery	743.0	
Industry	1,613.2	
Total Exports		$ 5,101.9
Imports (CIF)		
Consumer goods	$ 584.1	
Capital goods	981.5	
Semi-Manufactures	2,227.7	
Duty-Free Zones	230.0	
Total Imports		$ 4,023.3

Source: Comité de Inversiones Extrangeras 1988 (10).

Forest products ($ 587 million), fresh fruit ($ 527) and fish meal ($ 358) are the three leading components under the Agriculture, Fishery and Industry category.

Inflation has been moderate by Chilean standards over the last few years. In 1987, the Consumer Price Index (IPC, Indice de Precios al Consumidor) reached 21.5% prompting the Central Bank to pursue a more restrictive monetary policy. The inflation rate is expected to be about 15% for 1988.

The labor force in Chile was estimated at 4.45 million as of April 1988 by the National Bureau of Statistics (INE, Instituto Nacional de Estadísticas). Unemployment nation-wide remains slightly over 8%. The metropolitan area of Santiago and regions II and III in the North have the highest unemployment rates (17). Currently the forestry accounts for slightly 2% of jobs nationally (20).

Wages increased just over 20% annually in 1987. The legal minimum income was just raised to 14,000 Chilean pesos ($57.54) per month starting in June of this year (13).

Another important economic policy relates to the exchange rate of the Chilean peso. The Central Bank adjusts the exchange rate daily for domestic inflation. In March, 1988, the U.S. dollar averaged 243.3 Chilean pesos. Chile's indexed exchange rate policy provides a competitive advantage to Chilean exporters.

The sale of stock in state owned properties is another key economic policy being implemented by the government. Large state owned enterprises, such as Pacific Steel Company (CAP, Compañía de Acero del Pacífico), CHILECTRA Chile's electric power distributing company and the Chilean telephone company (CTC, Compañía de Teléfonos de Chile) are among the enterprises going public (privatization in the Chilean stock market terminology). This program is designed to substancially reduce the size of the public sector in Chile.

The Finance Minister (Ministro de Hacienda) has also announced the lowering of general customs duties from 20% to 15% effective January 1988. These measures are designed to further boost exports and foreign investment to ensure continued growth (4).

A record $1.17 billion of foreign investment entered Chile in 1987. Some 40% of these transactions were carried out under Decree Law 600, Chile's foreign investment statute, with the remainder as a result of debt/equity swaps under Chapter XIX of the Central Bank's Foreign Exchange Regulations (4).

Chapter XIX of the Central Bank's Foreign exchange regulations permits foreign investors to acquire portions of the Chile's foreign debt at a discount, which are then converted by the banking system into local currency at face value to implement investments (10). Significant investments have been made in different sectors of the Chilean economy by New Zealand, Japan and the United States.

Institutional Structure of the Chilean Forestry Sector

In addition to the general economic policies of the country which have a direct bearing on the forestry sector, there are several government agencies, private institutions and universities which also support forestry sector activities.

Corporación Nacional Forestal (CONAF)

CONAF is the primary government agency responsible for the promotion of forestry in Chile and is under the Ministry of Agriculture. CONAF's major functions are the enforcement the forest management legislation, coordination of fire protection services, administration of the national parks and forest reserves, and strategic planning for the forestry sector. In addition to Central offices in Santiago, CONAF has regional offices (Direcciones regionales) throughout Chile.

In the early seventies and eighties CONAF engaged directly in planting. CONAF also plays a government-directed role in employment creation programs for foresters and woods workers but with strong annual variations particularly in the rural areas of Chile.

Currently CONAF administers Decree Law 701 (a forest management subsidy for afforestation and management) and coordinates the efforts of private and government agencies in all aspects of forestry activities. It has programs designed to plant sand areas, planting efforts in arid-zones, conservation of endangered flora and fauna and agro-forestry activities deserve special mention. Some of these programs are carried out with technical and financial assistance from international organizations, such as the Interamerican Development Bank.

Instituto Forestal (INFOR)

INFOR was founded in 1961 by CORFO (Corporación de Fomento de la Producción - a development financial institution). This institution is primarily responsible for research and statistical documentation of the forestry sector. It maintains cooperative information agreements with most Chilean statistical sources which allows it to regularly publish current statistics on the forestry sector.

INFOR headquarters in Santiago has four divisions, silviculture, forest inventory, forest industry and economic studies. Recently INFOR established a new branch office in Concepción (region VIII) in an attempt to further promote forestry research and decentralize its operations. However, budgetary problems continue to affect its current and potential role as a research and information gathering agency.

Corporación Chilena de la Madera (CORMA)

CORMA is the most important forest products trade association in Chile. CORMA acts at the government level to promote the benefit of the private companies. It has also formed smaller associations of forest products producers in the major forestry regions of the country. CORMA

attempts to coordinate research between the private companies and universities in an effort to promote the forestry sector development.

Other Organizations

ASIMAD (Asociación de Industriales de la Madera) is an association of firms engaged in secondary wood manufacturing. The main focus of this association is the promotion of exports of manufactured wood products such as furniture components.

Fundación Chile is a 50/50 venture between the Chilean Government and the International Telephone and Telegraph Co (ITT), whose primary objective is the transfer of foreign technology. A particularly important project is "thermal energy dwelling" (viviendas energitermicas) which promotes the widespread the use of radiata pine lumber as building material.

Among the financial institutions, CORFO is the one playing the most important role in the forestry sector. This government agency offers financial assistance to forestry projects, particularly small wood products manufacturing companies.

PROCHILE is a technical department within the Ministry of Foreign Affairs. It's primary function is the promotion of Chilean exports, particularly forest products. PROCHILE'S technical divisions furnish domestic producers with information on market conditions abroad and bring foreign entrepreneurs into contact with Chilean producers (10).

Educational Institutions

Forestry education at the professional level started in the early fifties. Currently there are six universities offering forestry degrees in Chile. These programs produce about 250 graduates per year. Undergraduate degrees are offered in silviculture and forest management. Universidad Católica in Talca (Region VII) is the only institution that offers a technician's degree (técnico forestal). Universidad del Bío-Bío located at Concepción offers undergraduate degrees oriented toward the forest products industry. Even though the forestry sector is expected to grow substancially in the future, current enrollment suggests that there will be an oversupply of professional foresters.

In 1982, Universidad de Chile started a graduate program offering the Master of Science in Wood Technology. This program lasted only four years. A new graduate program in forestry was started in 1986 by Universidad Austral in Valdivia (region X) with emphasis in silviculture.

Continuing education for professional foresters and unskilled workers is provided by the National Training Center at Escuadrón in Concepción and is administered by CONAF. Major companies are also developing training programs for their own personnel.

CHAPTER II

THE CHILEAN FOREST RESOURCES

Chile is well endowed with forest resources. Commercial forests are estimated at 8.9 million hectares of which 1.24 million are plantations. The remaining 7.6 million forested hectares are composed of native forests.

Chile also has 13.3 million hectares of natural parks and forest reserves. Almost ninety percent the parks and reserves are in regions XI and XII (35). The total area contains 34 national parks and 40 forest reserves. CONAF administers these areas under the Sistema Nacional de Areas Silvestres Protegidas (National System of Protected Wildlife Areas) (29).

An overall picture of Chilean forest resources in area and volume terms is provided in Table 1. A breakdown by regions is presented in Appendix Table 1.

Table 2. Chilean forest resources through 1986.

Type of resource	Area (ha)	Volume (million m^3)
TOTAL	8,858,815	1,049.3
Native forest	7,616,500	915.1
Planted forest	1,242,315	134.2
Radiata pine	1,080,491	114.3
Other species	161,824	19.9

Source: INFOR 1987 (35).

Plantations

Radiata pine (*Pinus radiata* D. Don) accounts for 87% of the forested area in plantation (35). Other species in order of importance are Eucaliptus (*Eucaliptus globulus*), Atriplex (*Atriplex nummularia*), Tamarugo (*Prosopis tamarugo*) and Douglas fir (*Pseudotsuga menziesii*). These species occupy about 118,000 hectares in Chile.

Radiata pine plantations provide the bulk of current Chilean forest production. For this reason, a great deal of attention has been given to the development of this particular species. The introduction of radiata pine started in the early 1950's. Moderate planting efforts took place until the early seventies. An estimated 290,000 hectares were planted to radiata pine by 1974 (35).

In October of 1974, Decree Law 701 was passed and ammended in 1979. This law has been one of the key factors in the increasing planting rate in the country ever since. The key provision of the amended version of Decree Law 701 (DL 701) lies in the 75% cost subsidy provided for the establishment of new plantations and future silvicultural practices, inexpropiability of the land declared of "forest aptitude" and some tax incentives. Private ownership of land is a key element of the current economic system implemented by the government. In the past, expropiability of land was at government discretion particularly during the periods of the "reforma agraria" (agricultural reform). In order to receive the subsidies, timberland must have a forest manage-

ment plan approved by CONAF (Corporación Nacional Forestal). Replanting of subsidized lands is the obligation of the receiver of the subsidy and no subsidies are scheduled for future stands.

The provisions of the Decree Law 701 end in 1994. Considerable discussion is already taking place regarding the continuation of these subsidies.

Radiata pine has extraordinary growth rates in the country. Soil and weather conditions, particularly the rainfall and temperature levels common to the central and southern parts of Chile, are ideal for this species. Yields of 30-35 m^3/ha/year are reported for the higuest sites, especially in regions VIII and X.

Between 1974 and 1978, the goverment through CONAF engaged directly in planting. It planted an average of 49% of all new plantations, with private companies planting the rest. Since 1979 the planting role has been taken by the private sector, with companies accounting for over 85% of the new plantations, annually. Table 3 provides a breakdown annual plantings by species.

