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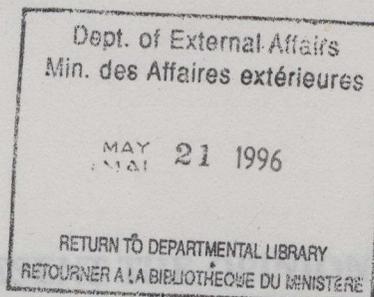
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A REPORT ON

**THE CHILEAN MARKET FOR
CANADIAN GOODS AND SERVICES
IN THE FORESTRY SECTOR**

December, 1992



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I. EXECUTIVE SUMMARY

Although small when compared to the traditional forestry industries of the Northern Hemisphere, Chile now counts on a significant and rapidly growing forest sector. Given this reality and the strength of Canadian forestry equipment, it makes practical sense to examine the market potential for Canadian goods and services in this sector.

Despite Chile's generous natural endowment of mixed temperate hardwood forests, over 90% of its industrial wood is grown on plantations. These tree-planted reserves of around 1.5-million hectares (ha) are primarily Radiata Pine (a species native to Southern California), and a small, but growing, sector of three species of the genus Eucalyptus (native to Australia). Both tree species grow rapidly under Chilean conditions, averaging over 20 cubic meters per hectare per year. Moreover, this growth rate is achieved early in the life of the stands, allowing for short, 10-year rotations for pulpwood and 25 for lumber.

Most of the industrial wood harvested in Chile, some 13-million cubic meters (m³) a year, is processed locally. In addition, some 4-million m³ are exported as raw material, either as logs (about 1.3-million m³), or as chips (some 2.7 m³). The total annual harvest for 1991 amounted to over 17-million m³. However, projections indicate that through both

A: OVERVIEW OF THE CHILEAN FORESTRY SECTOR

Chile's forest industry is rapidly evolving from a structure originally intended for a small protected local market, to a more modern one intended to be internationally competitive, exporting most of its production. Generally speaking one branch, the chemical pulp industry, can be considered to be fully modernized and others are following suit: sawmills, paper production and some segments making wood-based panels.

Close to 70% of the country's forest and forest industry output, in terms of value, is exported and this proportion should increase in the future.

In a development context, Canadian goods and services could increase their presence in the market - currently concentrated in engineering services for the pulp and paper industry - into other promising areas. These include: tree harvesting and logging, transportation equipment, sawmills - engineering and equipment - lumber drying kilns, chipping equipment, lumber remanufacturing - engineering and equipment - and pulp and paper machinery and equipment.

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2. NATURAL RESOURCES BASE

Until the early part of the 19th century, fully one third of Chile's national territory was covered by rich mixed temperate forests. However, today Chile's forestry resources consist of:

- industrial plantations of over 1.5-million ha; and,
- several million ha of land that, while suitable for forests, either stands idle or is used for grazing or subsistence agriculture.

This chapter will review Chile's forestry resource base in the following three sections: forestry land, natural forests and plantations.

2.1 Forestry Land

Although there is no comprehensive data inventory of Chile's forestry resource base, sufficient information does exist to provide the following picture of Chile's soil use capabilities:

<i>Use Capability Class</i>	<i>Area (000 ha)</i>	<i>%</i>
Arable	5,480	7.2
Grazing	8,200	10.8
Productive forestry	8,650	11.5
Conservation forestry	25,200	33.2
- Non-productive (deserts, mountains, etc.)	<u>28,250</u>	<u>37.3</u>
TOTAL	75,780	100.0

These figures demonstrate that the Chilean topography and climate are very conducive to the tree growth. Indeed, given these characteristics, forest resources can play an even greater role in the development of Chile's productive capabilities. This is reflected not only in the large percentage of forested land, but also in the substantial amount of grazing land which would be more profitable if converted to industrial wood plantations.

In fact, however, there is a sharp contrast between the amount of territory suitable for forestry (for reasons either of soil capability or economic advantage), and the actual land area used to grow trees, either as natural forests or in plantations. Less than half of the territory that could support forests currently is doing so.

2.2 Native Forests

While Chile's natural forests have not been surveyed on a national basis for over 45 years, recent estimates suggest that this resource has the following parameters:

Use Capacity	Ownership	
	Public	Private
	(000 ha)	
Protected & Park Lands	850	9,730
Productive	<u>650</u>	<u>3,450</u>
TOTAL	1,500	13,180

Despite the importance of privately owned productive natural forests relative to the total amount of native forests, their role in Chile's forest economy is not that significant. They produce no more than 5% of the country's forestry products. The following reasons have been given why this particular resource remains an "under-achiever":

- most of the "productive" forests are isolated and expensive to reach;
- standing volumes per ha are relatively small due to over-maturity and the selective logging in the past;
- government regulations tend to make harvesting costs high; and,
- "green" movements and the current mood of public opinion have often kept able corporations at a distance.

2.3 Plantations

In the last century, two exotic species were cultivated in Chile: *Pinus Radiata*, a native of southern California, and *Eucalyptus globulus*, native to Australia. While Radiata Pine (as it is commonly known) has traditionally been used for either pulpwood or lumber, the original use for Eucalyptus was as pit props in coal mining. More recently however, Eucalyptus has been successfully used as a pulpwood and, to a small extent, as lumber.

Currently, the total land surface under industrial plantations is estimated at around 1.5-million ha, with Radiata Pine making up almost 85% of that total. Eucalyptus plantations constitute the lion's share of the remaining 15%.

While plantation forestry is not new to Chile, it was not practiced in large amounts until 1974. At that time, the government decided to actively support and subsidize

plantations. This policy, plus the liberalization of the economy, stimulated a robust interest in the private sector. Consequently, the resource base has grown rapidly, as is shown by the following figures:

Year	Pine Plantations (000 ha)	Total Area under Plantation
1983	967.7	1,067.7
1985	1,040.3	1,188.6
1987	1,118.1	1,285.5
1989	1,192.3	1,386.4
1990	1,243.3	1,460.5
1991	1,305.3	1,555.2

The increase in the use of plantation forestry is the root cause of the surge of Chilean exports of wood product and raw material (ie, logs and chips) over the last 15 years. This export boom has been almost entirely dependent on this transplanted resource base. (See Chapter 4 for a statistical review of Chilean forestry exports.)

One key to the commercial success of the exotic species is their comparative cost advantages over native growths. Plantations are usually located near existing infrastructures and are concentrated in areas of milder climate and topography. As a result, they are easier to harvest. Furthermore, through managed growth (pruning, spacing, etc) they produce more commercially viable wood per tree than do the wild growths. Finally, precocious growth of between 20 and 35 m³/ha/yr, makes investment in timber plantations an attractive proposition.

3. CURRENT FORESTRY LEGISLATION

Ninety five percent of Chile's natural forests and plantations are privately owned. The one major exception are the forests managed by the **Sistema Nacional de Areas Silvestres Protegidas (SNASPE)** -- the government body dedicated to conservation and recreation and the agency charged with managing Chile's National Parks and Forest Reserves. SNASPE directly manages around 1.5-million ha of natural forests, and also controls another 12-million ha of non-forested, but protected, national lands (ie, deserts, mountains, etc.). SNASPE reports to **Corporación Nacional Forestal (CONAF)**, the Chilean Forestry Service, which in turn reports to the Ministry of Agriculture.

Although legislation protecting Chile's natural forests dates back to the 16th century, current regulations are recent and relatively simple. Decree 701 of 1974 and the amendments of 1980 -- Decreto Supremo 2565 and 316 -- constitute the basic framework

for forestry practices in Chile. In addition, Law 18.326 of December 1984, created SNASPE and Chile's National Parks and Reserves, while decrees 29, 43 and 56, specifically forbid the exploitation of two native species considered "natural monuments": *Araucaria (Araucaria araucana)* and *Alerce (Fitzroya cupressoides)*.

Essentially, Decree 701 and its amendments establish the following basic rights, limitations and incentives for forestry practices described in the following sections.

3.1 Natural forests

- private ownership rights as understood for other types of real estate;
- the prohibition of all harvesting and reforestation methods not approved by CONAF. Before a forestry operation can get underway, the technical features of its harvesting and reforestation plans must be explicitly detailed in a "Management Plan". CONAF will only recognize the management plans prepared by a qualified professional forester. This plan must assure the area be replanted with the same species as is harvested;
- as indicated before, some species of importance, like *Araucaria* and *Alerce*, which have been over-exploited in the past, may not be harvested at all; and,
- the state will provide the following tax incentives to forestry operations that have a CONAF-approved management plan: exemption from territorial taxation (around 2% estimated value of the land), and the 50% reduction of personal taxes applied to the income earned from that operation.

3.2 Plantations

- private ownership rights as understood for types forms of real estate;
- no restrictions on forestry practices (ie, harvesting and reforestation techniques) unless the owner has his estate declared "forestry land", (ie, suitable only for forests);
- if located on soil unsuitable for agriculture, the plantations will have access to the same tax incentives described previously;
- the restrictions for "forestry land" are those established by a management plan, which must be submitted to CONAF. Such a plan is freely designed by the owner, with the only requirement being that the land must remained forested;

- subsidies: the costs of plantation and silvicultural practices such as thinning and pruning, are reimbursed to the plantation owner. In practice, this represents around 70% of the actual cost.

The legal framework described above has proven to be very effective in stimulating the emergence of plantations as the driving element in the development of Chile's forestry sector. In only 16 years, a substantial plantation base of around 1.2-million ha has been created with the relatively small government investment of around US\$71.2-million in subsidies. In sharp contrast, the contribution of natural forests to the economy has stagnated and the resource itself is declining in absolute terms. Evidently, the existing legal framework has been unable to encourage the rational exploitation of productive natural forests, or to ensure its conservation.

Currently, the Chilean Congress is considering a proposal for a new law governing the exploitation and conservation of native forests. As it now stands, this initiative would put a strong emphasis on the protection of the native forests from any additional declines due to commercial exploitation. It does, however, propose a subsidy on silvicultural and replantation practices that would allow for the sustained use and full regeneration of productive natural forests.

4. FOREST INDUSTRY

Despite its relatively small size and recent development, at least in comparison with the traditional forestry industries of the Northern Hemisphere, Chile's forest industry is well diversified and quite modern in most sectors. In fact, lumber, wood-based panels and pulp and paper subsectors all boast several plants designed to be internationally competitive. Moreover, these subsectors have all experienced significant growth due to the introduction of technical innovations.

4.1 Consumption of Raw Material

Since 1976 and particularly in the last 4 years, raw material consumption by the forest industry has grown rapidly. While total consumption expressed in m³ of logs underbark (m³ ub) stood at around 4-million in 1976, it surpassed 9-million in 1985 and reached 17-million in 1992. The evolution of raw material consumption by the industry since 1975 is illustrated by the following figures:

Industrial Wood Consumption

Year	Radiata Pine	Other Species	Total
		(000 m ³ ub/year)	
1975	3,560	481	4,041
1980	7,611	861	8,472
1985	8,656	905	9,561
1990	9,718	2,541	12,259
1991	12,645	4,400	17,045

4.2 Sawmills

Although currently declining in importance in relation to other subsectors, lumber has the longest history of any forestry subsector in Chile. It remains the largest single consumer of logs and, until recently, consumed 50% of the industry's resource inputs. This share is now about 40%, with pine logs making up close to 90% of the raw material.

As with the rest of the forest industry, lumber has grown consistently in recent decades. With a total production of close to a million m³ of lumber in 1975, production has more than tripled, to surpass 3-million m³ in 1991.

Lumber Output

Year	Pine	Others	Total
		(000 m ³)	
1975	744	216	960
1977	1,292	44	1,336
1980	1,899	350	2,249
1982	1,012	159	1,172
1985	1,871	320	2,191
1987	2,309	368	2,677
1990	2,889	438	3,327
1991	2,750	467	3,217

Despite this impressive increase, Chile's lumber industry is still characterized by a large number of small units with poor productivity and low conversion yields. This situation is now slowly changing, as larger and more modern sawmills are generating an increasing share of total production. As of 1990, 8 large plants represented some 30% of the total national lumber output, while some 1,000 very small units constituted only 36%. This situation is illustrated by the following 1991 figures:

<i>Lumber Production (000 m³/year)</i>	<i>Number of Sawmills</i>	<i>Lumber Production (000 m³/year)</i>
60 and more	8	990
20 to 59	11	355
10 to 19	26	368
5 to 9	64	409
Less than 5	1,000	<u>1,095</u>
TOTAL	1,109	3,217

About a third of the lumber produced is exported -- mostly production from the larger sawmills. The remainder is used locally. This distribution between the domestic and the export market has remained stable since 1985.

Along with the modernization process now under way in the lumber industry, several new plants designed to further process lumber through kiln-drying, planing, finger-jointing, panelling and furniture manufacturing have been established in recent years. Although still far from being consolidated, remanufacturing and woodworking hold considerable promise and there is great potential for rapid growth in the coming years. As with much of Chile's forest industry, this particular branch is oriented almost exclusively toward the export market.

4.3 Wood-based Panels

The 4 basic product lines -- plywood, fibreboard, chipboard and medium-density fibre (MDF) -- all manifest considerable differences in development, efficiency and market orientation. As a result, this branch of Chile's forest industry is not easy to characterize. The differences are enormous between the traditional, very small plywood mills and the recently founded chipboard and MDF plants. As a result, each subsector must be examined separately.

4.3.1 Plywood

Chile currently has 7 small plants, 2 of which -- BOMASA and MASISA -- are modern (*see Appendix III*). In 1991, the plywood sector produced only 50,000 m³, using mainly native hardwood species. Exports represent only 20% of total production and went primarily to Europe.

Along with fibreboard production, plywood has been one of the least dynamic of Chile's forest industries. Capacity remained stagnant for years and only grew significantly

in 1990-1991 when a modern mill, BOMASA, came on-line. This new mill produces 30,000 m³/year -- large by Chilean standards -- and is based, like the older versions, on native species. In 1985 total output was 39,500 m³ and 40,700 m³ in 1990. Both figures are well below capacity. This rather unimpressive picture of Chile's plywood industry can be explained by the following basic reasons:

- most plants are either too small or too old to be competitive domestically or internationally;
- logs of native species, basically *Nothofagus*, suitable for peeling have become scarce and consequently expensive; and,
- the nearly 10% devaluation of the Chilean peso vis-a-vis the American dollar during 1991 and early 1992 has further eroded the marketability of this industry's product in the global market.

The future does not hold much promise for plywood producers in Chile. This situation will not change until a major reorientation to Radiata Pine-based production is undertaken. Pine will be the only wood that will remain in abundant supply over the coming decades.

4.3.2 Fibreboard

Chile's fibreboard industry consists of only one significant operation: **Cholguán** (see *Appendix III*), which is based on pine and boasts an annual capacity of around 60,000 m³. Although one of the oldest industrial operations in the sector, this mill has gone through successive expansion and revamping operations to keep it efficient and well adapted to the internal market requirements. Exports have accounted for up to 50% of production during periods of slack internal demand, but it is essentially an operation designed to supply the domestic market. The growth prospects of the fibreboard industry in Chile will remain limited until steps are taken to improve the end-product, no longer very popular in the global market. Fierce competition from foreign suppliers also complicates any possible expansion plans.