Table 3. Annual plantings by major species (in hectares)

Year	Total	Radiata Pine	%	Other Species	%
1978	77,371	65,413	84.5	11,968	15.5
1979	52,226	48,869	93.6	3,357	6.4
1980	72,164	60,086	83.3	12,078	16.7
1981	92,781	88,529	96.0	4,252	4.0
1982	68,586	61,637	89.9	6,949	10.1
1983	76,280	63,884	83.7	12,396	16.3
1984	93,602	76,982	82.2	18,620	17.8
1985	96,278	80,630	83.7	15,648	16.3
1986	66,195	55,058	83.2	11,137	16.8

Source: CONAF 1987 (35).

The majority of radiata pine plantations were established during the last ten years, causing an uneven age class distribution in Chilean forests. Eighty three percent of all plantations are less than 15 years old. Most of these plantations are concentrated in regions VII and VIII (35). The age class distribution and volumes of the existing radiata pine plantations are presented in Appendix Table 2.

Another characteristic of the radiata pine plantations in Chile is the high degree of ownership concentration. Three large companies Compañía Manufacturera de Papeles y Cartones (CMPC), Celulosa Arauco y Constitución (CELCO-ARAUCO) and the former Industrias Forestales S.A.(INFORSA) own approximately 405,000 hectares or 39% of the total planted area through December 1985 (35). This is an increase from 31% concentration in 1978 (40). Until recently Industrias Forestales S.A. was an independent company. However, INFORSA was purchased by CMPC in December 1986 and at the same time the latter sold the Bio-Bio paper mill to Tassman Forestry of New Zealand. Included in the sale of the Bío-Bío paper mill was 40,000 hectares of forest land with 28,000 hectares of radiata pine (3).

Native Resource

As noted earlier, 7.6 million hectares in Chile are reported in native forests. Almost 50% is concentrated in region X. A breakdown of the area covered with native forests by region together with estimated standing volumes are presented in Table 4.

Table 4. Productive native forest by region through 1981.

Region	Area (1,000 ha.)	Volume (millions of m^3)*
TOTAL	7,616.5	915.1
I	4.0	--
V	--	--
R.M.	2.7	--
VI	41.2	0.3
VII	196.4	6.4
VIII	401.7	24.1
IX	632.9	82.0
X	3,592.6	744.2
XI	1,686.0	42.2
XII	1,059.0	15.9

*INFOR defines "productive forest" as those areas containig volumes over 30 m^3/ha. and having an average DBH greater than 25 centimeters. Therefore, the above figures do not relate to the economic feasibilty of exploiting those areas (34).

Source: INFOR 1987 (35).

Much of the Chilean native resource was heavily exploited in the forties and early fifties. In fact, lumber production was based almost exclusively on native species until the mid sixties. As a result most of the high value species started to gradually disappear. Species such as Lingue (*Persea lingue*), Ciprés de las Guaitecas (*Pilgerodendron uvifera*) and Raulí (*Nothofagus alpina*) are almost non-existent at the present time. In addition, Araucaria (*Araucaria araucana*) and Alerce (*Fitzroya cupressoides*) stands were declared Natural Monuments in 1976 (46).

Another characteristic of this resource is the low exploitable volume per unit of area. An average hectare is estimated to yield between 60-120 m^3. Only 15% of this volume is considered of exportable quality, 50-60% can be used for lower grade products and the rest is only suitable for fuelwood consumption (46).

Although 7.6 million hectares in Chile are covered with native forest, only 3 million hectares are considered economically exploitable (46). The remaining area is primarily covered by burned and degraded forests. A breakdown of the three million hectares is presented in Table 5.

Commercial forests are located primarily in regions IX, X, XI and XII (46). The Chilean commercial native forest is highly concentrated in the following four areas.

Table 5. Chile's native commercial forest.

Type of forest	Area (hectares)
Commercial forest	850,000
Marginal productive forest	1,540,000
Second-growth forest	600,000
TOTAL	2,990,000

Source: Ulloa 1984 (45).

Valdivia Area (region X)

The most important area is called "Complejo Panguipulli". It has a total area of 240,000 hectares of which 50% is economically feasible to harvest. The most important species is Raulí. Second-growth stands and current plantations of Raulí are the most promising areas for future timber supply. Extensive research on this species is underway.

Also in the Valdivia area, the "Cordillera del Sarao" area contains about 279,000 hectares suitable for limited management. Commercial species are of the Nothofagus genius, such as Coigue (*Nothofagus dombeyi*), Tepa (*Nothofagus pumilio*) and Roble (*Nothofagus obliqua*).

Chiloé Area (region X)

Forests within this area are located primarily on Chiloé island. They also occupy land in the adjoining province of Llanquihue. Major species in this area are Tepa (*Laurelia philippiana*), Canelo (*Drymis winteri*), Mao (*Podocarpus nubigena*) and Coigue de Chilóe (scientific name unknown). Canelo (*Drymis winteri*) is the most promising species because it has fiber characteristics for pulp production (22).

This area has a moderate climate and the "Carretera Austral" (Southern Highway) is expected to link this part of the country with the populated sectors. The Southern Highway is divided into three major sections and has a length of about 650 miles. This road was inaugurated in March 1988, and should have a major economic impact in the region in the near future (9).

Alsén Area (region XI)

Forests in this area are only accessable by sea. The most important species are Coigue, Tepa, Tineo (*Weinmannia trichosperma*) and Mao. Logging difficulty constraints development of this area. Soils in this region are often satured with water.

Magallanes Area (region XII)

Lenga (*Nothofagus pumilio*) is the single most important species in this area. It is easily regenerated and can be found in easily accessible pure stands

Other Native Resources

Approximately 1.5 million hectares are classified as marginal productive forest land. These forests are located between regions VII and XII. Major characteristics of these forests include

lower quality trees, poor stand conditions and difficult access. Portions of these lands could be rehabilitated through improved management.

The third type of native resource mentioned in Table 5 are the second growth native forests. These are primarily naturally regenerated. An estimated 600,000 hectares are covered with this type, about 25% located in Region VIII.

The higher value native species such as Raulí, Roble, Coigue, Tepa and Lenga have shown good response to silvicultural treatments such as selective cuttings, thinnings and pruning. However, government subsidies have been argued to be essential in order to achieve the future potential of existing second growth native forests. A goverment law similar to Decree Law 701 designed to improve the management of native forest is under consideration.

Some Chilean valuable native species are of continuing interest to Pacific Rim importers. The recent sale of part of the "Complejo Panguipulli" to private companies by its former owner CORFO and the purchase of the "Contao" area (region X) by a foreign bank suggests that investments in the Chilean native resource are profitable as well.

Silviculture, Management and Protection

Silvicultural and management treatments are essential for the production of good quality logs. These are particularly important for species such as radiata pine which is a very poor self pruner and most of the emphasis is on radiata pine because of its dominance in production.

Site preparation for planting includes brush removal and burning. Planting uses bare root stock with a common density of 1,600 stems per hectare. Survival rates of over 90% are common. The Winter planting season runs from May through August of each year.

Nurseries used by the larger companies are designed for mass production. These nurseries also supply smaller forest owners. Some 272 reported nurseries have an estimated production of 170 million seedlings per year. Radiata pine seedlings account for 69% of total production (35).

A cooperative forest genetics program was started in Chile in 1977 by Universidad Austral de Chile, CONAF and several forest products companies. This resulted in substantial increases in the production of genetically improved radiata pine seedlings. The establishment of a radiata pine clonal orchard is currently being implemented. Since 1985, increased research on some native species has taken place and research on Eucaliptus is inminent (11).

Radiata pine plantations are targeted to two major end-uses, pulpwood and high quality sawntimber. The objective of radiata pine sawlog production is to produce large diameter (over 20 cms), knot-free logs. This philosophy was extensively promoted by Sutton (45). Early pruning and heavy thinnings are the commonly used to achieve this objective, and widespread use of these intensive practices started in 1980. Since the knot-free management regime is new, the bulk of the existing radiata plantations yield a high proportion of small diameter knotty logs.

By 1995 about 75% of the plantations in the country will be under intensive management. Region VIII is expected to have almost 82% of its plantations under some kind of intensive forest management by the same year (34). The continuation of this level of intensity may depend on extention of DL 701.

During 1986-87 a total of 5,141 reported forest fires destroyed approximately 91,000 hectares of forest land. Regions V, VIII and IX were the hardest hit (35).

Currently CONAF and the major companies coordinate their fire suppression efforts. Permanent fire-fighting teams are maintained throughout the year. Extensive forest fire prevention

programs are also carried out by CONAF, however, human activity continues to be the principal factor in starting fires (24).

The most serious pest has been pine shoot moth, *Rhyacionia buoliana* (called "polilla" del pino). This insect was discovered in plantations of region X particularly around Valdivia a few years ago. Over 15,000 hectares, primarily of radiata pine, have been affected to date (32). A successful control program was carried out by CONAF with technical assistance from Spain and the United States during 1986 and 1987. In spite of these efforts, it is estimated that 3,270 hectares of radiata pine plantations will be lost annually to fire and disease (34).

Future Timber Supply

The increasing number of radiata pine plantations and the necessity of planning future investments in the forestry sector led the Instituto Forestal (INFOR) to publish the first study on Chilean timber supply in 1984 (39).

The simulation model OFERTA (SUPPLY in english) developed by INFOR was used in projecting timber availability for the period 1984-2004. The model uses only physical variables in the estimation of future availability of wood. Projections were made assuming a planting rate of 51,500 hectares over the period, with an average rotation age of 24 years.

Final results suggest that by the period 1990-1992 timber harvests could reach 17.8 million m^3, 59% of which is projected to be of sawlog quality, with the remainder pulpwood. By the year 2000 it is estimated that almost 46 million m^3 will be available, with 65% classified as sawlogs and 35% as pulpwood (39).