4.3.3 Chipboard

Unlike plywood and fibreboard, Chile's chipboard industry has shown robust development in recent years. Although the number of plants has remained at 3 for about 10 years (see *Appendix III*), all have been either modernized or expanded recently. Not only has output grown, but efficiency has improved and product diversification has been enhanced. Over the last decade annual production has more than tripled, from some 60,000 m³ in 1982 to

around 280,000 m³ in 1992. Throughout its development the chipboard industry has used pine as its sole raw material.

Like the plywood and fibreboard industries, chipboard production has been intended basically for the domestic market. However, small volumes have occasionally been exported at marginally profitable prices. Current efforts to reduce the trade barriers of Chile's neighbours (particularly in Argentina and the other MERCOSUR countries) may improve the prospects for chipboard exports.

4.3.4 Medium Density Fibre (MDF)

The newest segment of Chile's wood panel industry, MDF, currently boasts only 2 plants: **Trupan**, onstream for a couple of years, and **Fibropanel** (see *Appendix III*), which was recently inaugurated. Both operations are focused on the international market and each has a capacity of 100,000 m³/year. In 1991, after a lengthy learning period, the first mill began operating at close to capacity with an annual output of around 90,000 m³. At that time exports represented some 60% of the total output and were destined mainly for the European market. With the second operation underway, and with the problems in start-up, technical and marketing experiences of the first mill, new investments in this particular area are not considered likely for some time.

4.4 Pulp and Paper Industry

With a relatively short history, the pulp and paper industry has become one of Chile's most dynamic and sophisticated sectors. Originally oriented towards the domestic market, it has become primarily an export business over the last 20 years. This is particularly true for chemical pulp and mass-produced papers like newsprint. For obvious reasons, the internationally oriented mills are larger and generally more efficient than those designed to supply the Chilean market. Five corporations (see *Appendix III*) control the overwhelming majority of Chile's pulp and paper production, but some small mills manage to compete in specialized niches of the domestic paper and board market.

This relatively small number of corporations is related to the size and characteristics of the forestry resource base. Plantations, that supply a vast majority of Chile's industrial wood, are in the hands of few corporations that started their reforestation programs some 20 years ago.

4.5 Paper and Board Production and Trade

Apart from its newsprint production, Chile's paper and board industry is focused almost exclusively on its domestic market. In fact, Chile now supplies more than 80% of its own paperboard needs (see Table 1). In 1990, Chile's domestic consumption totalled 416,000 metric tons (mt), which equals 31 kilograms (kg) per capita. Table 1 demonstrates that industrial papers and boards represent about 50% of Chilean consumption; writing and printing papers another 36%; and absorbing papers the remaining 14%. Chile is a net exporter of newsprint (primarily to South America) and a net importer of writing and printing papers. However, in gross terms, the volume of exports is almost double imports for all papers and boards.

Table 1

Production and Trade of Papers and Boards in 1990

Item	Production ¹	Imports (mt/year)	Exports ¹	Apparent Consumption
Newspaper	171,000	-	115,009	55,991
Other Writing and Printing Papers	60,000	43,118	4,916	98,202
Tissues and Other Absorbing Papers	54,000	2,325	418	55,907
Wrapping and Packaging Papers and Boards	164,000	30,494	708	193,786
Other	<u>13,000</u>	<u>-</u>	<u>33</u>	<u>12,967</u>
TOTAL	462,000	75,937	121,084	416,853

¹ Only total production -- 485,000 mt -- and total export figures -- 155,000 mt -- are available for 1991.

Except for newsprint, which is produced by two modern medium-sized mills, **INFORSA** and **Papeles Bío-Bío** (see Appendix III), the rest of the papers and boards are produced by relatively small scale, although usually modern, plants. In total, Chile has 12 mills producing papers and boards (see Appendix III), with the following size distribution:

Size Distribution of Chile's Paper and Board Mills

Rated Capacity (mt/year)	Number
100,000 and more	2
50,000 to 99,000	2
10,000 to 49,000	2
Less than 10,000	<u>6</u>
TOTAL	12

4.6 Chemical Pulp, Production and Trade

With the exception of 3 mechanical pulp operations (INFORSA, Papeles Bío-Bío and CMPC), and 1 small sulphite/paper plant integrated mill (INFORSA), Chile's pulp comes from 5 large kraft operations producing for the export market (see Appendix III). The most recent official production figures, for 1991, would vastly underestimate the current situation. All 5 kraft mills have either undergone major revamping or came online since 1990 (see Appendix III).

Production in 1990 and current installed capacity are considerably different, as illustrated by the following figures:

Mill	1990 Pulp Production (mt)	Current Capacity 1992 (mt/year)
Arauco I-II	186,000	545,000
CELPAC	-	315,000
Laja	308,000	310,000
CELCO	196,000	280,000
Santa Fe	-	<u>240,000</u>
TOTAL	690,000	1,690,000

Only 1 of these mills (Santa Fe), uses Eucalyptus as its raw material, while the other 4 rely on Radiata Pine for 100% of their raw material requirements. This situation should change before 1995 when Eucalyptus will be added to the raw material mix in 2 plants -- Arauco and Laja -- currently using only Radiata Pine (see Appendix III).

As of 1991, Chile exported close to 700,000 mt of chemical pulp, which accounts for 71% of all the wood pulps produced. However, if only kraft pulps are considered, chemical pulp makes up fully 84% of total exports of wood pulp. Out of the 700,000 mt exported,

fully bleached pulps represent approximately 70%, while the remaining 30% is accounted for by unbleached pulp from Celco (the only Chilean mill without bleaching facilities). By late 1993, when all 5 kraft mills currently operating will reach full capacity, pulp exports are estimated at 1.55-million mt per annum, or close to 90% of total production. Chilean pulp is currently exported to a number of countries around the world, with Europe being the largest buyer.

5. STATISTICAL OVERVIEW

The purpose of this chapter is to present a statistical and graphical overview of Chile's forestry sector. The overview begins with broad economic indicators, continues through resource base indicators plus sectoral output, and ends with a résumé of trade figures. As is noticeable throughout the chapter, available statistics are often inadequate, and systematically slow in forthcoming.

5.1 GNP Contribution

Slowly but surely the importance of the forestry sector to Chile's Gross National Product (GNP) has been growing. However, its overall contribution to the economy remains modest, as is shown below:

Forestry's Contribution to Chile's GNP

Year	%
1975	2.14
1985	2.64
1986	2.83
1987	3.29
1988	3.45
1989	3.18
1990	3.26
1991	3.23

One should keep in mind, however, the strong expansion of the Chilean economy during these years, with GNP growing at an average of close to 5% in real terms over the last decade. The sectoral contribution to exports is considerably more significant and currently represents around 14% of the total.

5.2 Resource Base

Forestry makes up an important part of land-use practices since, in many instances, Chile's geography does not lend itself to other productive uses. This is shown by the following figures:

<i>Land Use Capability Class</i>	<i>Area (000 ha)</i>	<i>Share of the Territory (%)</i>
Arable	5,480	7.2
Grazing	8,200	10.8
Productive forestry	8,650	11.5
Conservation forestry	25,200	33.2
Non-productive (deserts, mountains, etc)	<u>28,250</u>	<u>37.3</u>
TOTAL	75,780	100.0

Statistical information on natural forests is outdated and inadequate, and the Chilean government is in the process of obtaining World Bank financing to establish a fully developed modern forestry inventory using geographic information systems (GIS). Appendix VI shows the geographical location of Chile's natural forest and plantations.

Recent estimates suggest the following numbers:

Natural Forests

<i>Use Capacity</i>	<i>Area (000 ha)</i>
Protection	9,730
Productive	<u>4,100</u>
TOTAL	13,830

Plantations now provide most of the logs that Chile harvests and either uses internally or exports. **The size of such plantations has increased rapidly over time:**

Plantations

Year	Radiata Pine	Other Species (000 ha)	Total Area
1983	967.7	100.0	1,067.7
1985	1,040.3	148.3	1,188.6
1987	1,118.3	167.2	1,285.5
1989	1,192.3	194.1	1,386.4
1990	1,243.3	217.2	1,460.5
1991	1,305.3	249.9	1,555.2

5.3 Industrial Wood Consumption

This heading excludes fuel and firewood, but considers logs used in domestic production processes and raw material (ie, logs and chips) exports.

Industrial Wood Consumption

Year	Radiata Pine	Other Species (000 m ³ ub)	Total
1980	7,610.9	861.0	8,471.9
1985	8,656.5	904.4	9,560.9
1987	10,453.4	1,116.0	11,569.4
1989	10,034.6	2,526.2	12,870.8
1990	10,717.7	3,541.0	14,258.7
1991	12,645.0	4,400.0	17,045.5

Raw material exports in the form of sawmill logs, pulp logs and chips represented close to 27% of the industrial wood consumption in 1990. The 1991 estimate is 29%.

The end-users of Chile's industrial wood production can be identified as follows:

End-users of Chile's Industrial Wood

Year	<i>Pulp and Paper</i>	<i>Sawmills</i> (000 m ³ /year)	<i>Wood-based Panels</i>	<i>Sawmill Logs</i>	<i>Exports Pulpwood</i>
1985	3,393.0	4,578.4	316.1	1,259.5	13.9
1987	3,660.4	5,595.1	363.9	1,273.3	676.7
1989	3,137.5 ¹	5,602.8	599.7	862.5	2,358.3
1990	2,595.4 ¹	6,997.5	608.2	1,033.4	2,828.8
1991	5,057.7	6,875.2	688.8	760.5	3,663.3

1. *This figure is underestimated because it does not include sawmill chips, information not available.*

5.4 Forest Industry Output

This section presents separate statistical information for lumber, pulp and paper and the wood-based panel industry.

Sawmills have traditionally consumed a large share of Chile's industrial wood production, and Radiata Pine makes up the bulk of the raw material. Over the last decade, sawmill output has shown the following trend:

Year	<i>Sawmill Production</i>		
	<i>Radiata Pine</i>	<i>Other Species</i>	<i>Total</i>
	(000 m ³ /year of lumber)		
1981	1,454.3	277.6	1,731.9
1983	1,422.7	183.5	1,606.2
1985	1,871.0	319.6	2,190.6
1987	2,309.5	367.6	2,677.1
1989	2,322.8	358.0	2,680.8
1990	2,889.1	437.8	3,326.9
1991	2,750.7	466.8	3,217.5

As shown by these figures, native hardwoods have a small and decreasing proportion of lumber production. This situation will tend to become more acute due to the deterioration of the resource base.

Wood-based panels have been and remain a relatively small segment of Chile's forest industry as shown by the following figures:

Wood-based Panel Production

<i>Year</i>	<i>Fibreboard</i>	<i>Chipboard</i>	<i>Plywood</i>	<i>MDF</i>
	<i>(000 m³/year)</i>			
1981	42.0	71.8	17.5	-
1983	41.6	72.0	15.0	-
1985	42.8	36.3	21.0	-
1987	45.0	171.8	29.4	-
1989	52.0	190.0	37.0	-
1990	51.5	178.3	40.4	69.9
1991	50.8	165.8	54.7	89.0

In the last decade Chile's pulp and paper industry was a consistent and important element of the forest industry, which is reflected in the following figures. However, in the last year with the start-up of 3 new mills, **Santa Fe, Arauco II and CELPAC**, pulp has become a central item of Chile's output.

Pulp and Paper Production

<i>Year</i>	<i>Mechanical Pulp</i>	<i>Chemical Pulp</i>	<i>Newsprint</i>	<i>Other Papers and Boards</i>
	<i>(000 mt/year)</i>			
1981	124.7	617.9	130.7	148.2
1983	139.9	656.2	155.2	169.6
1985	157.7	679.6	172.1	197.3
1987	152.6	708.4	179.5	262.4
1989	161.0	679.8	166.5	271.3
1990	159.8	644.3	171.0	291.0
1991	179.0	934.0	171.0	314.0

5.5 Forest Products Trade

This section contains volume and price information for logs, lumber, chemical pulp and newsprint. **This kind of information is not available for other products which are exported in lesser quantities.**

Radiata Pine Saw Logs and Lumber: Exports and Prices¹

Year	Exports		Prices	
	Logs (000 m ³ /year)	Lumber	Logs (US\$/m ³ FOB)	Lumber
1981	363.2	864.4	47	109
1983	1,026.3	754.3	33	84
1985	1,259.5	706.0	32	73
1987	1,273.3	1,019.9	39	87
1989	862.5	889.6	43	109
1990	1,033.4	1,052.0	49	126
1991	760.8	1,036.3	51	135

¹ Exports of other species are negligible.

Kraft Pulp and Newsprint Exports and Prices

Year	Exports		Prices		
	Pulp (000 mt/year)	Newsprint	Unbleached (US\$/mt FOB)	Bleached (US\$/mt FOB)	Newsprint
1981	410	43	388	491	491
1983	523	92	249	370	374
1985	503	116	264	340	418
1987	525	126	428	544	481
1989	482	126	469	776	567
1990	581	115	395	648	555
1991	664	115	405	514	590

6. FUTURE DEVELOPMENT TRENDS

The rapid development of Chile's forestry sector started some 15 years ago through a vast upswing in **Radiata Pine** and Eucalyptus planting. However, the more tangible industrial results have **only** been showing recently. This growth in the industrial exploitation of the now maturing plantation growths will continue in the coming years. In its 4 sections, this chapter deals with: the availability of raw material; its use; forest industry development; and foreign trade. The future investment requirements of this sector are examined.

6.1 Availability of Raw Material

As has been pointed out earlier, plantations and not natural forests, currently provide the bulk of the industrial wood Chile uses and exports. This reliance on transplanted and managed growths is expected to be accentuated in coming years. Nevertheless, natural forests do maintain productive potential and are included in the following exhibit:

Industrial Wood Availability: 1991-2005

Year	Plantations		Natural ¹ Forests	Total
	Radiata Pine	Eucalyptus (000 m ³ /year)		
1990	10,717.7	870.0	2,671.1	14,258.7
1995	16,300.0	1,700.0	2,600.0	20,600.0
2000	23,300.0	3,500.0	2,600.0	29,400.0

¹ The concept of availability can be estimated systematically for plantations. In the case of natural forests, given Chilean conditions, it is a mere guess.

The above numbers suggest an interesting potential for forest industry development in the coming year. Simply put, the supply of industrial wood will be more than double current volumes.

6.2 Forest Industry Development

Much of coming investment is already in the planning stage and is already underway to some extent. So, the prognosis presented in this section is more than just an educated guess -- at least up until 1995. This is particularly true for the large scale and multi-year investments of the pulp and paper sector. Beyond 1995 though, the estimate is based on the amount and characteristics of the raw available material. The following figures are based on a projection of the forestry sector recently prepared for the Ministry of Public Works.

Development Prognosis for Chile's Forest Industry Production

Year	Lumber (000 m ³ /year)	Wood-based	Pulp and
		panels (000 m ³ /year)	paper (000 mt/yr)
1990	3,326.9	340.1	1,116.0
1995	3,800.0	500.0	2,025.0
2000	4,800.0	600.0	2,800.0

As shown by the preceding figures, all the subsectors are expected to show dynamic growth over this decade. However, it is the pulp and paper area that will exhibit the fastest growth, followed by the lumber and wood-based panel industries.

While 3 greenfield pulp and papers projects have been announced -- 2 near Valdivia and 1 west of Curicó -- other future projects are far less defined and the specifics of which companies and what locations have yet to be revealed. All 3 are to be totally or partially owned by foreign corporations: **Daio Paper** of Japan, **Stora K.** of Sweden and **Attisholz Holding Ltd.** of Zürich, Switzerland.

Growth in the lumber subsector should come mostly from the established large forest owners like **CMPC**, **Arauco** and **Industrias Forestales** and their sawmill subsidiaries (see *Appendix III*) that control the raw material.

6.3 Trade

Given the prognosis presented in Section 5.2, the bulk of the raw material to be generated in Chile will be processed locally, with one possible exception: hardwood chips from natural forest exploitation. Chile's processed forest products exports will increase substantially, especially in pulp and paper, as the following figures show:

Projections of Chile's Forest Products Exports

<i>Year</i>	<i>Lumber (000 m³/year)</i>	<i>Wood-based Panels (000 m³/year)</i>	<i>Pulp and Paper (000 mt/yr)</i>
1990	1,052.0	85.0	696.1
1995	1,000.0	95.0	1,490.0
2000	1,000.0	120.0	2,060.0

6.4 Investment Requirements

To see the **business** potential of the development prognosis already presented, a preliminary estimate of the investment requirements of the industry follows. Much of the total investment will be in the form of imported specialized goods and services, opening opportunities for countries, such as Canada, with experience in the forest industry.

Investment Requirements in Sawmills

<i>Period</i>	<i>Investment per m³/year (US\$)</i>	<i>Capacity Increase (000 m³/yr)</i>	<i>Total Investment in Industry (US\$000)</i>
1992-1995	120	665.4	79,848
1996-2000	120	1,000.0	120,000

Investment Requirements in the Wood-based Panel Industry

<i>Period</i>	<i>Investment per m³/year (US\$)</i>	<i>Capacity Increase (000 m³/yr)</i>	<i>Total Investment in Industry (US\$000)</i>
1992-1995	500	160.0	80,000
1996-2000	500	100.0	50,000

Investment Requirements in the Pulp and Paper Industry

<i>Period</i>	<i>Investment per mt/year (US\$)</i>	<i>Capacity Increase (000 ton/yr)</i>	<i>Total Investment (US\$000)</i>
1992-1995 ¹	2,500	794.0 ¹	1,985,000 ¹
1996-2000	2,500	570.0	1,425,000

¹ *Most of this investment has already been made and is in the process of coming to age.*

1. Introduction

In recent years, Chile's forestry sector has been made up primarily of its traditional state-owned forests. Although private forests cover a far larger area, they provide only a limited amount of the national wood. In dealing with the silvicultural aspects of the state forests, timber, forest and products are considered separately.

1.1. National Forests

The national forests are state-owned and are primarily privately managed. They are the main source of timber.

The state forests are divided into two main groups: the state forests and the state forests. The state forests are the main source of timber and are primarily privately managed. They are the main source of timber.

B. COMMERCIAL POTENTIAL FOR CANADIAN GOODS AND SERVICES IN CHILE'S FORESTRY SUBSECTORS

Chile's forestry sector is divided into two main groups: the state forests and the state forests. The state forests are the main source of timber and are primarily privately managed. They are the main source of timber.

1.1. Plantations

In these forests, the privately-owned plantations are typically managed using modern silvicultural practices. This is particularly true on the estates owned by large landowners. These account for some 60% of the 1.5-million ha now in plantations. Various activities can be identified in the following basic activities:

1. Seedling production (genetic improvement), with two decades of practice and extended experience.

2. Nursery operations, technically well developed and implemented at a substantial scale, more than 3-million seedlings per year.

7. SILVICULTURE

As pointed out in earlier chapters, Chile's forestry resource base is made up primarily of its 1.5-million ha of plantations. Although natural forests cover a far larger area, they provide only a limited proportion of the industrial wood. In dealing with the silvicultural aspects of Chilean forestry, natural forests and plantations are examined separately.

7.1 Natural Forests

Both protected and productive natural forests are primarily privately, not state, owned. They can be characterized as follows:

- over 13.8-million ha (70% protected and 30% productive) of this resource is found in the mountainous areas of the central-south and southern zones of Chile (*see Appendix VI*).

These areas display difficult climatic conditions with long winters plus heavy precipitation (rain in the central areas and snow in the extreme south); and,

- ownership, management and exploitation of these forests is typically done on a small scale and with primitive technology. Large forestry corporations have not been active in natural forests, for policy reasons such as public image.

Within the relatively limited publicly managed forests, commercial exploitation is replaced by conservation and recreation. For this purpose, the government owns almost 1.5-million ha of natural forests, along with some 12-million ha of non-forested lands. This area is spread across the length of Chilean territory and constitutes a nationwide chain of national parks, natural monuments and wildlife preserves.

7.2 Plantations

In sharp contrast to natural forests, the privately-owned plantations, are typically managed using intensive silviculture practices. This is particularly true on the estates owned by large corporations. These account for some 60% of the 1.5-million ha now in plantations. Modern silviculture can be identified in the following basic activities:

- tree breeding (genetic improvement), with two decades of practice and extended application;
- modern nurseries, technically well developed and implemented at a substantial scale, more than 3-million seedlings per year;

- up-to-date planting techniques supported by well-equipped, highly professional organizations;
- modern information systems to keep track of statistics, mapping and forest growth information, including modern GIS support; and
- sophisticated management information systems.

7.3 Possible Areas of Interest for Canadian Suppliers of Goods and Services in Silviculture

As an open economy, Chile has had access to goods and services from all over the world. In this competitive and rapidly growing market, silviculture practitioners have demanding standards in quality and service. Specific areas of interest to Canadian suppliers are:

Services

- national parks: design, organization and management, consultancy.
- wildlife management: consultancy and training.
- tree breeding: genetics, plant reproduction, seed production, training.
- nurseries: design, operation and management, consultancy.
- plantation technology, training.
- industrial forest silviculture, consultancy.
- site preparation.

Goods

- wildlife laboratories and field equipment.
- national park operation: instruments and equipment.
- plant breeding and nursery laboratories, instruments, machinery and equipment.
- planting equipment and tools.
- thinning and pruning equipment and tools.

8. FOREST HARVESTING

For the same reasons as those explained in Section 6 (*see page 19*), forest harvesting of Chile's plantations is significant in volume, dynamic in growth, and technologically sophisticated. However, this is not true for natural forests. As shown by current industrial wood production statistics and the growth estimated for the coming years, plantations will provide the bulk of the output. In 1991, only 18% of the annual production of 14-million m³ of industrial wood generated by Chile's natural forests. In the predictions for Chilean industrial wood production in 1995 and 2000, (20.6- and 29.4-million m³ respectively), the importance of natural forests continues to decrease as a share of the total output: 18% in 1991, 12% in 1995 and 8% in 2000.

Harvesting techniques for natural forests and plantations are significantly different in Chile. In the natural forest, environmentally-conscious operators must work through selective cutting, reduced volumes per ha and big heavy logs. In the plantation context, clear cutting, high volumes per ha and medium- to small-size logs prevail.

8.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services in Forest Harvesting

As pointed out for silviculture, and for the same reasons, the Chilean market for goods and services in forest harvesting is open and very competitive. The intense competition is already well known to a number of Canadian exporters who have long been active in the Chilean market for timber felling and logging equipment. Currently, about 70% of the logging is done by skidders and the remaining 30% with cable equipment. Three brands of skidders, each with similar market shares, constitute the bulk of the some 400 units currently operating in Chile: **Caterpillar, Timber Jack and John Deere**. Chilean firms, particularly the large ones, are increasingly facing growing volumes of wood to harvest. They are therefore moving into more sophisticated tree harvesting equipment: fellers, feller-branchers, forwarders and the like.

The areas of greatest potential for Canadian suppliers are:

Services

- harvest planning, equipment selection, economics and ad hoc software consultancy.
- services on technical planning and construction of roads for forest harvest operations, including GIS applications, consultancy and training.
- site preparation.

Goods

- felling and logging equipment and tools including light cable logging units.
- road construction and maintenance equipment.
- log loading, unloading and yarding equipment and tools.
- specialized log transportation trucks.

9. KILN-DRYING

The vast majority of lumber produced in Chile comes from Radiata Pine, with the remaining proportion coming from either native species or Eucalyptus. In 1990, 2.9-million m³, or about 90%, of lumber came from Radiata Pine, out of the annual total output of 3.3-million m³. For all practical purposes then, kiln-drying must be used on softwoods. Short drying schedules with moisture contents ranging between 20% and 8% (depending on the final destination of the product) are required. Traditionally, only a small proportion of the country's lumber output has been kiln-dried, with the latest estimates suggesting that this figure approximates 20%. However, there is a general recognition among Chilean foresters that this situation must change and that kiln-drying must be more fully implemented, for the following basic reasons:

- export markets demand (where the bulk of Chilean production is destined) necessitates more kiln-dried lumber -- indeed international wood sales to European markets are now largely kiln-dried versus green lumber;
- export markets no longer accept PCP-treated lumber, thereby forcing suppliers to kiln-dry their lumber before shipping or face "blue stain"; and,
- an increasing proportion of lumber is now destined to remanufacturing which requires a kiln-dried raw material.

9.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services in Kiln-Drying

With a growing lumber output -- expected to increase from today's 3.3-million m³ per year to close to 5-million by the end of the decade -- and an increasing demand for kiln-drying, there is strong potential for Canadian suppliers on this area.

Services

- Consultancy in planning and design of kiln drying operations, economics of kiln drying and market opportunities for kiln dried wood.
- Training in kiln drying with modern installations.

Goods

- Kiln instruments and control systems.
- Kiln chambers and equipment.
- Humidity control and efficiency equipment.

10. CHIPPING EQUIPMENT

As Chile's forest industry continues to develop and to pattern itself on the forest utilization practices of the developed countries, Chile is integrating the use of its industrial wood among its various end consumers. In this process, chipping is becoming more popular in three relatively new areas:

- in the forests themselves, with portable chippers;
- at the sawmills, with small stationary units, to handle by-products destined for pulp mills; and,
- in the vicinity of ports, in large stationary units designed to process chips for export.

The volume of wood for chip processing will increase as does the availability of industrial wood (i.e., by over 100% before the end of the decade).

The Chilean market in this area has two distinct segments: the first made up by the heavy units required by the pulp and paper industry and by chip exporters; and a second formed by the relatively light units used by sawmills and portable outfits. In the first segment chippers are normally **selected** by the engineering firms in charge of mill design. In the second segment chippers are **selected** separately as independent pieces of equipment. In this latter market a Chilean manufacturer of chippers -- ECASO S.A. -- has been able to establish itself firmly as the leading supplier.

10.1 Possible Areas of Interest for Canadian Suppliers of Goods in Chipping Operations

Chippers along with the other types of standard forestry equipment, face a competitive market in Chile. However, rapidly increasing demand should present opportunities for new suppliers in some of the following areas:

Goods

- portable softwood chippers to run in conjunction with logging operations, normally associated with debarkers.
- stationary softwood sawmill chippers.
- stationary pulp mill chippers for softwoods and hardwoods.
- large stationary hardwood chippers for export operations.
- technical accessories and/or modifications to increase efficiency.

11. SAWMILLS

During the next several years, Chile's lumber industry is expected to grow in sheer size and sophistication. Production, as mentioned earlier, is expected to grow from the current 3.3-million to 4.8-million m³ per annum by the year 2000. Both plant modernization and the pressures of more inputs (and therefore greater output) will require investment in technology and equipment. Chilean foresters, eager to tap the international market with greater value-added wood products, are now focusing on developing a sawmill industry capable of competing globally. Chile's wage advantage is eroding (although still much cheaper than in North America) and the only way to achieve greater and more efficient production is through greater mechanization.

Chilean sawmill operations are based almost exclusively (with the exception of some limited hardwood) on Radiata Pine, and this is not expected to change.

According to the figures presented earlier in this study, the new sawmill capacity to be installed in Chile during the 1990s will require an annual investment of approximately US\$25-million a year. At the same time, the modernization and refurbishment process will demand another investment of approximately another US\$8-million. In total, US\$33-million is expected to be invested annually in Chilean sawmill operations until the year 2000.

11.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services in Lumber Mills

Over the last 10 years, lumber output in Chile has increasingly come from the modern and medium-sized operations. The contributions of the small, outdated mills is declining in relative terms. The emergence of the modernized sawmills has meant an increasingly active role for foreign suppliers: locally produced equipment cannot cope with growing technical standards. Large sawmills often use engineering consultants to manage the design and procurement needs resulting from major expansions. The importance of these engineering groups is illustrated by the most recent and large sawmill project. The \$30-million expansion of MADEX facilities was done with German equipment, based on the recommendation of an American engineering group. Canadian equipment was not considered as the American firm was not familiar with Canadian suppliers.

While a knowledge of the local market is essential, modern equipment is crucial for international competitiveness. The growth and renewal expected in this industry should offer opportunities in the following areas:

Services

- sawmill feasibility studies.
- sawmill programming, design and engineering.
- sawmill management consulting.
- lumber marketing assistance.

Goods

- sawmill machinery and equipment, particularly in high-technology components.
- computerized production control systems.
- wood preservatives and anti-stain chemicals.

Canadian firms have come under criticism for a perceived lack of after-sales service. Chilean sawmill operators demand that their suppliers provide technical support, preferably using experienced personnel. Past experience of having technical repair instructions faxed to a sawmill, rather than hands-on attention, has harmed future sales efforts. Foreign suppliers, who are strong in this section, chiefly European (German, Italian) and American, maintain an active local presence as well as technical support. This often includes regularly scheduled maintenance visits to sites, and not just to service break-downs.

12. LUMBER REMANUFACTURING

Lumber remanufacturing is forcefully establishing itself as a significant branch of Chile's forest industry, despite only a short history. In its initial phase of development (ie, over the last 5 years), it uses both native hardwoods and Radiata Pine -- with various degrees of processing and economic success. Currently, some 90% of the total output of remanufactured lumber, around 140,000 m³/year, is based on Radiata Pine. The remaining 10% is derived from several native hardwoods suitable for furniture parts.

Both investment and output have been growing rapidly in recent years, mostly as a secondary stage of the sawmill industry, with which it has often been associated. Although future development is not easy to estimate confidently in this still nascent branch of the forest industry, it is clear it will be actively explored by several new ventures in the years to come. Once again, the lead will probably come from the large forestry groups outlined in Appendix III, especially the affiliates already engaged in wood processing.

The new focus on remanufacturing stems from the Chilean desire to move into higher value-added processing and will aim basically to find ways to make lumber production in Chile more profitable in a global market.