These projections stimulated considerable discussion within the Chilean forestry sector. Major criticisms arose from the fact that the OFERTA model was based on overstated inventory figures and the volumes given represent "gross" values. In addition, the model does not consider capital or market constraints.

In May of 1987 INFOR released an updated report on future timber supply in Chile. Basic data used in the revised model included the total number of hectares in plantations in the country through December 1985. The projection period was 30 years (34). Adjustment factors for logging costs, forest fires, disease and for currently innaccessible were included. Three different scenarios were assumed for future planting rates. The model also assumes that provisions of the Decree Law 701 will end in 1994.

Three levels of management intensity were considered: very limited management, traditional and intensive. The "traditional" management regime includes two commercial thinnings at 12 and 17 years, respectively. At age 12, between 28 and 43 m^3/hectare, are expected to be removed, with between 66 to 107 m^3/hectare during the second thinning. Under the "intensive" management level, stands are thinned at ages 5 and 11. Projected volumes are shown in Table 6. Another important assumption of the model refers to the rotation age. Although a minimum cutting age of 20 years was used, volumes are also simulated for rotations of 22 and 24 years.

For a rotation age of 20, timber supply goes from 14.1 million m^3 in 1988 to 23.2 by the year 2015. Longer rotation ages decrease current availability but increase available supplies towards the end of the projection period.

An important implication of longer rotations is the increase in available logs of over 20 centimeters of DBH (minimum sawable limit by Chilean standards). A short rotation age of 20 delivers 1 million m^3 more volume than a long rotation scenario of 24 years for the period 1986-1994. However, by the period 2004-2015 total short rotation volume is significantly less (34). A

breakdown of future volumes by size class for rotations of 20 and 24 years are presented in Table 7.

Table 6. Future timber supply in Chile.

	Plantation rate: 57,000 ha. 1987 estimates (million of m /year)		
	Minimum cutting age in years		
	20	22	24
1986-1988	14.1	12.4	10.7
1989-1991	14.3	12.4	11.3
1992-1994	15.3	14.4	12.6
1998-2000	21.0	23.4	24.1
2001-2003	21.8	24.9	27.1
2004-2006	22.1	24.9	28.9
2007-2009	22.6	24.9	29.0
2010-2012	23.2	24.9	29.0
2013-2015	23.2	24.9	29.0

Source: INFOR 1987 (34).

Table 7. Total volume by log diameter.

	Volume in million of m^3		
Minimum rotation age : 20 years			
Period	10-20 cm.	20 cm.	Total
1986-1994	10.5 - 11.0	3.6 -4.3	14.1 - 15.3
1995-2003	11.8 - 12.8	7.2 -9.0	19.0 - 21.8
2004-2015	12.2 - 13.7	9.9 -9.5	22.1 - 23.2
Minimum rotation age : 24 years			
Period	10-20 cm.	20 cm.	Total
1986-1994	8.1 - 9.5	2.6 -3.1	10.7 - 12.6
1995-2003	10.6 - 12.6	7.6 14.6	18.2 - 27.1
2004-2015	12.6 - 12.7	16.3 16.3	28.9 - 29.0

Source: INFOR 1987 (34).

Besides rotation age, the future planting rate is another important variable in estimating future timber supply. A planting rate of 70,000 hectares per year would increase total volume for logs between 10-20 cm. in diameter by 16% over those projected based on planting 57,000 hectares per year. For logs over 20 cm. volumes would increase by 14% at the higher planting rate.

In summary, projections of future timber supply indicate that between 1986 and 1994 available volumes will increase slowly, with sharp increases expected by the year 2015.

CHAPTER III

THE CHILEAN FOREST INDUSTRY

The Chilean forest industry has shown remarkable growth and development during the last 15 years. Total roundwood consumption by the industry has increased from 4.9 million m^3 in 1974 to 9.9 million m^3 in 1986 (35). These figures exclude fuelwood consumption. Fuelwood consumption in Chile was estimated at 5.8 million m^3 in 1985 (27).

The sawmilling sector ranks first in terms of roundwood consumption within the Chilean forest industry. Although the pulp and paper consumes slightly less roundwood than the sawmilling it is the most important sector economically. Panel products rank third in terms of roundwood consumption. The roundwood consumption levels by the major forest industries are presented in Appendix Table 3.

Pulp and Paper

This sector includes the production of mechanical pulp, chemical pulp (unbleached, semi-bleached and bleached), newsprint and other papers such as packaging, tissues, printing and writing. Current production as a percentage of installed capacity for 1983 is presented in Table 8.

Table 8. Pulp and Paper production during 1983 as a percentage of installed capacity.

Product	Installed capacity[1] (in tons)	Production[2] (in %)
Mechanical pulp	187,000	75
Chemical pulp	680,000	97
Newsprint	180,000	86
Other papers	253,000	67

[1]1983 figures from González 1986 (30).
[2]1983 figures from CONAF 1987 (35).

The most important products in this sector of the forest products industry are unbleached and the bleached kraft pulps. Three mills currently produce and export these products. The largest kraft mill is located in Laja (region VIII). The Laja mill is owned by Compañía Manufacturera de Papeles y Cartones (CMPC), the largest holding company in Chile. Production during 1986 totaled 234,000 tons of bleached pulp and 51,000 tons of unbleached pulp. Over 50% of the bleached and 40% of the unbleached pulp were exported during 1986 (41).

The other two plants are owned by CELCO-ARAUCO (a joint Venture with the New Zealand group Carter Holt Harvey and the Chilean Angellini group). The Arauco mill (region VIII) started production in 1972. During 1986 157,000 tons of bleached pulp for export were produced (32).

The second plant owned by CELCO-ARAUCO is located in Constitucion (region VII) with a capacity of 226,000 tons per year. Again most of the pulp produced by this mill is exported.

Industrias Forestales S.A (INFORSA) was formerly the third largest Chilean forest products company. However, because of financial difficulties arising from the yet delayed project "Papeles Sudamérica" it was purchased by CMPC, in December 1986. In order to comply with Chilean anti-trust regulations CPMC agreed to sell off the Bío-Bío newsprint plant, as a part of the merger, but the sector remains highly concentrated.

The Bío-Bío plant located in Concepción formerly owned by CMPC is currently owned by the Tassman Forestry Company of New Zealand. This plant has a capacity of 80,000 tons per year. It uses domestically produced semi-bleached cellulose and mechanical pulp from radiata pine. The mix used is composed of 20-25% of semi-bleached cellulose and 75-80% of mechanical pulp (31).

The CMPC plant located in Nacimiento formerly owned by INFORSA (region VIII) originally started operations in 1964. Currently the mill has two newsprint machines with an installed capacity of 120,000 tons per year. This plant uses radiata pine fiber as raw material and produces both chemical and mechanical pulp (22% and 78% respectively).

INFORSA started the construction of the "Papeles Sudamérica" plant in the early eighties, which was delayed for sometime because of financial problems. Recently this plant was purchased by the Sociedad Forestal e Industrial Santa Fé S.A. Major stockholders of this company are the group Royal Dutch Shell, Scott Worldwide Inc. and Citibank. According to the new owners this plant will produce bleached pulp from Eucaliptus and will have an estimated capacity of 200,000 tons per year. This plant will require an additional investment of $200 million and should be in operation by 1991 (14).

CMPC subsidaries produce a variety of other paper products in limited quantities such as bags of all kinds, trays, tissue papers, tab cards and fine printing and writing papers. The Spanish group Manuel Isidro Tejedor owns 7 plants using primarily waste paper in the production of lower quality printing and writing papers as well as corrugated boxes for the fruit market. Current capacity of the seven plants is estimated at 35,000 tons per year (32). Other small privately owned plants are responsible for the remaining paperboard production in the country. A more detailed breakdown of installed capacity and production is provided in Table 9.

Table 9. Paperboard production during 1985 as a percentage of installed capacity.*

Product	Installed capacity	Production (%)
Packaging Paper/Board	119,000 tons	80
Printing & Writing papers	85,000 tons	80
Tissues	38,000 tons	80
Other Paper & Boards	6,000 tons	80

*The small differences arising in the total installed capacity between Tables 8 and 9 are due to the different information sources used and years.

Source: Hunter 1987 (32).

In summary, all of the pulp production and more than 80% of paper production capacity is owned by the two major integrated companies, CMPC-INFORSA and CELCO-ARAUCO. In addition, these companies own the bulk of the radiata pine forest and have a large degree of market control in pulpwood prices (40). The remainder of the productive pulp and paper capacity is produced by a smaller mills often own through joint ventures, smaller holding companies, and independent companies.

Sawmilling

Sawn wood production totaled 2.03 million m^3 in 1986, less than half of the estimated installed capacity of 4.4 million m^3. Lumber produced peaked in 1980 at 2.25 million m^3 (36). Sawn wood production figures for 1981 through 1986 are presented in Table 10.

Table 10. Sawn wood production in thousand of m^3.

Year	Production
1981	1,732.0
1982	1,172.0
1983	1,606.0
1984	2,001.6
1985	2,190.6
1986	2,025.9

Source: INFOR 1987 (36).

Even though lumber production has shown a remarkable increase in the last 15 years, it recently seems to have stabilized around 2 million m^3. A more complete picture of lumber production in Chile and proportion of the major species sawn are presented in Appendix Table 5 for the period 1974-1986.

In 1960, native species accounted for almost 70% of the nation's lumber production. Substitution of radiata pine started in the early 60's. By 1965 radiata pine production accounted for nearly 50% of total produced. Since then, radiata pine has continued to increase, reaching 96% of total production in 1977. Currently, radiata pine lumber production accounts for about 86% of total production (35).

During the same period there has been a shift toward international markets for sawn wood products. In 1960, lumber exports represented less than 10% of total lumber production. This aspect of the market changed dramatically in the 1970's. Between 1977 and 1982 lumber exports accounted over 50% of total production. During 1986, internal consumption was 57.3%, with exports accounting for the remainder (36).

Mill Size

Concentration of lumber production on radiata pine and the change in market orientation from the domestic market to a mix of foreign and domestic markets correspond to major changes in the industry structure including an increase in mill size and the use of more sophisticated mill technology.

According to INFOR approximately 1,597 sawmills were operating during 1985. At least 80% of these were small portable mills (48). The number of mills by size and current production as a percentage of total production is presented in Table 11.

Table 11. Number of sawmills and production by size.

Capacity m^3/year	Number of mills	Percent of Total Production
Large (over 18,000)	14	28.6 %
Medium (10,000-17,999)	8	6.8 %
Small (1,000- 9,999)	332	48.7 %
Too small (over 1,000)	1,243	15.9 %
TOTAL	1,597	100.0 %

Source: Vidaurre 1987 (48).

Mills with a capacity greater than 10,000 m^3/year accounted for 35% of total production. Sawmills producing 1,000 to 9,999 m^3/year accounted for 49% of the nation's total production. The remaining 16% was produced by the smallest mills.

Lumber produced by the larger mills is primarily exported while the smaller mills produce exclusively for the domestic market. The location of the mills and their relative importance to total production is presented in Table 12.

Table 12. Number of sawmills and production by regions.

Region	Number of mills	1985 Production (m^3)	Percent of Total Production
IV	6	1,234	0.1
V	17	39,251	1.8
VI	46	73,532	3.4
VII	98	293,612	13.4
VIII	485	1,176,452	53.7
IX	317	308,785	14.1
X	561	260,608	11.9
XI	28	14,495	0.7
XII	44	22,660	1.0

Source: Vidaurre 1987 (48).

As indicated in table 12, 85% of Chile's lumber production is concentrated in regions VII and X. Region VIII alone accounts for more than 50% of the country's production.

The small capacity mills use primarily circular head rigs and are characterized by poor utilization. Quality control is almost non-existent. A small number of these mills are still steam- driven but the majority are diesel-electric. Many of these mills start up and shut down according to market conditions.

Medium-and large-size sawmills use a variety of technologies and equipment. For some of the larger mills, sophisticated electronic log scanners, mechanized lumber handling and grading equipment are used. Also, the larger mills are more frequently located in combination with dry kilns and treating plants.

The largest sawmill in Chile is Aserraderos Carampangue (region VIII) is equipped with Linck machinery. It is the only large sawmill which owns no forest land and has to buy excess logs from other companies and individual contractors.

The second largest sawmill is Aserraderos Copihue located in Constitucin (region VII). The mill has a capacity of 100,000 m^3/year plus drying, preserving and dressing plants (32).

Some of the other sawmills with the latest technology are Aserraderos Mininco owned by CMPC and Aserraderos Andinos owned by a Swiss group. Both produce good quality kiln-dried products and are located in the region VIII.

Sawmills located in region IX through the southern part of Chile are primarily mobile (called aserraderos mòviles or de montaña) and process native species such as Tepa, Coigue, Roble and Raulí. In the extreme south of Chile, the single most important species is Lenga (region XII).

Source of Stumpage

Mills obtain stumpage from two sources: their own forest land holdings and/or from other private producers. Historically, the most successful producers have been those who cut timber from their own lands. The larger mills are usually integrated so long term log supply is then assured (32). Also larger mills are oriented toward the international market and demand higher quality stumpage. The larger companies are relatively price responsive, particularly in the international market (40). The larger companies also own most of the higher quality, more intensively managed stands.

Employment in the sawmilling industry reached approximately 17,000 people in 1986 or about 25% of the total employment generated by the Chilean forestry sector. The world wide recession reduced employment in this industry between 1982 and 1984 with employment declining to less than 13,000 people (36).

Lumber Remanufacturing

In 1986, 57.3% of total lumber production was consumed internally. The major consumer in the domestic market is the remanufacturing industry. The remanufacturing plants in Chile are called "barracas". They produce dimensional and finished lumber.

Total production is spread over a large number of plants. Six hundred plants were reported working in 1986. Production reached about 551,000 m^3 of dimension lumber and 560,000 m^3 of finished lumber in 1986. Radiata pine accounts for 79% of total production. Other species used include Alamo, Coigue, Roble, Tepa, Raulí and Eucaliptus.

The Metropolitan Area (Santiago) is the single major producer. Regions VII, VIII, IX and X account for 45% of production. Most remanufacturing plants have production capacities of less than 1,500 m^3/year. Only 57 plants reported production rates of over 4,500 m^3/year.

During 1986, about 91% of the remanufactured dimension and finished lumber was consumed by the domestic market, with the remaining 9% going overseas. Major consumers for both products are presented in Table 13. The housing industry was the primary consumer, accounting for 69% of the total production (33). However, the housing industry still depends heavily in other building materials such as masonry and bricks (32). More complete and detailed information concerning this industry is presented in Appendix Table 6, including production figures for the years 1983 and 1986.

Table 13. Major consumers of the Chilean Lumber Remanufacturing during 1986.

Consumer	Dimensional Lumber (%)	Finished Lumber (%)
Exports	9.3	1.4
Housing and construction.	68.8	66.4
Wholesalers	9.6	9.5
Wood boxes	6.5	11.5
Agricultural uses	2.5	1.8
Furniture	2.1	7.1
Doors and windows	1.2	2.3

Source: INFOR 1988 (33).

Wood Preservation

Treated wood production totaled almost 66,000 m^3 in 1986, of which 39% was sawn wood (dimensional and finished lumber) with the remainder divided among poles and posts, and vineyard posts. Production is currently less than one-sixth of installed capacity. Only 12 sawmills in Chile are integrated with preservation plants (46). Again output from these plants is generally destined for the export market.

In 1986 aproximately 5% of the 450,000 m^3 of lumber were used by the housing industry was treated in some way (33,37).

Drying

Currently, orders for dried lumber far exceed installed capacity which is estimated at 700,000 pulgadas madereras[1]. The equipment is primarily conventional dryers (temperature reaching below 100 Celcius degrees) of European origin. There are only two high-temperature dry-kilns in the country (12). Only the larger sawmills are able to meet the desired moisture contents of less than 12% and thus have exportable quality kiln-dried lumber.

Considering that lumber exports accounted for approximately 860,000 m^3 in 1986, the potential for additional drying capacity is clear. In addition, most of the sawmills use air drying.

Native species have traditionally been air-dried in the southern part of the country. They are generally more difficult to dry than radiata pine.

On the positive side, dry kiln capacity has increased by 15% over the last three years (12). Larger mills are regularly investing in new kilns and more sophisticated technology (32). In addition, dry kilns manufacured by Chilean specialists are now available for smaller lumber producers (12).

Most experts agree that the country will have to increase drying capacity by at least 5-7 times in order to keep up with current orders. An increasing radiata pine timber availability and more competitive markets for softwood lumber will force this industry to develop accordingly.

Panel Products and Veneer

This industry has expanded rapidly during the last decade. However, it remains a small component of the Chilean forest products industry. Based on 1985 and 1986 figures, this industry consumes 3-4% of total roundwood production and accounts for 2-3% of total annual exports on a value basis by the f[illegible]. Production is oriented toward the domestic market, with housing construction and the furniture industry the primary consumers. Current installed capacity for this industry are presented in Table 14 as reported by Hunter 1987.

1 Pulgada maderera (p.m.) is one of the two measurement units for lumber in Chile. One cubic meter of logs sawn will yield, an average, 21.2 p.m. of sawn lumber (35). A 1000 board feet of full sawn lumber would equal about 94.2 p.m.. More simply, 1 p.m. is approximately equal to 10.6 board feet of full sawn lumber, or about the same volume as 2 full sawn 2x4 studs, 8 feet in length.

Table 14. Installed capacity of the Panel Products and Veneer industry for 1984.

Product	Unit	Capacity
Fiberboard	tons	40,000
Particleboard	tons	108,700
Plywood	m^3	31,500
Veneers	m^3	11,900

Source: Hunter 1987 (32).

Particleboard and fiberboard production is concentrated in three plants (2-particleboard, 1-fiberboard). Similarly, plywood and veneer production are concentrated among a small number of producers with small mills. Production figures for the industry by product are shown in Table 15 for some selected years.

Table 15. Production of the Panel Products and Veneer industry (in thousand of m^3).

Year	Fiberboard	Particleboard	Plywood	Veneer
1965	13.40	12.92	7.70	1.02
1970	18.90	22.46	10.50	2.14
1975	13.00	16.31	2.60	1.46
1980	43.10	42.92	19.80	5.73
1981	42.10	71.85	17.50	6.90
1982	43.70	56.30	10.10	8.00
1983	41.60	72.00	15.00	8.92
1984	39.90	114.31	20.40	9.37
1985	42.80	136.30	21.00	11.19
1986	43.80	145.81	25.10	13.10

Source: INFOR 1987 (35).

CHAPTER IV

CHILEAN FOREST PRODUCTS MARKETS

Export Markets

For many years exports were confined to products of the extensive mining industry. Chilean copper is well known internationally. Chile ranks first in the world with its reserves of copper and selenium, second in molybdenum, rhenium, iodine and lithium. Currently the country supplies close to 20% of the world's production for the above products (5).

Even though the mining sector has shown a continuous increase in total exports, its contribution to the total Chilean exports has been decreasing on a percentage basis. The mining sector has decreased as a percentage of total exports in recent years with copper dropping from 82.2% in 1973 to close to 40% in 1986. In contrast, the fishery and forestry sectors have increased in importance to some extent (Table 16).

Table 16. Participacion of the different sectors in total Chilean exports.