12.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services in Lumber Remanufacturing

Some 20 lumber remanufacturing mills, with a variety of capacities, are currently operating in Chile (*see Appendix III.5*). The largest operations have annual productions in the region of 40,000 m³, the smallest have about around 4,000 m³. Diversity is also found in mill design and origin of its machinery and equipment. Machinery has been imported from some 8 countries, such as Argentina, Brazil, Canada, Germany, Denmark and the USA, as yet with no recognized "traditional" supplier.

Under the conditions described above, Canadian suppliers would appear to have their best options in the following areas:

Services

- feasibility studies for lumber remanufacturing mills.
- planning and design of lumber remanufacturing operations.
- consultancy work on revamping and expansion of today's medium-sized lumber remanufacturing mills.

Goods

- machinery and equipment for lumber remanufacturing mills, including kiln-drying instruments and equipment.
- process control systems.
- spare parts and replacement machinery in existing mills.

13. PULP AND PAPER

As previously discussed, the pulp and paper industry is the largest segment of Chile's forest industry. It is also the one showing the best prospects for growth over the coming years. These facts are well known to Canadian consulting engineers and machinery and equipment suppliers, who have participated actively in the development of Chile's pulp and paper industry for over 20 years. **H.A. Simons Ltd.** of Vancouver was project leader in the construction of 2 of Chile's most modern pulp mills: **Arauco II** and **CELPAC**. The company coordinated the procurement plans for both of these projects worth, each worth over US\$600-million. The role of consulting engineers in completing procurement needs of forestry projects should not be underestimated. The Simons experience in the pulp and paper sector is mirrored in the sawmill sector (*see Section 10.1*) and shows that the consulting engineering group is a key decision-maker in the selection of equipment. Simons' familiarity with Canadian equipment, and that equipment's inherent quality, resulted in strong Canadian content in these 2 projects.

13.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services in the Pulp and Paper Industry

As indicated earlier, Chile's pulp and paper industry is oriented to the export market, and is based primarily on kraft pulp. Due to recent large investments, all the mills in this group are either new or revamped. Some 4 greenfield projects are expected to be in operation by the end of the decade, 3 in softwoods (Radiata Pine), as indicated in Section 5.2. Short-fibre pulps, **Eucalyptus**-based, are to be introduced into the production cycles of existing mills currently using Radiata Pine (*see Chapter 5*). Consequently, the areas of interest for Canadian suppliers seem to be the following:

Services

- engineering consulting for new mills and adaptation of some of the existing ones to operate on Eucalyptus rather than on Radiata Pine.

- engineering on process improvement for existing mills.

Goods

- machinery and equipment for new mills.
- machinery and equipment parts for the maintenance of existing operations.
- process control engineering, hardware and software to improve the efficiency of existing operations.

14. FOREST-FIRE FIGHTING

Over the last 20 years, Chile has developed a forest-fire fighting system that covers the central and central-south regions of the country. This system was produced through the joint efforts of the public and private sectors and primarily targets the protection of the pine and Eucalyptus plantations. As a secondary objective, this system offers a degree of protection to the natural brush formations of central Chile, as well as to the natural forests of the south. This focus on the plantation reflects the fact that the risk of fire is much smaller for natural forests than it is for plantations. However, experts in this area agree that the country needs to update its forest-fire fighting system to make it more rational and efficient.

14.1 Possible Areas of Interest for Canadian Suppliers of Goods and Services for Forest-fire Fighting

Although some Canadian suppliers have already been active in this field, the potential exists for more activity in the following areas:

Services

- **forest-fire** fighting planning and operations management, consulting and training.
- **forest-fire** fighting systems: design, revamping and implementation, consulting.

Goods

- **forest-fire** fighting equipment and tools including, detection and communication equipment plus specialized helicopters, planes and fire fighting chemicals, sprays and delivery systems.

15. ENVIRONMENTAL STUDIES

Following global trends, Chile has given considerable attention to the environmental topics related to its natural forests and its plantations. Yet, despite the ongoing debate, little has been done in the way of concrete studies to deal with the outstanding issues. This has not been the case with the environmental aspects of industrial development where timely action by the private sector in recent years has shown results and decreasing public opinion concern.

15.1 Possible Areas of Interest for Canadian Suppliers of Services in Environmental Studies

Under current Chilean conditions, the focus for environmental studies in the forestry sector should be on native forests and plantations. For native forests, the topics could include the impact of deforestation and how best to reforest harvested tropical species. With regard to plantations, the obvious topic appears to be the environmental impact of quick growing artificial forests on soils, flora and fauna.

16. ENGINEERING SERVICES

Generally speaking, Chilean engineering capabilities are sophisticated and mostly self-sufficient, except in highly specialized areas such as pulp and paper mill design. In this context, engineering services have been dealt with in connection to the various industrial branches of the forestry sector discussed earlier.

17. PEST CONTROL SERVICES

No substantial efforts have been required or applied in Chilean forestry for pest control. Chile's mixed natural forests, to date, have been spared any significant infestation and the plantation are sufficiently well managed that any pest is quickly identified, isolated and dealt with. As Chile then is essentially pest-free, business potential is decidedly limited. Technical exchanges between the Institut Forestal (INFOR) and Forestry Canada -- specifically, Pacific Research Centre in Victoria, mean that in any event of pest manifestation, Canada is well positioned to help out.

18. FORESTRY OPERATIONS SAFETY EQUIPMENT

Although not always the case, concern for safety is now wide spread in the Chilean forestry industry, in both forest operations and production operations. Three branches of the sector appear as the ones with most business potential for Canadian suppliers: logging operations, lumber sawmills and the pulp and paper industry. As well as these 3, other promising topics would be:

Services

- training and demonstration on safety procedures, practices and use of specialized equipment and tools.
- consultancy on the operation of a workman's compensation program.

Goods

- specialized safety equipment and tools.
- safety-oriented chemical products needed in industrial processes.
- administrative equipment associated with installation of reduced work-accident ratios programme and workman's compensation programme (eg, computer system).

APPENDIX I

AN OVERVIEW OF CHILE'S COMMERCIAL FOREST SPECIES

Very few of the forest species growing in Chile are commercially relevant. Only 2 (both transplanted) out of 25 native and introduced plantation species, make up over 90% of the wood cuttings harvested - *Pinus radiata* (Radiata Pine) and *Eucalyptus globulus* (Eucalyptus). In addition, a group of natural species belonging to the genus *Nothofagus*, are worth mentioning. Consequently, this Appendix includes 3 sections, 1 for each of the 2 exotic species and 1 for the genus *Nothofagus*.

1.1 Radiata Pine

A tree from the genus *Pinus* *Pinus D. Don* (syn. *P. insignis* Douglas), usually called Radiata or Monarch pine. It is native to a narrow coastal strip of southern California. The strip is 100 km wide and ranges from sea level to 2000 m elevation. Of negligible economic importance in the United States, it is popular as an ornamental in some regions, mainly in the Southern Hemisphere. Chile is one of the best examples. Radiata Pine grows quickly and has a high yield of good quality wood for many uses. It has been planted from 33° latitude South down on the coastal range, central valley and foothills of the Andes (see Appendix IV).

C: APPENDICES

In its native habitat, Radiata Pine ranges in height from 10 to over 35 m at maturity. The average is between 20 and 33 m. When fully grown, it can have a diameter from 60 to 120 cm and can reach 160 cm. The bole of isolated trees is very irregular, often leaning and twisted. In trees growing closely together, the bole may be 8 to 16 m out of a total height of 33 m. From the 3rd to the 15th year, the tree forms long internodes, 1 to 3 m long, giving knot-free lumber. It has a short life span, 80 to 100 years on good sites and less on poor ones.

1.1.1 Physical Properties of the Wood

The wood from the Radiata Pine can be described as follows:

Colour: Heartwood: light brown to pinkish brown, even; Sapwood: creamy white, with light brown latewood; Knots: light brown.

C: APPENDICES

APPENDIX I

AN OVERVIEW OF CHILE'S COMMERCIAL FOREST SPECIES

Very few of the forest species growing in Chile are commercially relevant. Only 2 (both transplanted) out of all exotic and industrial plantation species, make up over 90% of the wood currently harvested: *Pinus radiata* (Radiata Pine) and *Eucalyptus globulus* (Eucalyptus). In addition, a group of natural species belonging to the genus *Nothofagus*, are worth mentioning. Consequently, this Appendix includes 3 sections, 1 for each of the 2 exotic species and 1 for the genus *Nothofagus*.

I.1 Radiata Pine

A true pine, *Pinus Radiata* D. Don (syn. *P. insignis*, Douglas), usually called Radiata or Monterrey pine. It is native to some 3,000 ha of a narrow coastal strip of southern California. This strip is about 200 km long and 10 km wide and ranges from sea level to 350 m in elevation. Of negligible economic importance in the United States, it is popular as an exotic growth in some regions, mainly in the Southern Hemisphere. Chile is one of the best examples. Radiata Pine grows quickly and has a high yield of good quality wood for many uses. It has been planted from 33rd latitude South down on the coastal range, central valley and foothills of the Andes (see Appendix VI).

In its native habitat, Radiata Pine ranges in height from 10 to over 35 m at maturity. The average is between 20 and 33 m. When fully grown, it can have a diameter from 60 to 120 cm and can reach 160 cm. The bole of isolated trees is very irregular, often leaning and twisted. In trees growing closely together, the bole may be 8 to 16 m out of a total height of 33 m. From the 5th to the 15th year, the tree forms long internodes, 1 to 3 m long, giving knot-free lumber. It has a short life span, 80 to 100 years on good sites and less on poor ones.

I.1.1 Physical Properties of the Wood

The wood from the Radiata Pine can be described as follows:

Colour Heartwood: light brown to pinkish brown, even; Sapwood: creamy-white, with light brown latewood; Knots: light brown.

<i>Growth Rings</i>	Positive growth-ring figure due to gradual thickening of tracheid walls through the latewood, accompanied by deepening colour, contrasting with the lighter early wood.
<i>Resin Canals</i>	Vertical, mainly in latewood, prominent as brown lines on side grain surfaces.
<i>Grain</i>	Straight, except in core wood or juvenile wood (close to the pith).
<i>Figure</i>	Moderate growth-ring figure in flat-sawn timber; moderate to high lustre in sapwood.
<i>Texture</i>	Moderately even and fine.
<i>Odour</i>	Slightly resinous.
<i>Density</i>	There is an appreciable variation from the pith outwards towards the bark at any given level above the ground, and from ground level upward in the tree trunk, as well as between different trees. A rough average is a basic density of 420 kg/m ³ /green volume and oven-dry weight.
<i>Shrinkage</i>	Apart from juvenile and compression wood, Radiata Pine has a relative small shrinkage and good stability. Shrinkage from green to 12% moisture content: radial 2.5%; tangential 4.0%; longitudinal 0.2%; volumetric 6.5%.
<i>Mechanical Properties</i>	Strength properties, the same as density, show a considerable variation with age and distance to the pith. An average for small clear specimens is the following:

Physical Properties of the Wood

The wood from the Radiata Pine can be described as follows:

Heartwood: light brown to pinkish brown, even; sapwood: creamy white with light brown latewood; knots: light brown

Moisture Content

	<i>12% mc</i>	<i>Green</i>
Static Bending Strength:		
fibre stress at proportional limit, MPa	41	16
modulus of rupture, MPa	85	38
modulus of elasticity, GPa	8.1	5.5
work to proportional limit, MJ/m ³	0.015	0.004
work to maximum load, MJ/m ³	0.08	0.057
Compressive Strength:		
at proportional limit parallel to grain, MPa	26	11
at maximum load parallel to grain, MPa	36	15
at proportional limit perpendicular to grain, MPa	6.4	3.0
Shearing Strength:		
maximum parallel to grain, MPa	11.7	5.2
Hardness:		
load to imbed 11.2 mm diameter steel ball half its diameter		
N end	4,820	2,330
N side	3,360	2,340

*Working Stresses for Radiata Pine Structural Grades
According to Chilean Standard NCh 1198:
Allowable Stresses for Structural Timber, at 12% Moisture Content*

Working Stresses (in MPa)

Grade Name	Compression					
	Bending <i>F_b</i>	Tension Parallel to Grain <i>F_c</i>	Shear in Beams <i>F_s</i>	Perpend. to Grain <i>F_p</i>	Parallel to Grain <i>F_c</i>	% of Elasticity (MPa) <i>E</i>
GS	11.0	6.6	0.9	2.5	8.3	10,500
G1	7.5	4.5	0.7	2.5	5.6	9,000
G2	4.0	2.0	0.4	2.5	4.0	7,000

I.1.2 Main Uses for Radiata Pine

Products manufactured from Radiata logs include: sawn, finger-jointed and glue-laminated lumber; turnery, round lumber posts and poles; board products of plywood, particleboard and fibreboard; and pulp and paper products. Many of the lumber and round products are treated with preservatives to a durability rating exceeding the naturally durable species.

Sawn Lumber: This product of Radiata Pine has a wide variety of applications: clear lumber for joinery and furniture; appearance grades for flooring, panelling and furniture; structural lumber for construction packaging and industrial grades for use in packing fruit, vegetables, and machinery, and for cable drums and pallets; preservative treatment of structural lumber provides durability appropriate to the end-use.

Glue-laminated Lumber: Its excellent gluing properties allow efficient structural finger-joints to be made in laminates that are assembled into glue-laminated beams. These beams are used in large structures and have the advantage, over other materials, of appearance, durability, structural performance, fire resistance and overall economy.

Plywood and Panel Products: Rotary-peeled veneer is assembled into plywood for construction, concrete formwork and other uses. Sliced veneer is priced for furniture. Particle and fibreboard are extensively used in furniture and construction.

Round Produce: Preservative-treated posts and poles are used extensively in agriculture, horticulture and buildings. Pile foundations and pole-framed construction withstand high wind and earthquake forces, meaning that houses can be built economically on sloping sites.

Pulp and Paper: Radiata Pine produces the raw material for a large range of pulp and paper products. Chemical and mechanical pulping produce pulps for fine tissues, writing, printing and packaging papers, magazine, newsprint and paper boards.

I.1.3 Summary

Radiata Pine grows fast and has a high yield. The properties of this wood, such as its even texture, moderate density, tracheid length and ease of processing and preservative treatment have established Radiata Pine as one of the most versatile species of the world. It is equally valued for its role in major engineering building structures, house construction, joinery, fencing, horticultural support structures, packaging, decorative veneer, furniture and pulp and paper products.

I.2 Eucalyptus Globulus Labill

The Eucalyptus tree is native to Australia and several species have been successfully introduced into Chile. The most common species of this genus in Chile is *Eucalyptus globulus*. On good sites it has a yield comparable to that of the Radiata Pine, around 28 m³/ha/year. Eucalyptus wood is pale brown with yellowish or pinkish tints. There is no noticeable difference between sapwood and heartwood. Positive growth rings figure, curly appearance somewhat frequent. The wood is very hard, heavy and of medium natural durability.

There is growing interest in planting Eucalyptus in Chile and there could be about 300,000 ha planted by the end of this century. The stand will be mainly of *E. globulus*, as well as *E. viminalis*, *E. regnans* and *E. delegatensis*.