Year (%)	Mining (%)	Agriculture and Fishery (%)	Industrial (%)	Forestry (%)	Total exports (million US$)
1960	86.6	5.1	6.7	1.6	467.7
1965	81.6	3.3	13.0	2.1	684.0
1970	85.5	5.4	5.2	3.9	1,111.7
1975	69.3	11.9	10.9	7.9	1,552.1
1980	59.3	15.3	12.8	12.5	4,670.7
1985	61.3	16.1	5.3	8.5	3,823.0
1986	54.8	28.6	6.8	9.7	4,222.4

Source: INFOR 1987 (35).

The growth of the forest products sector in Chile is a direct result of government policies that have created an economic and legal environment designed to promote this aspect of the economy. This trend was already visible in the late seventies. In 1975, forestry exports accounted for only 7.9% of the country's exports. By 1980, this sector had risen to a high of 12.5 %. During 1987 forest products exports accounted for only 11% of total exports, however, forest products exports reached a new high in value terms of $ 577.3 million (6). The value of forest exports by product for the period 1981-1987 are presented in Table 17 in order of importance. A breakdown of the Chilean forest products export volumes by products, for the period 1974- 1986 is presented in Appendix Table 8.

Major export products in order of importance are bleached and unbleached kraft pulp, radiata pine sawlogs, radiata pine lumber and newsprint. In 1987, these products accounted for 84% of the forest products exports in value terms. The principal markets for Chilean forest products exports are Asia, South America and Europe. The most important countries within these regions are Japan, Germany and Peru (6).

The bulk of forest products exports are shipped through the three major ports located around Concepción in region VIII. They account for 91% of the 2.67 million tons of forest products exported in 1986 (25). These ports are San Vicente and Talcahuano operated by the state company EMPORCHI and the privately owned Lirquen Port. The only other ports of significance to forest products trade are San Antonio and Valparaiso, both located in region V.

Table 17. Chilean forestry exports by major products (1981-1987; in thousand dollars f.o.b.).

Product/Year	1981	1982	1983	1984	1985	1986	1987
Total	353.3	332.1	326.2	382.7	334.6	403.1	577.3
Major products	317.9	300.0	293.8	343.8	294.3	352.7	467.6
Pulp	183.2	172.6	159.9	200.0	150.9	192.4	262.6
Lumber	95.7	63.5	65.8	74.1	54.5	69.7	85.4
Newsprint	21.3	27.0	34.2	39.8	48.8	51.7	61.2
Logs	17.7	36.9	34.0	29.9	40.1	38.9	58.4
Other products	35.3	32.1	32.4	38.8	40.3	50.4	109.7

Source: CONAF-INFOR 1987 (25) and Chile Forestal 1988 (6).

The major ports in region VIII are operated on a 24-hour basis and are very price competitive. Current port facilities are considered adequate, at least for the next several years. Additional shore facilities for handling and storage of forest products are under construction.

A more serious constraint on forest products trade is the limited highway system and the poor condition of the rail network, particularly in regions VII and VIII (41,28,26,8). The government is increasing its budget for these purposes and a program financed by the Interamerican Development Bank to improve the country's transportation infrastructure is underway (21). In addition, private investment for developing other export facilities such as in the port of Coronel are also underway (1).

Another means used to export forest products is by truck. About 166,000 tons were exported by trucks in 1987, primarily lumber exports to Argentina (35). These exports cross the Andean Mountains through passages such as Puyehue (ragion X), Los Andes (near Santiago) and others in the XII region.

Pulp Products

Kraft pulp is Chile's most important forest product, both in terms of roundwood consumption, and in terms of forest products exports. Conversely, Chile is a marginal exporter of kraft pulp to the world's kraft woodpulp trade. Currently, about 11 million tons of pulp are traded world wide, with Chile's contributing 4.3% the total volume traded (27).

Chile has a long tradition of exporting softwood kraft pulps. The first kraft pulp was shipped to Venezuela in 1959 by CMPC. In 1986, Chilean pulp exports consisted of 281 thousand tons of unbleached pulp and 258 thousands of bleached pulp or a total of 539 thousand tons (41). Total shipments in 1987 declined slightly to 524.6 thousand tons (6). Volumes by type of kraft pulp exported are presented for the period 1982-1986 in Table 18.

Table 18. Volumes of exporting Chilean kraft pulp (in thousand of tons).

Product/Year	1982	1983	1984	1985	1986
Unbleached	210.9	259.8	220.9	221.8	281.3
Semibleached	61.5	52.1	41.2	37.3	26.1
Bleached	189.7	211.5	230.6	244.0	257.9
Total	462.1	523.4	492.7	503.1	565.2

Source: INFOR 1987 (35).

During recent years bleached and unbleached pulp exports have steadily increased, while semi-bleached pulp exports have steadily declined and currently represents only a small proportion of total exports. More than half of the exported volume of bleach pulp (56.4%) goes to Europe. West Germany, Belgium and France are the major consuming countries within this region accounting for 46% of all Chilean exports of bleached pulp (25). Latin America and Asia are the other major importers of bleached pulp. Major Latin America importers of Chilean bleached pulp are Venezuela, Peru and Colombia (25).

CELCO-ARAUCO and CMPC are the major exporting companies sharing the market in almost equal proportion (25). Both companies have their own sales agents within the major markets. In addition, CMPC's subsidiary CPMC Internacional, coordinates the bulk of the company's international marketing efforts.

Slightly over 67 percent of unbleached pulp exports were sold to the Asian market and 20.3% were shipped to South American countries. China, Korea and Japan imported 52.9% of the Chilean unbleached pulp in 1986 (25). The bulk of the unbleached pulp (93%) was marketed by CELCO-ARAUCO.

Almost two third's of Chile's exports of semibleached pulp on a volume basis are exported to other South American countries particularily Brazil and Colombia. The remainder is exported to Europe. A breakdown of the Chilean pulp exports by country of destination is provided in Appendix Table 9.

Historically, bleached pulps have commanded the highest prices in the export market, however, export prices have declined substantially since the peak year of 1980. Prices during 1986 were about equal to 1982 levels for semibleached and unbleached pulps. The latest figures released by INFOR for 1987 show continued improvement in bleached pulp prices over 1986 levels with prices reaching 1980 levels. Significant increases are reported for the unbleached and semibleached pulps as well (6). Nominal average prices for kraft pulp exports from Chile are presented in Table 19.

Table 19. Nominal average f.o.b prices for kraft pulps (in US $/ton).

Product/Year	1982	1983	1984	1985	1986
Bleached pulp	455	370	448	340	385
Unbleached pulp	293	249	361	264	282
Semibleached pulp	429	338	430	337	412

Source: INFOR 1987 (35).

In exporting kraft pulp, Chile has a substantial comparative advantage, due to the extremely low wood costs and other factors. Product quality also meets international standards and is well received by importing countries. Moreover, it is likely that Chile's competitive advantage will increase as already established radiata pine plantations enter in production and new investments in plants and technology occur.

Paper Products

The most important exported commodity manufactured by the paper industry is newsprint. It ranks fouth within the Chilean forest export products, behind bleached pulp, semibleached pulp and radiata pine lumber. Newsprint accounted for 10.6% of the total value of exports by the country in 1987 (6). An average of slightly over 100,000 metric tons of newsprint were exported annually over the period 1982-1986 (35). Export levels of newsprint by country of destination are presented in Appendix Table 10.

Apart from newsprint, card stocks and other special papers are also marketed overseas, however, their proportion of Chile's export market is relatively minor.

Historically South America has been the most important market for Chilean newsprint exports. During 1986 exports to other South American countries accounted for over 80% of all shipments. Asia is the second largest market for Chilean newsprint, purchasing 13.4% of exports (25). Brasil and Perú are the largest South American markets for Chilean newsprint, accounting for 42.6% of the total newsprint exports in 1986. The political effect on exports to both Perú 1977-82 and Argentina 1982-85 is worth noting.

Export prices have followed the same pattern as kraft pulps discussed earlier in this chapter. A large price increase took place in 1987 (22.6% over 1986) for newsprint export prices (6).

INFORSA, formerly an independent company, continues to furnish over 60% of the total exports volume and CMPC the remaining 40%. As we mentioned earlier, recent changes in ownership will cause both companies to export now under the same name.

Sawn Wood Products

About 22 millions m^3 of conifer sawnwood is traded world wide. Canada, the Soviet Union and the United States are the major suppliers. Chile's proportion of the 1985 world market was about 3.4% (27).

Chilean exports of sawnwood increased from 150,000 m^3 in 1970 to 1.3 million m^3 in 1980. Exports declined sharply to less than 700,000 m^3 in 1982 (35). Export figures for 1987 reveal a promising recovery with exports rising to about one million m^3 (6).

Radiata pine is the predominant species used in the manufacture of sawn wood products in Chile and accounts for over 95% of Chilean sawn wood exports in volume terms. The native species, primarily hardwoods make up the rest of the sawn wood exports.

The bulk of Chilean sawn wood exports are in the form of radiata pine lumber. Only 13% is in the form of squares of which most goes to Japan (25). Latin America continues to be the largest market for Chilean radiata pine lumber, however, its importance has declined since the mid-seventies. Currently Argentina and Venezuela are the largest importers, although exports to the latter have declined in recent years. The second largest regional market is the Middle East where Egypt accounts for almost 19% of all sawn wood exports. A breakdown of radiata pine lumber exports is provided in Appendix Table 11 for the period 1970-1986.

Export prices for lumber have followed the same pattern as the other major Chilean forest product exports. Peak prices were obtained in 1980 with subsequent price declines. However, price levels in 1987 and in the first quarter of 1988 appear promising (18).

Until 1974, marketing efforts were devoted primarily to supplying the Argentinian market throught direct contact with clients and local agents. In 1974 marketing efforts were expanded through use of marketing consortiums. These efforts lead to the development of sawnwood products markets in Venezuela and the Middle East (45).