I.2.1 Geographic Distribution

Eucalyptus trees are grown successfully along the coast from Aconcagua Province to Puerto Montt. It grows well on good sites, ranging from sea level to 500 m above sea level and in areas without severe frosts.

I.2.2 Characteristics

The height of a Eucalyptus tree, at maturity, is over 50 m and its diameter at breast height can average 80 to 100 cm. The bole is straight and cylindrical, even in rather isolated trees. It is clear of branches for much of its height. The bark of mature trees is light brown and fibrous consistency that presents difficulties in mechanical debarking and hogging.

I.2.3 Wood Properties

The wood is heavy, with a basic density of 720 kg/m³. It has a high shrinkage with changes in moisture content. From green to a moisture content of 12% the shrinkage is: radial 3.6%; tangential 7.3%; and volumetric 10.8%. It is prone to collapse during the drying process. Mechanical properties derived from tests of small clear specimens at 12% mc follow:

12% mc

Basic Density: 720 kg/m³**Static Bending Strength:**

fibre stress at proportional limit, MPa	76.0
modulus of rupture, MPa	117.0
modulus of elasticity, GPa	15.7

Compression Strength:

at proportional limit parallel to grain, MPa	56.0
at maximum load parallel to grain, MPa	68.0
at proportional limit perpendicular to grain, MPa	11.8

Shearing Strength:

maximum parallel to grain, MPa	12.7
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Hardness:

N end	7,306.0
N side	6,864.0

The natural durability of the untreated wood ranges from 5 to 15 years in exterior applications and soil contact. The wood has a low permeability and is considered unsuitable for commercial pressure treatment due to the low absorption rate and penetration of preservatives.

Drying of wood from the *E. globulus* species does present some problems. The normal procedure is to air-dry the wood for 1 year and then kiln-dry to the desired moisture content. Kiln-drying from the green lumber must be done very carefully to avoid severe collapse and honeycomb. It is recommended that logs be sawed radially to produce quartersawed lumber, which is less likely to degrade during the drying process.

1.2.4 Uses

Because of its strong mechanical properties *E. globulus* wood is used in heavy structures, pit props and railroad ties. Because of its elasticity, it is used in tool handles; because of its hardness it is used in flooring and parquet; and its appearance means it can be used in decorative panelling and veneers. It is also used in furniture because of its strength and appearance. Its high yield and fibre quality means this wood can be used in the manufacture of chemical pulp for writing papers.

1.2.5 Limitations

Growing Eucalyptus on a large scale may bring the sanitary problems present in other regions where it is grown as an exotic species. Being resistant to pressure treatment and not having a good natural durability limits its uses.

1.3 Genus Nothofagus (Southern Beeches)

The Nothofagus genus is spread throughout the indigenous Chilean forest, and some species have significant commercial value. The most important are: Coigüe (*N. dombeyi*), Roble (*N. obliqua*), Raulí (*N. alpina*) and Lenga (*N. pumilio*). Species of lesser importance are: Coigüe de Magallanes (*N. betuloides*), Coigüe de Chiloé (*N. nitida*), Ñirre (*N. antarctica*), Hualo (*N. glauca*) and Ruil (*N. alessandri*).

1.3.1 Coigüe

Tree Characteristics: Coigüe is the most abundant species in the forests of southern Chile. It has simple alternate leaves with lanceolate to oval lanceolate shapes. In some trees the leaves acquire a leaden-silver colour. The bark is grey, thin and has long longitudinal fissures that form narrow plates. It is the biggest broad leaved tree in the Chilean forest, with mature trees reaching a height of 50 m and a diameter of 4 m or more at breast height. The tree's stump can sometimes form large buttresses.

Coigüe is not deciduous and keeps its foliage year round. It has a straight cylindrical bole clear of branches up to a considerable height. The crown has a very distinctive stratified or terraced appearance making it easy to distinguish.

Geographic Distribution: It inhabits moderately wet environments between Colchagua in the Los Andes range and south of Aysén, in pure stands, or mixed with other trees common to its geographical distribution. It ranges from sea level up to almost as high as vegetation can grow on the mountains.

Wood Properties: The colour of the wood is light brown with thin bands of a pinkish, greenish and yellowish hue. The grain is homogenous and fine-textured.

The wood is considered medium heavy, with a basic density of 600 kg/m³. It has a high shrinkage rate with changes in moisture content. From green lumber to 12% mc, the shrinkage rate is: radial 4.8%, tangential 5.9%, and volumetric 8.7%. Coigüe is prone to collapse and honeycomb when it is being dried. Its mechanical properties are shown in Table 2.

Its natural durability ranges from medium to low. The wood is impervious and not

suitable for commercial pressure treatment processes because of a low adsorption rate and penetration of preservatives.

Drying coigüe can present special difficulties. Kiln-drying from green lumber is seldom accomplished because of severe degradation that usually takes the form of collapse and honeycomb. The practical drying procedure is to air-dry for 1 to 2 years, to a moisture content of 15-25%. The wood is then kiln-dried, on a moderate schedule and at low temperatures: 40 to 60° and relative humidity of the kiln: 80-50%. Logs are recommended to be sawn radially producing quartersawed lumber which is less likely to degrade during the drying process.

Uses: Coigüe is adequate for structural purposes, flooring, sidings, furniture, packaging, cooperage, tool handles, railroad ties, boat construction, plywood and decorative veneers, toys, and as raw material for chemical pulp (short fibre).

I.3.2 Roble

Tree Characteristics: This deciduous tree has simple alternate leaves, with an oval and asymmetrical shape and with doubly serrated margin. It can reach heights of up to 40 m and diameters of 2 m in mature trees. In the southern part of its range, it can grow alone or in association with Laurel, Raulí and Lingue.

Geographic Distribution: Roble is found in the Andes, the coastal range and in the Central Valley from Bío-Bío to Puerto Montt. It is found in deep moist soils up to altitudes of 600 m above sea level.

Wood Properties: The heartwood is reddish brown and the sapwood is whitish. The wood is fine-textured with homogeneous grain and medium heavy, with a basic density of 550 kg/m³. It has a moderate shrinkage with changes in moisture content. From green lumber to 12% mc the shrinkage rate is: radial 2.2%, tangential 5.3%, and volumetric 6.0%.

Its mechanical properties are shown in Table 2. The natural durability of Pellín of the heartwood of Roble is very high.

Uses: Roble, because of its high natural durability and mechanical properties, is used in all kinds of **structures**, including those in marine conditions. Other uses include shingles, boat construction, **railroad ties**, fencing, piling, pit props, plywood, veneers and raw material for **chemical pulp**.

I.3.3 Raulí

Tree Characteristics: This deciduous tree has simple alternate leaves, with oval to oval-elliptical shape, with an even serrated margin and regularly marked nerves. Raulí has a straight cylindrical bole that is as much as 40 m high and 2 m in diameter in mature trees. A large portion of the bole is free of branches. The specie can form pure stands and also occurs in mixtures with Roble, Coigüe, Mañío, Ulmo and Tapa.

Geographic Distribution: Raulí grows between Curicó in the Andes range and Lago Ranco, but it is especially important in both ranges, from Malleco to Valdivia, forming pure stands of new growth. Its latitudinal distribution is from 200 to 800 m above sea level.

Wood Properties: The heartwood of Raulí is uniformly brown or pale pink in colour and the sapwood has a somewhat lighter pink tone. The growth rings are not very distinguishable and the grain is smooth, fine-textured and homogeneous. Its basic density is 520 kg/m³, with a low shrinkage. From green lumber to 12% mc the shrinkage rate is: radial 1.7%, tangencial 3.3%, and volumetric 7.2%. Its mechanical properties are shown in Table 2. Raulí has a moderate natural durability and can be easily kiln-dried.

Uses: Raulí is one of the most valuable species of Chile's indigenous forest. Consequently, considerable attention is now being directed towards its management, especially new growth. This interest has been further stimulated by the fact that young pure stands react well to silviculture. These growths can be harvested in 60 years or less.

The wood is in demand on the domestic and international markets for its dimensional stability, easy drying, sawing and planing, attractive finish, excellent results in gluing, burnishing and painting.

The most common uses are: millwork, floors, parquet, doors, windows, shingles, furniture, cooperage, boat building, cigar boxes, carvings, toys, plywood, veneers and raw material for mechanical pulp.

I.3.4 Lenga

Tree Characteristics: This tree has simple alternate leaves, with an oval shape, crenulated and parallel nerves. Each pair of nerves encloses 2 dark green lobes. The leaves are deciduous and turn red in autumn before falling. A tree can grow to between 15 to 30 m high, depending on where it grows, and can have a diameter of over 1 m. It has a stratified branching structure like the Coigüe.

Geographic Distribution: Lenga grows between Ñuble in central Chile, in the Andes mountains, and Tierra del Fuego, in the extreme south. It is especially abundant in the high mountains and in Coyhaique and Magallanes, where it generally grows in pure stands.

Wood Properties: Lenga wood is light brown with shades of yellow and pink. Sapwood is lighter in colour. Growth rings are visible, and the grain is smooth and fine-textured. Its basic density is 520 kg/m³ and has a low shrinkage. From green lumber to 12% mc, the shrinkage rate is: radial 1.9%, tangencial 3.8%, and volumetric 5.8%. The wood's mechanical properties are shown in Table 2. Lenga has a moderate natural durability. Kiln drying is moderately difficult and can be accomplished with well-trained operators and adequate drying kilns.

Uses: Lenga is considered a very valuable forest resource, because it is readily available and its properties are very similar to Raulí which can be advantageously replaced by Lenga. The most common uses are exterior and interior facing, doors, windows, flooring, shingles, furniture, veneers and raw material for chemical pulp.

Table 2

Nothofagus: Mechanical properties derived from tests of small clear specimens at 12% moisture content

	<i>Coigüe</i>	<i>Roble</i>	<i>Raulí</i>	<i>Lenga</i>
Static Bending Strength				
fibre stress at proportional limit, MPa	50.0	63.0	51.0	45.0
modulus of rupture, MPa	76.0	83.0	77.0	46.0
modulus of elasticity, MPa	10.2	12.1	9.9	9.9
Compressive Strength				
at proportional limit parallel to grain, MPa	24.0	33.0	31.0	26.0
at maximum load parallel to grain, MPa	44.0	46.0	45.0	42.0
at proportional limit perpendicular to grain, MPa	8.8	7.8	8.3	7.0
Shearing Strength				
maximum parallel to grain, MPa	10.7	11.8	10.9	10.1
Hardness				
N side	4305.0	4952.0	4952.0	5217.0
N end	4050.0	4560.0	4069.0	3560.0

APPENDIX II

RELEVANT ORGANIZATIONS IN THE CHILEAN FORESTRY SECTOR AND THEIR ROLES

1. **ATCP Chile:** Asociación Técnica de la Celulosa y el Papel de Chile
(Chilean Pulp and Paper Association)

Address: Lincoyán 199, Piso 2
Concepción
Telephone: 56-41-237679

ATCP Chile is a professional private association, created in 1974, and comprises of the engineers and technicians of the pulp and paper industry.

2. **CIPMA:** Centro de Investigación de Problemas del Medio Ambiente
(Centre for Environmental Studies)

Address: Av. Holanda 1515
Santiago
Telephone: 56-2-2749600
Fax: 56-2-2232028

CIPMA is a private non-profit organization dedicated to studying Chile's environmental problems.

3. **CONAF:** Corporación Nacional Forestal
(Chilean Forestry Corporation)

Address: Av. Bulnes 285
Santiago
Telephone: 56-2-6966749
Fax: 56-2-715881

CONAF is the section of the Ministry of Agriculture in charge of forestry. Its fundamental objective is to contribute to the preservation, growth, management and exploitation of the country's forest resources for the purpose of supporting the forestry development along with the protection of the forest and its environment.

4. **CORMA:** **Corporación Chilena de la Madera**
(Chilean Wood Association)

Address: Agustinas 814 Of. 407, Casilla 914
Santiago
Telephone: 56-2-384184
Fax: 56-2-397485

CORMA is a private association, created in 1952, which gathers most of the foresters, producers, exporters and technicians of the forestry sector. CORMA has regional committees in the 7th, 8th, 9th and 10th regions of Chile, covering most of the forest resources and forest activities in the country.

5. **ASIMAD:** **Asociación de Industriales de la Madera**
(Industrial Association of Wood-Based Products)

Address: Obispo Donoso 5, Of. 61
Santiago
Telephone: 56-2-2748707
Fax: 56-2-274870

ASIMAD was created in 1937. Its main objective is to promote the improvement, development and protection of the wood-based industry in Chile.

6. **APT:** **Asociación de Productores de Tableros Contrachapados**
(Plywood Producers Association)

Address: Agustinas 853, Of. 507
Santiago
Telephone: 56-2-332567

APT is a newly-formed trade association for plywood producers. Its objective is to promote common production standards, product use and to represent the industry to other private and public institutions.

7. **Fundacion Chile**

Address: Av. Parque Antonio Rabat Sur 6165, Casilla 773
Santiago
Telephone: 56-2-2185211
Fax: 56-2-2420900

Fundación Chile is a private non-profit technology transfer organization, created in 1976. Its main objective is to bring to Chile those technologies which can optimize the nation's natural resources and productive capacity.

8. **Colegio de Ingenieros Forestales**
(Professional Foresters Association)

Address: San Isidro 22, Of. 503, Casilla 9686
Santiago
Telephone: 56-2-393286

This association gathers university-trained foresters, with the objective of keeping good professional standards, discuss and propose policies concerning forestry and promote professional activity.

9. **INFOR: Instituto Forestal**
(Forest Research Institute)

Address: Huérfanos 554, Casilla 3085, Correo Central
Santiago
Telephone: 56-2-397911
Fax: 56-2-381286

INFOR is a state institution intended to play an active role in developing forestry activities in Chile. This is done through its research programmes in silviculture, forest management, forest economics, wood technology and also through technology transfer. One important activity is the compilation and analysis of the data related to the forest activity in the country, including domestic and international markets, to provide useful information to foresters, companies and government.

10. **CIREN-CORFO: Centro de Investigación de Recursos Naturales
(Natural Resources Research Centre)**

Address: Av. Manuel Montt 1164, Casilla 14995
Santiago
Telephone: 56-2-2749669
Fax: 56-2-496407

CIREN-CORFO collects and analyzes information pertaining natural resources: land use, vegetation cover, forest types, etc. It is owned by the government but provides services primarily to the private sector.

APPENDIX III

LIST OF MAJOR CORPORATE ENTITIES IN THE FORESTRY SECTOR

The list presented below includes 5 subsectors and within them 2 or 3 classes, based on size, according to the existing range. In Chilean forestry it is often the case that big or medium-sized companies are involved in several subsectors. As a result, the same names appear several times in an arrangement such as is being one used here. The 4 subsectors detailed below are: forest owners, sawmill operators, wood-based panel producers and the pulp and paper firms. Yet, before dealing with these subsectors separately, an introductory section will identify the 6 largest corporations with activities in more than one area.