Currently Chilean sawn timber is exported by a large number of companies, but 25 account for 97% of all exports (32). Consorcio Maderero is the largest exporter of Chilean radiata pine lumber at the present time. It accounts for almost 26% of total lumber exports. It is also the second largest exporter of radiata pine cants (25). Aserraderos Carampangue, the largest sawmill in Chile, is the second largest lumber exporter with 17% of the total lumber exports.

Over the last 6 years, an average of 20,000 m^3/year of native hardwoods have been exported (35). During 1986, Argentina was the single largest importer. The primary species purchased by Argentina were Raulí and Lenga. Exports of the latter species have increased in recent years due of the creation of the Consorcio Exportador Integrado Chileno-Argentino (a joint consortium between the two countries), and the existance of good quality forests of Lenga in region XII. New investments in existing port

facilities in region X, the major hardwood producing region in Chile, will undoubtly lead to a further expansion of hardwood exports (7).

The future of Chilean radiata pine lumber exports remains uncertain because of the quality shortcomings already mentioned regarding this species. However, increased supplies of clear sawlogs and use of improved milling and drying techniques could substancially the image of this product.

Sawlogs

Until 1975 log exports were banned by the Chilean government. Since then, log exports have ranked among the top four Chilean forest products exports. Annual exports have exceeded one million m^3 since 1982 (25). Almost 99% of all logs exported are radiata pine.

Shipping cost is another important factor relative to the economic feasibilty of exporting radiata pine sawlogs. At the present time, freight costs represent over 40% of the C&F price shipped to the Asian market (42,38). Bulk carriers are primarily used for transport. Another characteristic of this market is that exported log volumes tend to be inversely related to average prices for processed products, showing a relatively high cross-elasticity of substitution (32).

The single most important market for Chilean radiata pine sawlogs is Asia. In fact, this region accounts for 94% of the Chilean shipments (25). South Korea, Japan and China are the major importing countries. Korea alone comprises 50% of the total. Japanese grading rules (JAS) are commonly used as quality standards for exports to Japan.

Sixty percent of the exported volume is shipped through the Consorcio Arauco/Mininco/Trinitarias (an export consortium). Another consortium, the Consorcio Maderero, is the second largest exporter with 17% of the total. Eleven different companies participated in the Consorcio Maderero during 1986 (25). A breakdown of log export volumes by country of destination is provided in Appendix Table 12.

Panel Products

Panel products represented slightly over 2% of the value of Chilean forest products exports in recent years (35). The most important traded commodities for the Chilean panel industry are various hardboard products. Hardboard products are manufactured in Chile by only one company, Cholgúan, located in Cholgúan, region VIII. About 26,000 tons are exported annually. The United States and Holland are the primary importers of these products (25).

The second most important product of the Chilean panel industry is particleboard. Most of these products are consumed internally. Chemical resin, freight costs and the current scale of production limit the competitiveness of these products in the international market. The current construction of a medium density fibreboard mill in region VIII may change the current status of the panel industry. It is also believed that if fiberboard production continues to be based on waste wood, expansion of exports may increase the profitability of this sector of the industry.

Domestic Markets

Chile's domestic demand for industrial forest products (excluding fuelwood) reached about 4 million m^3 of roundwood in 1986. This figure represents about 40% of the current annual harvest (35). On a per-capita basis during 1986, the consumption of solid wood products was about 104 m^3 per thousand population and 20 kg per capita of paper. These consumption levels are far below levels found in developed countries. However, Chilean consumption levels are similar to those of other Latin American countries.

Domestic consumption levels are also highly correlated with the growth of Chile's economy (32). Therefore, future development and growth of the domestic market is likely to be dependent upon continued economic growth.

Solid wood products constitute the largest domestic market in Chile, with most of the volume going into housing construction. However, per capita consumption of construction lumber is very low. Traditional building techniques used in Chile favor the use of bricks and masonry (albañilería is the spanish translation). The lower cost of these materials compared with wood explain part of the tendency to favor masonry construction. In addition, cultural factors also play a role. However, wooden houses have advantages especially in earthquakes zones, which are common in Chile and in the temperate climatic zones in the South.

It is estimated that there is a housing deficit in Chile of about 1 million dwellings today (46). This is concentrated in Santiago, the capital of Chile, where about 40% of the population lives. In addition, over 40% of metropolitan homes are considered sub-standard (32).

Currently the government is addressing the housing deficit through direct subsidies, however, the limited purchasing power of much of the population has more than offset these efforts. About 70,000 new houses are expected to be built in 1988 according to the latest announcement by the Ministry of Housing in Chile (16).

Governmental agencies and private companies are aware of the antagonism against wooden houses and they are promoting the use of wood construction techniques. An important program called "Viviendas Energitérmicas" (thermal energy dwelling), is administered jointly by Fundación Chile, CONAF and University of Chile. This program emphasizes the advantages of wood as building material. Highlighted advantages wood construction techniques include earthquake resistance, thermal insulation, and fire resistance among others.

Among the other miscellaneous domestic markets, the fruit box industry will continue to demand sawnwood. However, these products may also be exported in the future. Coniferous sawn wood will continue to provide the bulk of the products destined for domestic consumption, with native species taking on an increasing role in international markets.

Paper comprises the second most important domestic market in Chile. Unfortunately, per capita consumption has declined nearly 70% to about 3.3 kg. since 1980 (35). Declining domestic consumption of newsprint, in part, reflects higher prices and strong international demand for newsprint exports. On the other hand, printing and writing paper and paperboard have shown a moderate rate of growth in domestic markets. No major changes are expected in the domestic market for paper products. Future growth will parallel the Chilean economy, which is estimated to grow at a rate between 4-5% annually.

Another component of the Chilean domestic market is panel products. Current wood panel consumption is about 12 m^3 per thousand population (35). Major consumers of panel products are the housing industry and the furniture industry. An annual growth rate of 5% is projected for the panel products in the domestic market with consumption reaching 0.7 million m^3 by the year 2000 (34).

In summary, it is estimated that the Chilean domestic market for forest products will continue to expand at rate similar to the growth rate in the overall economy or in the range of 4-5% percent per year.

CHAPTER V

FUTURE DEVELOPMENT OF THE CHILEAN FORESTRY SECTOR

A key question facing market analysts around the world is: "what role will Chile play in future international markets for forest products?". Thus far we have addressed elements of the question, such as future timber supply projections made by the Instituto Forestal presented in Chapter II. Future domestic consumption of forest products and potential development of the international markets for Chilean wood products were also addressed in Chapter IV. However, these studies do not fully address Chile's economic potential to achieve these goals. Available forest resources are one key factor, however, other issues such as available investment capital, the investment climate and many other factors must be considered in forecasting the country's overall potential.

Future Investments

One of the first attempts at estimating the future investment needs of the forestry sector was completed in early 1984 (45). Susaeta estimated that $476 million would be needed for the period 1986-1990 and $850 million for the period 1991-1995. Almost 80% would be in the form of the new investments in plant and equipment particularly in pulp and paper mills. The investment requirements for improvements in the country's infrastructure were estimated at about $75 million.

Roundwood consumption was estimated at 5.2 million m^3 for the period 1986-1990 and up to 8.3 million between 1991 and 1995. Aproximately, 50% of these levels would be in the form of pulpwood demand. Wood supply and demand were considered in balance according to Susaeta's projections. Since plantation establishment seems directly linked to DL 701, the continuation of subsidies to roundwood production could be a major factor.

A separate study done by the World Bank, made public in August of 1987, estimated investment needs in Chile's forest products industry through the year 2004 at $2.6 billion (2). The study estimated investments of aproximately $390 million in pulp- producing facilities, $430 million in paper mills, $130 million in sawmills and $60 million for the manufacture of panel products and other processed-wood items. Another conclusion was probable shortages of clear sawlogs and pulpwood in the future. If the projected investment program were carried out successfully Chilean forest exports would increase to about $1,200 million annually in 1986 dollars.

After the World Bank report, Chilean estimates were revised. INFOR's 1987 study of future timber supply discussed in Chaper II concluded that timber supply was adequate to keep up with the future expansion of the Chilean forest industry (34). INFOR estimated that investments totaling $3.7 billion would be needed for the period 1986-2003. Of this total, 61% would be in the form of industrial plants, 9% in harvesting equipment, 7.4% in planting and the rest in infrastructure, energy and other activities.

A new study of future investment requirements by the Chilean forestry sector was recently released by the Forestry Investments Committee. This study indicates that private sector investments between 1986 and 2003 for projects costing more than $ 50,000, will top $1.4 billion, with approximately 90% concentrated in the manufacture of pulp and paper. Public sector investments would be needed for road, rail, and port facilities at an additional cost of $150 million (2).

Although there are substantial differences in the projected values, it is clear that future investment may be the most serious constraining factor in the development of Chile's forest sector. On the other hand, wood availability, domestic market requirements, and export market potential are less likely to be limiting factors.

LITERATURE CITED

1. Anonymous.1988. Coronel: un puerto para el siglo XXI. *In*: Chile Forestal. Corporación Nacional Forestal, Enero.

2. ——.1988. Forestry Study Completed. *In:* Chile Economic Report. Corporación de Fomento de la Producción, January.

3. ——.1988. Grupo Fletcher, nuevo dueño de planta Bío-Bío. *In*: Chile Forestal. Corporación Nacional Forestal, Enero.

4. ——.1988. Minister of Finance Reviews Economy's Perfomance. *In*: Chile Economic Report. Corporacin de Fomento de la Producción, January.

5. ——.1988. La Economía Chilena en 1987. *In*: Foreign Investment report. Comité de Inversiones Extrangeras, January-February.

6. ——.1988. Record histórico en exportaciones forestales. *In*: Chile Forestal. Corporación Nacional Forestal, Febrero-Marzo.

7. ——.1988. Puerto Montt: una nueva opción para embarcar. *In*: Chile Forestal. Corporación Nacional Forestal, Febrero-Marzo.

8. ——.1988. Sector forestal tiene uno de los mejores potenciales de crecimiento del mundo. *In*: Chile Forestal. Corporación Nacional Forestal, Febrero-Marzo.

9. ——.1988. Southern Highway Completed. *In*: Chile Economic Report. Corporación de Fomento de la Producción, March.

10. ——.1988. Pillars of foreign investment. *In*: Foreign Investment Report. Comité de Inversiones Extrangeras, March-April.

11. ——.1988. Closer and Closer to the Ideal Forest. *In*: Chilean Forestry News. Corporación Nacional Forestal, April.

12. ——..1988. 1987: The Year of the Dryers. *In*: Chilean Forestry News. Corporación Nacional Forestal, April.

13. ——.1988. La Semana Económica. *In*: El Mercurio, Edicin Internacional. Semana del 21 al 27 de Abril.

14. ——.1988. Aspiramos a ser participantes de importancia en la industria forestal. *In*: Chile Forestal. Corporación Nacional Forestal, Mayo.

15. ——.1988. La Semana Económica. *In*: El Mercurio, Edición Internacional. Semana del 9 al 15 de Junio.

16. ——.1988. La Semana Económica. *In*: El Mercurio, Edición Internacional. Semana del 16 al 23 de Junio.

17. ——.1988. Referencias financieras. *In*: Boletín de Mercado. Corporación Nacional Forestal, Junio.

18. ——.1988. Precios de productos forestales Chilenos 1987. *In*: Boletín de Mercado. Corporación Nacional Forestal, June.

19. ——.1987. Pino Radiata: a la conquista del mercado interno. *In*: Chile Forestal. Corporación Nacional Forestal, Mayo.

20. ——.1987. Forestry Prepares for Further Expansion. *In*: Chile Economic Report. Corporación de Fomento de la Producción, June.

21. ——.1987. Más caminos y puertos para el sector forestal. *In*: Chile Forestal. Corporación Nacional Forestal, Julio.

22. ——.1987. El canelo: Pino radiata del bosque nativo? *In*: Chile Forestal. Corporación Nacional Forestal, Agosto.

23. ——.1987. Nuestra meta debe ser la especialización. *In*: Chile Forestal. Corporación Nacional Forestal, Agosto.

24. ——.1985. What do Chileans Know About Forest Fires. *In*: Chilean Forestry News. Corporacin Nacional Forestal, October.

25. CONAF-INFOR.1987. Exportaciones Forestales Chilenas. Corporación Nacional Forestal-Instituto Forestal. Serie Informática #38, 122 p.

26. Contreras J.M. and Kunz M.1984. Infraestructura vial requerida por el sector forestal en la VII región. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros Forestales, 214p.

27. FAO.1986. Yearbook of Forest Products. Food and Agriculture Organization of the United Nations, Rome.

28. Ferrer, O.1984. Infraestructura vial y desarrollo forestal. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros forestales, 214p.

29. Gándara, J.1986. El sistema nacional de areas silvestres protegidas y la generación de servicios a la comunidad. *In*: Proceedings of Simposium Economía Forestal en Chile. Universidad del Bío-Bío, Tomo II, 180p.

30. González, J. and Giovo, H.1986. Evolución de la produccin en la industria forestal. *In*: Proceedings of Simposium Economía Forestal en Chile. Universidad del Bío-Bío, Tomo II, 180p.

31. González, J. and Ruiz de Gamboa, J.1984. El papel periòdico en America Latina. *In*: Proceedings of the XI Jornadas Forestales. Colegio de Ingenieros Forestales, 214p.

32. Hunter, L.A.J.1987. The Chilean Forestry Sector. New Zealand Forestry Council. Information Paper #2, 77p.

33. Instituto Forestal.1988. La industria dimensionadora y elaboradora de maderas en 1986. Informe Tècnico #111, 86p.

34. ——.1987. Disponibilidad de madera de pino radiata en Chile 1986-2015. Informe Tècnico #103. Mayo, 54p.

35. ——.1987. Estadísticas Forestales 1986. Boletín Estadístico #1, Junio, 100p.

36. ——.1987. Algunos aspectos relevantes de la Industria del Aserrío. Septiembre, 12p.

37. ——.1987. Situación actual y potencial de la Industria de Impregnación en Chile. Diciembre, 10p.

38. Jèlvez, A.1986. El flete marítimo y los productos forestales chilenos. *In*: Proceedings of Simposium Economía Forestal en Chile. Universidad del Bío-Bío, Tomo II, 180p.

39. Kunz, M.1984. Disponibilidad futura de madera en pie de pino insigne. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros Forestales, 214p.

40. Mc Ketta, Ch.1986. Imperfecciones estructurales en mercados: El Caso de las Industrias forestales en Chile. *In*: Proceedings of Simposium Economía Forestal en Chile. Universidad del Bío-Bío, Tomo II, 180p.

41. Muñoz, C.1984. Infraestructura de servicios ferrocarriles del sur. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros forestales, 214p.

42. Ruiz, M.1987. The Export Marketing of Kraft Softwood Pulps; the experience of Chile. FAO. FO:PAP/87/Inf.11, Rome.

43. Saenz, A.1984. La exportación de rollizos de pino insigne. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros Forestales, 124p.

44. Susaeta, E.1986. Requerimientos y posibilidades de inversión en el sector forestal en el decenio 1986-1995; algunas consideraciones preliminares. *In*: Proceedings of Simposium Economía Forestal en Chile. Universidad del Bío-Bío, Tomo I, 143p.

45. Sutton, W.1983. Manejo de Plantaciones de Pinus radiata D. Don. Short course lecture series at Arauco, Chile. 59 p.

46. Ulloa, F.1984. Alcances sobre la disponibilidad de bosque nativo comercial en Chile. *In*: Proceedings of XI Jornadas Forestales. Colegio de Ingenieros Forestales, 214p.

47. Vargas, C.1986. Los Consorcios de Exportación y problemas pràcticos en la Comercialización de productos Forestales. *In*: Proceedings of Simposium Economa Forestal en Chile. Universidad del Bío-Bío, Tomo I, 143p.

48. Vidaurre, S.1987. Necesidades de la Industria de la madera aserrada en Chile. *In*: Revista Ciencia e Investigación Forestal. Instituto Forestal, April.

APPENDIX

Table 1. Chilean Forest Resources by regions.

Region	Native Forest[1]		Radiata pine[2]	
	Area (1,000 ha.)	Volume (million m)	Area (1,000 ha.)	Volume (million m)
I	4.0	--	--	--
V	--	--	23.3	3.1
R.M.	2.7	--	1.0	--
VI	41.2	0.3	62.3	3.9
VII	196.4	6.4	218.7	22.4
VIII	401.7	24.1	531.2	59.8
IX	632.9	82.0	180.3	19.4
X	3,592.6	744.2	63.7	5.7
XI	1,686.0	42.2	--	--
XII	1,059.0	15.9	--	--
TOTAL	7,616.5	915.1	1,080.5	114.3

[1]Up to 1981

[2]Up to 1986

Source: INFOR 1987

Table 2. Age class distribution of radiata pine plantations through December 1986.

Age class	Area (hectares)	Volume (1,000 m^3)
1-5	325,122	--
6-10	315,261	--
11-15	255,438	39,389
16-20	113,799	35,594
21-25	36,986	17,470
26-30	19,483	11,421
31 and +	14,402	10,426

Source: INFOR 1987

Table 3. Consumption of roundwood by the major forest industries 1974-1986; in thousands of m^3.

Year	Mechanical pulp	Chemical pulp	Lumber	Boards & veneer	Logs for export
1974	297.6	1,600.4	2,923.9	136.7	--
1975	275.0	1,661.6	2,006.4	91.7	6.2
1976	311.4	1,989.0	2,556.1	123.1	17.0
1977	313.3	2,417.4	2,792.2	149.5	147.6
1978	323.4	2,731.3	3,082.8	191.1	679.2
1979	325.8	2,909.5	4,588.8	220.3	965.7
1980	254.9	2,838.0	4,562.5	218.2	1,052.4
1981	311.7	3,151.4	3,619.7	323.9	361.1
1982	288.7	2,816.5	2,450.2	240.1	892.0
1983	408.7	3,522.2	3,356.9	282.1	1,026.3
1984	390.6	3,619.3	4,174.3	363.1	905.6
1985	394.3	3,649.4	4,578.4	395.4	1,273.4
1986	415.7	3,624.1	4,211.7	458.7	1,163.7

Source: INFOR 1987

Table 4. Production of the Pulp and paper industry 1974-1986; in thousands of metric tons.

Year	Mechanical pulp	Chemical pulp	Newsprint	Other papers
1974	119.0	313.8	118.2	188.7
1975	110.0	325.8	119.7	145.8
1976	124.5	390.0	133.0	165.1
1977	125.3	478.0	132.2	167.4
1978	129.4	535.6	131.9	168.6
1979	130.3	570.5	134.4	171.2
1980	131.1	632.0	131.0	195.3
1981	124.7	617.9	130.7	148.2
1982	115.5	552.3	124.4	145.3
1983	139.9	656.2	155.2	169.6
1984	157.1	682.3	167.6	198.3
1985	157.7	679.6	172.1	197.3
1986	154.0	693.5	168.8	219.4

Source: INFOR 1987

Table 5. Production of the Lumber industry 1974-1986; in thousands of m^3.

Year	Total	Radiata pine	Other species
1974	1,398.5	1,084.0	314.5
1975	960.0	744.0	216.0
1976	1,223.3	1,154.4	68.9
1977	1,336.0	1,291.9	44.1
1978	1,475.0	1,352.9	122.1
1979	2,195.6	1,869.6	326.0
1980	2,249.4	1,899.4	350.1
1981	1,731.9	1,454.3	277.6
1982	1,172.4	1,012.5	159.9
1983	1,606.2	1,422.7	183.5
1984	2,001.5	1,709.5	292.0
1985	2,190.6	1,871.0	319.6
1986	2,025.9	1,746.7	279.2

Source: INFOR 1987

Table 6. The Chilean Lumber Remanufacturing industry.