1. **Compañía Manufacturera de Papeles y Cartones S.A. (CMPC)**

The oldest and most important corporation in the Chilean forestry sector, CMPC owns 3 pulp and paper mills -- Laja, Puente Alto and Valdivia -- large forest holdings -- Forestal Mininco -- sawmills, remanufacturing mills and several paper converting facilities. Although widely diversified its main products are: logs, lumber, kraft pulp and papers (industrial, writing, printing and tissues). Immediate expansion plans include US\$32-million for modernizations of its 2 existing sawmills (Mininco and MADEX) and the construction of 3rd one, as well as another US\$28-million for its plantation and harvesting operations (Forestal Rio Vergara).

In addition to the operations indicated above, CMPC has a controlling interest in 2 other corporations: Industrias Forestales S.A. (INFORSA) and Celulosa del Pacífico S.A. (CELPAC) to be covered in the following sections.

Although the shares of CMPC are dispersed among several hundred owners, 2 generations of a single family control and manage the business.

CMPC and its fully owned subsidiaries produce annually around:

- 2.5-million m³ of round wood;
- 230,000 m³ of lumber;
- 300,000 mt of kraft pulp; and,
- 350,000 mt of papers and boards.

2. **Celulosa del Pacífico S.A. (CELPAC)**

A newly-formed corporation, CELPAC owns and operates a recently inaugurated kraft pulp mill designed to have an annual capacity of 315,000 mt of bleached pulp. This state-of-the-art unit is expected to reach capacity output by the end of 1993, and is located in a town called Miminco.

This corporation's owners are CMPC and Simpson Lumber Co. of the USA.

3. **Industrias Forestales S.A. (INFORSA)**

This corporation, an veteran of the forestry industry, boasts CMPC as its controlling shareholder. The rest of the shares are widely dispersed among several hundred owners.

INFORSA's basic product is newsprint -- 120,000 mt/year -- processed in an integrated operation of mechanical and sulphite pulps. The mill has recently been revamped to make it a modern operation. As well as newsprint, INFORSA operates a sawmill with an output of 120,000 m³/year and a plantation estate of around 130,000 ha primarily in Radiata Pine.

4. **Celulosa Arauco and Constitución S.A. (Arauco)**

With kraft pulp as its basic product, this corporation has 3 mills -- Arauco I, Arauco II and Constitución -- with a rated total capacity of some 800,000 mt/year. In addition, it operates 6 sawmills producing around 240,000 m³/year and a vast estate of forest plantations totalling over 250,000 ha, growing mainly Radiata Pine. All 3 kraft pulp mills are either new or have been recently renovated.

Although part of the company's stock is in the hands of many shareholders, the corporation is controlled by 2 majority shareholders, Anacleto Angelini, a Chilean entrepreneur, and the Carter Holt company of New Zealand.

5. **Forestal e Industrial Santa Fe S.A. (Santa Fe)**

A newly established company, Santa Fe, is owned by 3 foreign corporations: Shell International (50%); and 2 American companies, Scott Paper (25%) and Citicorp (25%). On the industrial side, Santa Fe operates a 240,000 mt/year kraft pulp mill using Eucalyptus pulpwood as its raw material and has a plantation estate of some 35,000 ha growing mainly *E. globulus* and *E. mitens*.

6. **Tasman Chile S.A. (Tasman)**

Fully owned by Fletcher Challenge of New Zealand, this corporation runs a newsprint mill recently revamped to a capacity of about 100,000 mt/year and has an estate of some 40,000 ha of Radiata Pine plantations.

III.1 Forest Owners

III.1.1 Large Companies

1. **Bosques Arauco Ltda.**, plantation ownership: 118,262 ha
2. **Forestal Celco Ltda.**, plantation ownership: 75,856 ha
3. **Forestal Valdivia S.A.**, plantation ownership: 58,075 ha

All 4 (?) are subsidiaries of Celulosa Arauco y Constitución S.A. with the following head office address:

Agustinas 1070, Piso 6, Casilla 880
Santiago
Telephone: 56-2-6981961
Fax: 56-2-6985967

Consequently, this corporation owns some 150,000 (?) ha of plantations, growing mainly Radiata Pine. The subsidiaries operate under one central management although they are part of different "cost centres" and have some operational autonomy.

5. **Forestal Mininco S.A., Forestal Rio Vergara**

This company is a subsidiary of Compañía Manufacturera de Papeles y Cartones S.A. with head office at:

Agustinas 1343, Piso 4
Santiago
Telephone: 56-2-6981941
Fax: 56-2-711957

It owns around 85,000 ha of plantations, mostly Radiata Pine.

6. **Forestal Cercex S.A., Forestal Rio Vergara**

Both subsidiaries of Industrias Forestales S.A., they have head offices at:

Agustinas 1350, Piso 7
Santiago
Telephone: 56-2-6954477
Fax: 56-2-6954477

These corporations own around 85,000 ha of plantations, mostly of Radiata Pine and are centrally managed from Forestal Mininco S.A.

7. **Forestal Bío-Bío S.A.**

A subsidiary of Papeles Bío-Bío, its head office is at:

Pedro Aguirre Cerda 1054, San Pedro
Concepción
Telephone: 56-41-371229
Fax: 56-41-371090

This corporation owns around 40,000 ha of plantations, mostly in Radiata Pine.

8. **Forestal Colcura S.A.**

9. **Forestal Monte Aguila**

Both are subsidiaries of Forestal e Industrial Santa Fé S.A., with head offices at:

Marchant Pereira 10, Piso 18
Santiago
Telephone: 56-2-2316616
Fax: 56-2-2316614

These corporations own around 35,000 ha of plantations, mostly Eucalyptus.

10. **Forestal Cholguán S.A.**

A subsidiary of Maderas Prensadas Cholguán S.A., its head office is at:

Estado 337, Piso 2
Santiago
Telephone: 56-2-395097
Fax: 56-2-332676

This corporation owns around 50,000 ha of plantations, mostly Radiata Pine, and is controlled by Anacleto Angelini, a Chilean entrepreneur.

11. **Bosques Chile S.A.**

This company is a subsidiary of Aserraderos Copihue S.A., and with head offices at:

11 de Septiembre 2155, Piso 14
Santiago
Telephone: 56-2-2326681
Fax: 56-2-2311903

This corporation owns around 30,000 ha of plantations, mostly Radiata Pine, and is jointly owned by Shell Chile (55%) and Citicorp of the USA (45%).

III.1.2 **Medium and Small Companies with Plantation Estates of Less Than 30,000 hectares**

12. **Forestal Tornagaleones**

This company is a subsidiary of Maderas y Sintéticos S.A. (MASISA) with head offices at:

Exposición 1258
Santiago
Telephone: 56-2-6837202
Fax: 56-2-6836398

MASISA is owned by the Pathfinder Group of the UK.

13. **Forestal San José**

This company has head offices at:

Monseñor Sótero Sanz 27
Santiago
Telephone: 56-2-2333411
Fax: 56-2-2319038

This corporation is owned by Inv. Hartwig S.A., a Chilean investment company.

14. **Forestal Cementos Bío-Bío S.A.**

This head offices for this company are at:

Camino Concepción-Coronel Km 11
Telephone: 56-41-371726
Fax: 56-41-374234

This corporation is owned by a cement factory which is controlled by Chilean shareholders.

15. **Forestal Millalemu S.A.**

This company is a subsidiary of Aserraderos Andinos S.A. and has a head office at:

Huérfanos 669, Piso 6
Santiago
Telephone: 56-2-6322322
Fax: 56-2-337082

This operation is owned by Cia. de Acero del Pacífico S.A. (CAP), a steel mill owned by several Chilean and foreign corporations.

16. **Maderera Río Itata S.A.**

The offices for this company are located at:

Camino Coelemu-Quirihue Km 3
Telephone: 56-42-511461
Fax: 56-42-511462

This is a family-owned operation and is controlled by Roberto Izquierdo.

17. **Universidad Austral de Chile**

This company has offices at:

Pedro Aguirre Cerda 2001
Valdivia
Telephone: 56-63-216185
Fax: 56-63-216964

The owner is a local private university, Universidad Austral de Valdivia.

III.2 Sawmill Operators

The following list excludes small sawmills not relevant to this study: many do not even have a stable address or telephone number. As a result, only large- and medium-sized operations are considered.

III.2.1 Large Sawmill Operations

1. **Aserraderos Andinos S.A.**

This mill is completely owned by CAP (100%). It has offices at:

Huérfanos 669, Piso 6
Santiago
Telephone: 56-2-6322322
Fax: 56-2-6337082

Product(s): Lumber, millwork, furniture

Capacity: Sawmill: 100,000 m³/year
 Millwork and furniture: 20,000 m³/year
Market(s): USA, Middle East, Europe
Equipment: Sawmill, Canalli (Germany), Indumet (Chile), Hildebrand, The Taylor (USA)
Operating: 14 years
Expansion Plans: Not disclosed

2. Aserraderos Arauco

Six mills, both sawmills and millworks, are operated by 1 corporation. Detailed information on each of the units is not available, except for output which are given in the following table.

One operation is new, El Colorado. The rest have been established for several years. El Colorado has basically German equipment (Linck).

Celulosa Arauco and Constitución S.A. is the owner of these mills (100%).

	<i>Annual Lumber Output</i> (m ³)
El Colorado	70,000
Escuadrón	55,000
La Araucana	35,000
Pilpilco	30,000
Maiteneo	30,000
Colico	<u>20,000</u>
TOTAL	240,000

3. **Aserraderos Copihue S.A.**

This company is owned by Shell Chile (55%) and Citicorp of the USA (45%). It has offices at:

Av. 11 de Septiembre 2155, Piso 14
Santiago
Telephone: 56-2-2326681
Fax: 56-2-2311903

Product(s): Lumber, millwork, furniture components, treated lumber and roundwood, logs, chips and pulp wood.

Capacity: Sawmill: 120,000 m³/year
Millwork: 20,000 m³/year
Furniture components: 10,000 m³/year

Market(s): Middle East, Japan, Europe, Argentina, local

Equipment: Sawmill: Frick, Schurmann, (USA)
Kilns: Bollmann (Germany), Moore (USA)
Components: USA, Italy, Brazil

Operating: About 15 years

Expansion Plans: None

Note: This company is currently up for sale

4. **Aserraderos Mininco S.A.**

Completely owned by CMPC (100%), this company has offices at:

Agustinas 1343, Piso 4
Santiago
Telephone: 56-2-698194

Product(s): Lumber

Capacity: 100,000 m³

Market(s): Middle East, Japan

Equipment: Linck (Germany) Ari (Sweden)

Operating: 8 years

Expansion Plans: Replacement of equipment in 1993-1994
Construction of new mill in 1993-1994

5. **Forestal Carampangue S.A.**

This company is owned by a French entrepreneur, M. Porte. Its offices are at:

Estado 10, Piso 14
Santiago
Telephone: 56-2-633968
Fax: 56-2-711957

Product(s): Lumber

Capacity: 150,000 m³/year

Market(s): Middle East, Japan, Europe

Equipment: Linck (Germany)

Operating: 15 years

Expansion Plans: None

6. **Maderas Nacimiento S.A. (MADEX)**

It is a completely owned subsidiary of Industrias Forestales S.A. (INFORSA) with head office at:

Estado 10, Piso 14
Santiago
Telephone: 56-2-633968
Fax: 56-2-711957

Product(s): Lumber

Capacity: 150,000 m³/year

Market(s): Middle East, Japan, Europe

Equipment: Kockumns, Dennis, Linck (Canada, Germany)

Operating: 15 years

Expansion Plans: Partial replacement of equipment

III.2.2 Medium-sized Sawmills

7. Aserraderos Aragón S.A.

This company is a subsidiary of Maderas y Sintéticos S.A. and has head offices at:

Exposición 1258
Santiago
Telephone: 56-2-6837202
Fax: 56-2-6836398

Product(s): Lumber, millwork

Capacity: 20,000 m³/year

Market(s): Argentina, local

Equipment: Premultini (Italy), Weinig (Germany)

Operating: 2 years

Expansion Plans: None

8. Aserraderos Cemento Bío-Bío S.A.

The owner of this company is Cementos Bío-Bío S.A., and the head office is at:

Camino Concepción-Coronel Km 11
Telephone: 56-41-371726
Fax: 56-41-374234

Product(s): Lumber

Capacity: 80,000 m³/year

Market(s): Middle East, Japan, Europe, local
Equipment: Linck (Germany), multiple circular saws and chipper canter
Operating: About 14 years
Expansion Plans: None

9. **Aserraderos Cholguán S.A.**

The owner of this company is Anacleto Angelini, a Chilean entrepreneur. The company has offices at:

Estado 337, Piso 2
Santiago
Telephone: 56-2-6395097

Product(s): Lumber, dimension stock
Capacity: 40,000 m³/year
Market(s): Local, Korea, the Netherlands, Germany, USA
Equipment: Chipper canter and multiple circular saws (Germany)
Operating: 12 years
Expansion Plans: In panels and millwork

10. **Agrícola y Forestal Casagrande Ltda.**

The owners of this company is the Casagrande family. Company headquarters for the company are:

Av. Recabarren 03160
Temuco
Telephone: 56-45-250004
Fax: 56-45-250005

Product(s): Lumber, dimension stock, finish furniture
Capacity: 15,000 m³/year

Market(s): Furniture: USA, Europe
Lumber: local

Equipment: Sawmill (Chile), remanufacturing plant (USA, Italy, Chile)

Operating: About 5 years

11. **Aserradero San Vicente S.A.**

The owner of this company is IMASA, a Spanish corporation. The offices are located at:

Av. Gran Bretaña 4793
Talcahuano
Telephone: 56-41-411934
Fax: (3641) 411115

Product(s): Lumber

Capacity: 80,000 m³/year

Market(s): Middle East, Korea, Japan

Equipment: Chipper canter, multiple circular saws, Linck (Germany)

Operating: About 12 years

Expansion Plans: None

12. **Aserradero Vista Alegre Ltda.**

The owner of this company is Universidad Austral, a regional university in Valdivia. The company's headquarters are at:

Av. Pedro Aguirre Cerda 2001
Valdivia
Telephone: 56-63-216185
Fax: 56-63-216964

Product(s): Lumber, millwork

Capacity: 20,000 m³/year
Market(s): Middle East, Japan, local
Equipment: Frame saw, Linck (Germany)
Operating: About 16 years
Expansion Plans: None

13. **Central Maderera**

The owner of this company is a family in the Curicó area. The offices are at:

Av. Alessandri 2102
Curicó
Telephone: 56-75-311327

Product(s): Fruit crate components
Capacity: 30,000 m³/year
Market(s): Local
Equipment: Band resaw, cut off saws, lathe (Chile, Spain, Italy)
Operating: About 12 years
Expansion Plans: None

14. **Forestal Tromen S.A.**

The offices for this company are located at:

Parque Industrial Escuadrón, sitio 6
Coronel
Telephone: 56-41-712043
Fax: 56-41-712044

Product(s): Lumber
Capacity: 30,000 m³/year

Market(s): Japan, Middle East
Equipment: Band saw and carriage, multiple circular saws (Brazil)
Operating: About 8 years
Expansion Plans: None

15. **Maderas Río Itata S.A.**

The owner of this company is Chilean entrepreneur Roberto Izquierdo. The company's headquarters are at:

Camino Coelemu-Quirihue Km 3
Telephone: 56-42-511461
Fax: 56-42-511462

Product(s): Lumber, dimension stock
Capacity: 30,000 m³/year
Market(s): Local, Middle East, Europe, Japan
Equipment: Sawmill: Ari (Sweden), Components (Germany)
Operating: About 4 years
Expansion Plans: In remanufacturing plant

16. **Industrias Fourcade S.A.**

Marcelo Fourcade is the owner of this company, which has its head office at:

Manuel Montt 850, Piso 2
Temuco
Telephone: 56-45-210189
Fax: 56-45-367077

Product(s): Lumber, dimension stock, finished furniture
Capacity: 40,000 m³/year

Market(s): Local, USA, Europe
Furniture (USA, Italy, Germany)

Equipment: Band saw and carriage, band resaw (USA, Chile)

Operating: About 18 years

Expansion Plans: None

17. **Sociedad de Industrias Madereras S.A.**

The owner of this company has not been disclosed. Its offices are at:

Longitudinal Sur Km 461
Los Angeles
Telephone: 56-41-295050
Fax: 56-41-295050

Product(s): Plywood

Capacity: 8,000 m³/year

Market(s): Local (for fruit crates)

Equipment: Lathe, press, clippers (Spain)

Operating: About 3 years

Expansion Plans: None

III.3 Wood-based Panel Producers

The number of companies operating in this area is small. However, for convenience's sake, they will be divided into 4 groups based on the types of panels: fibreboard, plywood, chipboard and MDF. Some companies produce more than 1 type of panel.