	Dimensional lumber		Finished lumber		Total	
	1986	1983	1986	1983	1986	1983
Total production in m^3	550,935	340,698	560,415	518,973	1,111,350	859,671
Radiata pine production in m^3	436,339	289,598	444,952	455,016	881,291	744,614
Number of plants						
Total					664	645
In operation					600	554
Destination of production in m^3						
Exports					59,232	49,062
Housing					754,903	464,448
Wood boxes					100,277	190,001
Furniture					51,454	22,015
Doors & windows					15,154	11,750
Agricultural uses					23,774	12,991
Wholesalers					106,516	109,404
Employment						
Number of persons					8,089	7,758

Source: INFOR 1988

Table 7. Production of the Panelboard and Veneer industry 1974-1986; in thousands of m^3.

Year	Fiberboard	Particleboard	Plywood	Veneer
1974	26.40	25.85	9.70	1.46
1975	13.00	16.31	12.60	1.46
1976	21.30	29.23	6.60	2.34
1977	26.40	31.70	9.10	3.87
1978	31.30	42.15	13.30	5.19
1979	41.50	46.15	16.00	6.04
1980	43.10	42.92	19.80	5.73
1981	42.10	71.85	17.50	6.90
1982	43.70	56.30	10.10	8.00
1983	41.60	72.00	15.00	8.92
1984	39.90	114.31	20.40	9.37
1985	42.80	136.30	21.00	11.19
1986	43.80	145.81	125.10	13.10

Source: INFOR 1987

Table 8. Volume of the Chilean forestry exports by major products 1974-1986.

Year	Sawlogs (1,000 m^3)	Lumber (1,000 m^3)	Pulpwood (1,000 tons)	Newsprint (1,000 tons)	Panelboards & veneers (1,000 tons)	Card stocks (1,000 tons)
1974	--	132.6	180.6	77.5	0.1	14.2
1975	'6.2	256.5	177.4	78.3	2.0	11.6
1976	17.0	412.5	283.5	92.9	11.5	14.7
1977	147.6	684.4	338.5	87.4	12.7	12.2
1978	679.2	795.1	437.7	76.7	18.1	13.3
1979	965.7	1,081.2	431.2	75.5	24.6	22.6
1980	1,052.4	1,295.4	414.8	65.4	28.7	15.0
1981	361.0	864.7	410.4	42.7	22.0	13.6
1982	892.0	618.7	462.1	54.9	34.6	9.0
1983	1,026.3	754.9	523.4	92.2	34.1	8.5
1984	905.6	885.8	492.7	110.4	41.4	14.0
1985	1,273.4	706.0	503.1	116.4	43.1	10.3
1986	1,163.7	866.4	565.2	131.5	3.4	5.2

Source: INFOR 1987

Table 9. Volume of chemical pulp exports by country of destination 1974-1986; in thousands of tons.

Year	China	Korea	France	Germany	Japan	Venezuela	Italy	Belgium	England	Columbia	Indonesia	Others
1974	--	--	--	--	--	2.8	--	--	--	23.8	--	154.0
1975	--	6.1	11.1	1.7	4.4	17.6	4.0	--	0.9	10.3	--	121.3
1976	0.2	15.6	22.4	14.5	0.3	7.4	14.7	--	1.7	13.3	--	212.9
1977	--	55.8	29.4	26.1	8.0	23.9	23.4	--	3.5	16.9	--	151.8
1978	5.0	53.5	42.2	31.0	34.7	28.2	18.0	--	2.8	29.5	--	192.0
1979	29.4	46.4	37.3	37.0	10.4	15.6	8.1	--	2.0	28.8	--	216.1
1980	39.9	30.3	41.6	36.4	27.7	24.0	8.2	--	3.6	22.3	--	180.8
1981	87.5	39.4	55.2	41.7	3.8	13.2	11.0	--	3.5	33.1	--	121.5
1982	55.5	44.5	53.3	41.5	18.3	20.3	32.1	29.7	--	25.4	6.9	134.6
1983	91.2	64.0	48.8	45.9	33.7	32.0	31.2	30.1	26.6	25.3	17.1	78.4
1984	119.8	26.7	32.5	53.2	22.7	46.0	22.3	22.4	21.0	40.3	9.1	76.7
1985	52.7	43.7	44.0	54.8	27.4	30.5	10.7	32.5	19.9	35.1	14.3	137.5
1986	71.5	55.8	30.7	52.0	56.8	54.2	7.1	60.9	15.3	27.6	16.3	117.0

Source: INFOR 1987

Table 10. Newsprint export volumes by country of destination 1974-1986; in thousands of tons.

Year	Brasil	Peru	Indonesia	Argentina	Venezuela	Dominican Republic	Colombia	Taiwan	Uruguay	Paraguay	Bolivia	Others
1974	19.7	18.8	--	23.2	--	--	2.9	--	8.2	2.9	0.5	1.3
1975	17.7	21.8	--	22.9	0.3	--	0.1	--	6.6	2.8	1.4	4.7
1976	24.5	18.4	--	24.1	4.3	--	0.6	--	4.2	1.7	1.0	14.1
1977	25.0	7.1	--	36.0	--	--	1.0	--	3.6	5.8	1.1	7.8
1978	25.5	0.7	--	33.1	--	--	0.9	--	3.7	5.8	1.6	5.4
1979	33.9	3.6	--	18.7	--	--	1.4	--	3.7	5.4	2.5	6.2
1980	22.4	1.2	--	26.5	--	--	1.3	--	2.1	6.5	2.6	2.8
1981	15.3	1.5	--	12.4	--	--	0.8	--	1.5	6.5	3.0	1.7
1982	18.3	6.6	2.0	6.1	1.4	--	1.1	--	2.3	9.7	2.9	4.4
1983	31.2	4.4	11.3	8.3	6.0	3.4	2.7	2.4	2.2	2.1	1.9	6.3
1984	35.2	14.4	12.5	1.7	5.4	2.3	3.7	3.2	6.3	5.9	2.5	17.3
1985	10.8	22.9	6.0	1.2	13.5	4.1	4.7	0.6	3.8	8.8	2.4	37.6
1986	24.8	31.3	2.6	10.2	9.1	5.0	4.9	3.0	3.3	4.2	4.6	28.5

Source: INFOR 1987

Table 11. Radiata pine lumber exports by country of destination 1970-1986; in thousands of m^3.

Year	Argentina	Saudi Arabia	Emirates	Kuwait	Oman	Egypt	Bahrain	Dominican Republic	Tunez	Puerto Rico	Venezuela	Japan	Other
1970	78.4	--	--	--	--	--	--	7.1	--	--	--	--	27.9
1971	73.0	--	--	--	--	--	--	5.5	--	--	--	--	36.5
1972	31.8	--	--	--	--	--	--	--	--	--	--	--	12.1
1973	37.9	--	--	--	--	--	--	--	--	--	--	--	11.1
1974	106.2	--	--	--	--	--	--	--	--	--	--	--	6.1
1975	191.2	--	--	--	--	--	--	3.0	--	--	24.4	--	10.3
1976	125.0	59.7	--	--	--	--	--	2.2	--	--	139.5	--	53.6
1977	215.5	92.0	19.3	18.0	--	--	--	31.4	--	--	123.5	--	148.9
1978	196.2	116.1	18.0	7.9	--	20.0	--	69.3	--	1.0	111.7	35.8	197.2
1979	339.8	113.4	57.7	71.4	--	13.8	--	62.1	--	--	102.4	27.7	246.8
1980	309.4	363.4	46..4	28.4	--	14.4	--	70.1	11.7	--	119.1	38.3	256.6
1981	234.1	258.6	28.8	23.7	--	73.8	--	14.7	15.3	--	106.6	--	91.8
1982	121.8	152.3	37.3	66.7	20.5	61.0	--	33.2	10.5	--	67.0	0.1	34.9
1983	203.1	146.9	82.9	62.3	42.2	29.8	28.2	31.5	22.0	2.8	23.3	28.9	35.2
1984	227.7	98.2	40.7	40.1	42.4	152.4	36.5	28.2	18.9	10.7	38.2	72.4	55.8
1985	124.8	83.8	23.5	23.0	42.6	102.0	18.6	31.4	16.5	26.0	36.5	103.2	59.9
1986	210.0	119.4	18.3	20.5	27.1	135.6	23.4	46.3	--	18.0	16.8	101.3	96.4

Source: INFOR 1987

Table 12. Radiata pine sawlogs exports by country of destination 1977-1986; in thousands of m^3.

Year		Korea	Japan	China	Argentina	Germany	Libano	Italy	U.S.A.	Taiwan	Venezuela	Others
1977		36.8	104.4	--	0.3	--	--	--	0.1	--	--	5.0
1978		539.5	88.9	--	0.1	25.4	2.0	0.9	--	--	--	15.7
1979		572.6	236.6	29.8	0.1	--	--	36.8	58.8	14.7	0.4	8.2
1980		487.9	337.5	161.6	0.4	--	0.7	4.5	--	--	0.6	10.6
1981		257.3	40.0	32.3	--	0.1	1.5	--	--	--	--	1.4
1982		475.4	98.6	314.3	--	--	--	--	--	--	--	0.1
1983		528.4	248.9	245.5	0.3	--	--	--	--	--	--	--
1984		392.0	342.9	154.7	0.3	--	--	--	--	9.8	--	0.9
1985	(1)	588.2	383.0	284.4	--	--	--	13.7	--	--	--	1.4
1986	(1)	518.4	211.6	214.7	--	--	--	17.6	--	--	--	169.6

Source: INFOR 1987