III.3.1 Fibreboard

1. Maderas Prensadas Cholguán S.A.

The company's owner is Chilean entrepreneur Anacleto Angelini. Its headquarters are at:

Estado 337, Piso 2
Santiago
Telephone: 56-2-395097
Fax: 56-2-332676

Product(s): Fibreboard
Capacity: 60,000 m³/year
Market(s): Local, Europe, Asia, USA
Equipment: Sunds Defibrator (Sweden)
Operating: Over 20 years
Expansion Plans: None

III.3.2 Plywood

2. Bosques y Maderas S.A. (MASISA)

A British company, known as the Pathfinder Group, owns this company, with offices at:

Av. 11 de Septiembre 1480, Piso 12
Santiago
Telephone: 56-2-2352880
Fax: 56-2-497613

Product(s): Plywood
Capacity: 8,000 m³/year
Market(s): Local and export to Europe, USA, Argentina, Venezuela
Equipment: Finland, Italy, Brazil and Japan

Operating: About 20 years

Expansion Plans: Phenolic- and melamine-coated plywood

3. **Emasil S.A.**

A local family owns this company, which has offices at:

Pedro Aguirre Cerda 1551

Valdivia

Telephone: 56-63-216263

Fax: 56-63-216165

Product(s): Plywood, doors, blockboard

Capacity: 25,000 m³/year

Market(s): Local, Europe, Mexico, USA

Equipment: Lathe R F R (Germany) and (Brazil) Press OTT (Germany), Clippers (USA), Driers Omeco (Brazil)

Operating: Over 20 years

Expansion Plans: None - the company has recently expanded

4. **Infodema S.A.**

This company is owned by a local family, and it has offices at:

Av. España 1000

Valdivia

Telephone: 56-63-216151

Fax: 56-63-216961

Product(s): Plywood, veneer, dimension stock, furniture components

Capacity: 30,000 m³/year

Market(s): Local, USA, Germany, Venezuela, Australia

Equipment: Italy, Germany

Operating: Over 20 years

Expansion Plans: None

5. **Maderas y Sintéticos S.A.**

The owner of this company is the Pathfinder Group, based in the UK. The company has offices at:

Exposición 1258
Santiago
Telephone: 56-2-6837202
Fax: 56-2-6836398

Product(s): Particle board, doors, plywood

Capacity: 280,000 m³ particle board
650,000 m² doors
15,000 m³ plywood/year

Market(s): Local, South East Asia, Central and South America, Europe

Equipment: Germany, Italy, USA

Operating: Over 20 years

Expansion Plans: Not disclosed

6. **Forestal Curacautín S.A.**

This company, whose ownership has not been disclosed, is located at:

Av. José Joaquín Pérez V. 9580
Santiago
Telephone: 56-2-5586586
Fax: 56-2-5584720

Product(s): Plywood, particle board

Capacity: 9,500 m³/year

Market(s): Local, Argentina

Equipment: Germany

Operating: Over 20 years

Expansion Plans: None

III.3.3 Medium Density Fibreboard (MDF)

7. **Manufacturera de Fibropaneles Chile S.A.**

The owners of this company are Chilean entrepreneur Anacleto Angelini and the Carter Holt Group from New Zealand. The company has offices at:

Estado 337, Piso 1
Santiago
Telephone: 56-2-6392555
Fax: 56-2-6336760

Product(s): MDF

Capacity: 100,000 m³/year

Market(s): Local and export

Equipment: Sunds Defibrator (Sweden)

8. **Fibranova S.A.**

The owner of this company is CAP S.A.

Product(s): MDF

Capacity: 100,000 m³/year

Market(s): Local and export (Far East)

Operating: 6 months

Expansion Plans: None

III.4 Pulp and Paper Producers

III.4.1 Large Corporations

1. **Celulosa Arauco y Constitución S.A.**

Arauco S.A. owns this company, which has offices at:

Agustinas 1070, Piso 6
Santiago
Telephone: 56-2-6981961
Fax: 56-2-6985967

Product(s): Bleached and unbleached Radiata Pine kraft pulp

Capacity: Around 750,000 mt/year

2. **Celulosa del Pacífico S.A.**

The co-owners of this company are CMPC and Simpson Lumber. Its offices are at:

Agustinas 1350, Piso 4
Santiago
Telephone: 56-2-6981941
Fax: 56-2-6993964

Product(s): Bleached Radiata Pine kraft pulp

Capacity: 315,000 mt/year

3. **Compañía Manufacturera de Papeles y Cartones S.A.**

CMPC has offices at:

Agustinas 1343, Piso 4
Santiago
Telephone: 56-2-6981941
Fax: 56-2-711957

Product(s): Kraft pulp, papers and boards

Capacity: 650,000 mt/year

4. **Forestal e Industrial Santa Fe S.A.**

This company, which has its offices at:

Marchant Pereira 10, Piso 18

Santiago

Telephone: 56-2-2316616

Fax: 56-2-2316614

Product(s): Bleached Eucalyptus kraft pulp

Capacity: 240,000 mt/year

5. **Industrias Forestales S.A.**

This company is owned by CMPC and a number of small shareholders. Headquarters for the company is:

Agustinas 1350, Piso 7

Santiago

Telephone: 56-2-6954477

Fax: 56-2-6954477

Product(s): Newsprint

Capacity: 130,000 mt/year

6. **Papeles Bío-Bío S.A.**

The company's owner is Tasman Chile S.A. The company's offices are located at:

Pedro Aguirre Cerda 1054

Concepción

Telephone: 56-41-371229

Fax: 56-41-371090

Product(s): Newsprint
Capacity: 100,000 mt/year

III.4.2 Small Companies in Paper and Boards

7. Cía. Papelera del Pacífico S.A.

The headquarters for this company are:

Km 63, Ruta Sur
Santiago
Telephone: 56-2-6721430

Product(s): Writing paper: 2,000 mt/year
Wrapping paper: 2,000 mt/year
Corrugated kraft: 6,000 mt/year
Couche: 4,000 mt/year

Capacity: 14,000 mt/year

Market(s): Local

Equipment: Beloit DD, Broth Shark, Voith, Sulzer, Tolosa, Keinefewers

Operating: Over 20 years

Expansion Plans: None

8. Fábrica de Papeles Carrascal S.A.

This company has offices at:

Carrascal 5150
Santiago
Telephone: 56-2-7731165
Fax: 56-2-732146

Product(s): Corrugated board, paper

Capacity: 36,000 mt/year (recycled fibre)

Market(s): Local
Equipment: Spain and Sweden
Operating: Over 20 years
Expansion Plans: In printing paper

9. **Schorr y Concha S.A.**

The address for this company's offices is:

Av. Carlos Schorr 433
Talca
Telephone: (071) 226406 - 223757

Product(s): Liner paper and corrugated board
Capacity: Liner paper 2,600 mt/year, corrugated board 500 mt/year (recycled fibre)
Market(s): Local
Operating: Over 20 years
Expansion Plans: At the feasibility stage

11. **Vera y Giannini S.A.C.I.**

The offices for this company are located at:

San Ignacio 1538
Santiago
Telephone: 56-2-5567894
Fax: 56-2-5567863

Product(s): Board, paper and corrugated board
Capacity: 40,000 mt/year
Market(s): Local

Equipment: Black Clawson, Bauer (refiners, depurators)

Operating: More than 20 years

Expansion Plans: None

III.5 Lumber Remanufacturing Mills

As previously indicated, lumber remanufacturing is relatively new in Chile and both the number and capacity of existing operations show considerable fluctuation in recent years. The more significant and stable operations are listed below.

Aserraderos Andinos S.A.
Huerfanos 669 Of. 613
Santiago
56-2-6337082/56-2-6337085

Aserraderos Aragon
Casilla 40 - A
Valdivia
56-63-218110

Aserraderos Copihue S.A.
11 de Septiembre 2155. Of. 14 T. C
Santiago
56-2-2311903

Casagrande
Recabarren 03160 Cas. 1685
Temuco
56-45-250005

Centro Tecnol. de Produc. Maderera S.A.
Ruta 5 Km. 660 Cas. 1204
Temuco
56-45-221776/56-45-221490
56-45-221490

Compañías Cic S.A.
Esquina Blanca 960
Santiago
56-2-5571634
56-2-5574362

El Rehue S.A.
Casilla 166 A
Villarrica
56-45-411659
56-45-411659

Forestal Millalemu S.A.
Arauco 343
Chillán

Forestal Mininco S.A. (Los Angeles)
Colón 300
Los Angeles

Fried Hermanos Ltda.
Carlos Fernandez 255
Santiago
56-2-5568461

Ind. Maderera Irizar Ltda.
Vicuña 1420
Santiago
56-2-5519849
56-2-5554346

Madera de la Patagonia Ltda.

Casilla 534
Punta Arenas

Maderama Ltda.

Panamericana Norte 1615
Santiago
56-2-779158

Maderas de Aysen S.A.

Marchant Pereira 221, Piso 12
Santiago
56-2-2740300

Maderas Prensadas Cholguán S.A.

Estado 337, Piso 2
Santiago
56-2-6332676

Maderas Saenz S.A.

Ejercito 401
Concepción

Maderas y Sintéticos S.A. MASISA

Casilla 40-A, Chumpullo S'N
Valdivia

Maderera Rio Itata S.A.

Mar del Plata 2111
Santiago
56-2-2256190

Muebles Fourcade

Casilla 184
Temuco
56-45-21189
56-45-240750

Muebles Sur

General Jofre 227
Santiago
56-2-2222039
56-2-6344577

APPENDIX IV

LIST OF CHILEAN FIRMS INTERESTED IN REPRESENTING CANADIAN SUPPLIERS IN CHILE

Some 40 firms were selected to inquire about their interest in representing Canadian suppliers of goods and services for the forestry sector in Chile. Positive replies were received from 30. These are listed below, separated into the following 4 fields: logging and transport, industry, chemicals, communication equipment and services. Some large firms would be in a position to be active in more than 1.

IV.1 Logging and Transport Equipment and Tools

1. Comercial CIDEF S.A.

Address: Av. 5 de Abril 5757
Santiago
Telephone: 56-2-7764071
Fax: 56-2-7794288

In Operation: About 17 years

Business Area: Agriculture, construction, mining, forestry

Product Line: Case, Monck (USA), Valmet Logging (Canada), Nissan (Japan)

Customers: Mining companies, forestry contractors, construction companies, car dealers

Annual Sales: Over US\$50-million

2. Distribuidora Cummins S.A.C.I.

Address: Bulnes 1203
Santiago
Telephone: 56-2-6972929
Fax: 56-2-6717037

In Operation: 20 years

Business Area: Mining, forestry

Product Line: Blount Inc. Forestry Equipment Div. (USA) - cranes, feller, buncher, Hydro-ax tractors Komatsu Inc. and Dresser Int. Co. - crawler tractors, front-end loaders, retro excavators Cummins Engine Co. - diesel engines

Customers: Mining companies, forestry contractors, construction companies

Annual Sales: Over US\$50-million

3. Distribuidora Perkins Chilena S.A.C.

Address: Av. España 69
Santiago
Telephone: 56-2-6972929
Fax: 56-2-6717037

In Operation: About 15 years

Business Area: Engines, front-end loaders, cranes, fork lift

Product Line: Perkins Engine (U.K., Brazil, Argentina) Clark, Link Belt, Bob Cat (USA)

Customers: Mining companies, Mapal, Forestal Mininco, construction firms

Annual Sales: Around US\$15-million

4. **Gildemeister S.A.C.**

Address: Avda. Las Rejas 113
Santiago
Telephone: 56-2-7764040
Fax: 56-2-7790930

In Operation: Over 30 years

Business Area: Crawler tractors, skidders, engines, trucks

Product Line: Caterpillar (USA and Canada), John Deere, Kenworth (USA)

Customers: Mining companies, Forestal Mininco, Forestal Arauco, construction companies

Annual Sales: Over US\$50-million

5. **Jaras S.A.**

Address: Barón de Juras Reales 5250
Santiago
Telephone: 56-2-6231215
Fax: 56-2-6231547

In Operation: Over 20 years

Business Area: Skidders, cranes, engines, loaders, transmissions

Product Line: Franklin, Detroit Diesel, Electra Haul, Allison (USA)

Customers: Mining companies, forest contractors, fishing companies

Annual Sales: Between US\$10 and 15-million

6. **Maco Industrial y Comercial S.A.**

Address: Av. Vicuña Mackenna 3212
Santiago
Telephone: 56-2-2381311
Fax: 56-2-2380315

In Operation: Around 20 years
Business Area: Front-end loaders, trucks, fork lift, chippers, cranes
Product Line: Husky, Precision, Hyster, International Navistar (USA), Farmi (Finland), O & K (Germany), VW (Brazil)
Customers: Port Operations, Forestal Mininco, small operators, car dealers
Annual Sales: Between US\$15-and 20-million

7. **Lanz y Cía. Ltda.**

Address: Dr. Manuel Barros Borgoño 233
Santiago
Telephone: 56-2-2352707
Fax: 56-2-2351070

In Operation: 10 - 20 years
Business Area: Chain saws
Product Line: Dolmar (Germany)
Customers: Forestry contractors
Annual Sales: Below US\$10-million

8. **Maga Ltda.**

Address: Toesca 2096
Santiago
Telephone: 56-2-6980252
Fax: 56-2-6953155

In Operation: Around 10 years
Business Area: Skidders, crawler tractors, sawmills, cranes, plywood machinery, chain saws
Product Line: KMC Kootoney Manufacturing Co. (Canada) Tree Farmer, Peerless (USA), Cremona (Italy), Shindiwa (Japan)

Customers: Forestal Mininco, Forestal Arauco, Norwood S.A.
Annual Sales: Less than US\$10-million

9. **Manfred Brauchle S.A.**

Address: Agustinas 1070
Santiago
Telephone: 56-2-6963294

In Operation: Less than 10 years

Business Area: Chain saws, hand saws

Product Line: Paulan (USA), Jack (Denmark)

Customers: Forest contractors

Annual Sales: Less than US\$10-million

10. **Salinas y Fabres S.A.C.I.**

Address: Rondizzoni 2130
Santiago
Telephone: 56-2-6835866
Fax: 56-2-6836750

In Operation: More than 30 years

Business Area: Road construction equipment, trucks, tires, cars

Product Line: Fiat Allis, General Motors, Mack Trucks Inc. (USA), The Yokohama Rubber Co., Toyota (Japan)

Customers: Enap, Copec, mining companies, transport companies, car dealers, forestry companies

Annual Sales: Over US\$50-million

11. **Sigdo Koppers Comercial S.A.**

Address: Panamericana Norte 5151
Santiago
Telephone: 56-2-6234883; 56-41-237506; 56-41-241845
Fax: 56-2-6234531

In Operation: Around 15 years

Business Area: Front-end loaders, cranes, feller buncher, trucks, fork lift

Product Line: Volvo BM (Sweden) Volvo - Michigan (Brazil), IVECO (Europe, Argentina), Case International (U.K.), Toyota (Japan), Barko (USA)

Customers: Mining companies, forest contractors, transport companies

Annual Sales: Over US\$50-million

12. **Tecfor Ltda.**

Address: Agustinas 611, Of. 91
Santiago
Telephone: 56-2-6330925
Fax: 56-2-6381654

In Operation: Less than 10 years

Business Area: Manufacture of loaders, log grapples, delimiters, slashers

Product Line: European cable logging equipment, portable sawmills, steel cables, and accessories

Customers: Forest contractors

Annual Sales: Less than US\$10-million

IV.2 Industrial Equipment

13. BSC Ltda.

Address: Panamericana Norte 3026
Santiago
Telephone: 56-2-7355609
Fax: 56-2-7375649

In Operation: More than 20 years

Business Area: Sawmills, harvesting equipment, hauling equipment

Product Line: Morbark International, Salem International, Price Industries, Peerless

Customers: Forest companies

Annual Sales: Less than US\$10-million

14. Comercial e Industrial ISESA S.A.

Address: Av. Pedro Aguirre Cerda 4693
Santiago
Telephone: 56-2-6213423,
Fax: 56-2-6213019

In Operation: Around 12 years

Business Area: Abrasive materials (sandpaper, grinding stones, files)

Product Line: SIA, VALLORBE (Switzerland)

Customers: Wood furniture manufacturers

Annual Sales: Less than US\$10-million

15. **Coofor Ltda.**

Address: Av. Einstein 760
Santiago
Telephone: 56-2-6213423
Fax: 56-2-6213019

In Operation: Over 20 years

Business Area: Saws, knives, files, chemicals

Product Line: Simonds, Pacific Hoe, Nicholson, Demhorst (USA), Criptogil (France), Hoseler, Lauser, Casco (Germany)

Customers: Cooperative associates

Annual Sales: Less than US\$10-million

16. **G. Weiblin y Cía. Ltda.**

Address: Dr. Sótero del Río 326, Of. 704
Santiago
Telephone: 56-2-6983168
Fax: 56-2-6983168

In Operation: Around 16 years

Business Area: Equipment and cutting tools for the woodworking and metal industry

Product Line: International Knife and Saw Inc. (USA); Northern Vibrator Manufacturing Limited (Canada)

Customers: Large forest corporations, Aserraderos Mininco

Annual Sales: Less than US\$10-million

17. **Ingemad Ltda.**

Address: General Ghana 576
Santiago
Telephone: 56-2-5566371
Fax: 56-2-5566818

In Operation: Around 15 years

Business Area: Manufacturer of cutting tools and grinding stones (diamond and borazon). Importer of woodworking equipment

Product Line: Watkin (UK), Ogam (Italy)

Customers: Wood panel and furniture producers

Annual Sales: Less than US\$10-million

18. **Kupfer Proveedores Industriales S.A.**

Address: Lincoyán 601
Concepción
Telephone: 56-41-233002
Fax: 56-41-224941

In Operation: Less than 10 years

Business Area: Cutting tools, steel cable, safety implements

Product Line: Simonds Industries, Wisconsin Knife

Customers: Forest contractors

Annual Sales: Less than US\$10-million

19. **Linares Maquinaria Ltda. (changed to LIMAQ Ltda.)**

Address: Martínez de Rosas 3305
Santiago
Telephone: 56-2-7738852
Fax: 56-2-7751215

In Operation: Less than 10 years

Business Area: Woodworking equipment

Product Line: Linares Metalúrgica (Argentina), A. Costa (Italy), Biesse (Germany)

Customers: Millwork and furniture manufacturers

20. **Max Hamdorf Maquinaria Ind. S.A.**

Address: Lira 2310
Santiago
Telephone: 56-2-6982605
Fax: 56-2-6995788

In Operation: Less than 10 years

Business Area: Woodworking equipment

Product Line: Several makes of used equipment, mainly of German origin

Customers: Small woodworking shops

Annual Sales: Less than US\$10-million

21. **Raab Rochette S.A.**

Address: Av. Libertador B. O'Higgins 1869
Santiago
Telephone: 56-2-6982605
Fax: 56-2-6995788

In Operation: Over 40 years

- Business Area:* Woodworking equipment, drying kilns, filing equipment
- Product Line:* Invicta Delta, Schifer (Brazil), The Taylor, Armstrong (USA), Kadoret (Canada), Gottert (Argentina), Udelhom (Sweden)
- Customers:* Many forestry companies
- Annual Sales:* Between US\$10 and 20-million
22. **Solecia Ltda.**
- Address:* Av. Holanda 27
Santiago
Telephone: 56-2-2333608
Fax: 56-2-2325880
- In Operation:* Over 20 years
- Business Area:* Sawmills, chippers, filing equipment, debarkers
- Product Line:* Soderhamns Verkstader, Bruks, Waco-Jonsereds (Sweden), Vollmer Werke (Germany), Stenner (UK)
- Customers:* Several sawmill operators
- Annual Sales:* Less than US\$10-million
23. **Ricardo Schmidlin**
- Address:* Box 14245
Santiago
Telephone: 56-2-2293623
Fax: 56-2-2293623
- In Operation:* Around 20 years
- Business Area:* Sawmills, drying kilns, MDF plants, debarkers
- Product Line:* Siempelkamp GmbH, Lignomat, Linck (Germany), Valoncone (Finland)

Customers: Aserraderos Cementos Bío-Bío, Madex, Aserraderos San Vicente, Forestal Carampangue

Annual Sales: Less than US\$10-million

24. **Ingen S.A.**

Address: Panamericana Norte 1515
Santiago
Telephone: 56-2-371295
Fax: 56-2-7355194

In Operation: Around 15 years

Business Area: Drying kilns, drying controls

Product Line: Manufacturer of drying kilns, Bollmann (Germany)

Customers: Centro Tecnológico de Producción Maderera, Maderas Río Itata, Maderera Las Rosas, medium size sawmills

Annual Sales: Less than US\$10-million

IV.3 Chemicals

25. **Comercial Ortiz y Alonso S.A.**

Address: Crescente Errázuriz 370
Santiago
Telephone: 56-2-2392298
Fax: 56-2-2392122

In Operation: Around 10 years

Business Area: Forestry equipment, instruments for analysis, chemicals

Product Line: U.J. Trading AB, Chej J Nora AB (Sweden), Asoma Instruments, K M G Bernuth Inc. (USA)

Customers: Treating plants, construction firms

Annual Sales: Less than US\$10-million

26. **Mathiesen S.A.C.**

Address: Nuncio Sótero Sanz 55, Piso 3
Santiago
Telephone: 56-2-2311803
Fax: 56-2-2318160

In Operation: Over 25 years

Business Area: Chemicals

Product Line: Pesticides for nurseries, anti sap stain chemicals

Customers: Forest companies

Annual Sales: Less than US\$10-million

IV.4 **Communication Equipment and Services**

27. **Camino Real S.A.**

Address: Panamericana Norte 1515
Santiago
Telephone: 56-2-7778052
Fax: 56-2-7355194

In Operation: Around 6 years

Business Area: Engineering and consulting services

Customers: Small- and medium-sized forest companies

Annual Sales: Less than US\$10-million

28. **Com Centre S.A. (Communication Equipment)**

Address: San Pío X 2422
Santiago
Telephone: 56-2-2518725
Fax: 56-2-2320857

29. **Geocam S.A. (Surveying Equipment)**

Address: Av. Salvador 1105
Santiago
Telephone: 56-2-2742559
Fax: 56-2-2049535

30. **Infora Estudios Ltda. (Consulting Services)**

Address: Alonso de Córdova 3890
Santiago
Telephone: 56-2-2287695

APPENDIX V

FORESTRY PUBLICATIONS

1. *Boletín Informativo de la Corporación Chilena de la Madera A.G.*
Contents: News concerning CORMA'S activities and the forest sector. Regional activities, technological reports and economic statistics. Published every 2 months.
2. *Chile Forestal*
Monthly magazine, published by CONAF.
Contents: News concerning activities on native forests and plantations, world market of forest products, forest prices domestic market, forest exports, technical papers, brief news.
3. *Chilean Forestry News*
Monthly magazine, published by CONAF. A summary in English of the contents of *Chile Forestal*.
4. *Lignum · Bosque · Madera · Tecnología*
Published by Fundación Chile every 3 months.
Contents: World forestry world news, Chilean forestry news, technical reports on different tree species, technical reports on equipment, silviculture, forest harvesting and other aspects of forestry activity.
5. *Renarres*
Published monthly by Colegio de Ingenieros Forestales A.G.
Contents: News concerning the forestry profession, and summaries of technical papers.

6. *ATCP Chile*

Published every 2 months by Asociación Técnica de la Celulosa y el Papel Chile.

Contents: Editorial, documents of ATCP activities, technical section, news of importance to ATCP members, commercial information.

7. *Instituto Forestal*

7.1. *Exportaciones Forestales Chilenas*

Monthly publication with statistics about prices and exports of forest products.

7.2. *Estadísticas Forestales*

Annual publication of forest statistics. Macroeconomic indicators. Forestry resources. Production and consumption. Exports. Prices. Transport. Price index. Availability of Radiata Pine lumber. Forest occupation.

7.3. *Boletín de Precios Forestales*

Monthly publication with prices of forest products and prices of provisions for the forest products industry.

8. *Boletín de Mercado Forestal*

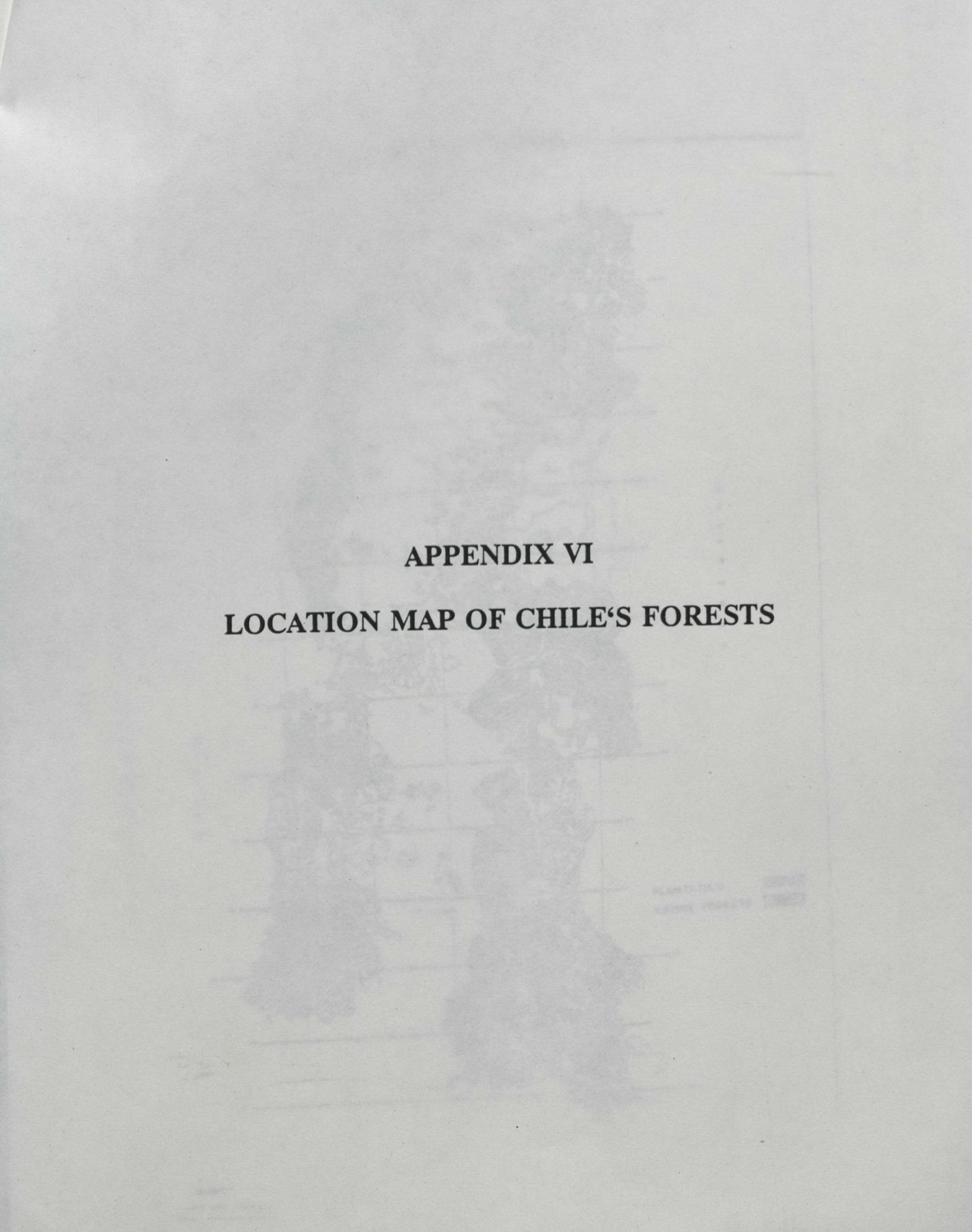
Monthly magazine published by CONAF.

Contents: Analysis of world forest products markets. National news of importance in the export of forest products. Important events. Prices of local market, prices of export markets. Financial data and economic indicators.

9. *Bosque*

Published every 6 months by Universidad Austral de Chile, Facultad de Ciencias Forestales.

Contents: Technical papers that cover specially silvicultural aspects of the native forest.



APPENDIX VI
LOCATION MAP OF CHILE'S FORESTS

MAP OF CHILE'S FOREST RESOURCES

PACIFIC OCEAN

ARGENTINA



PLANTATION
NATIVE FORESTS

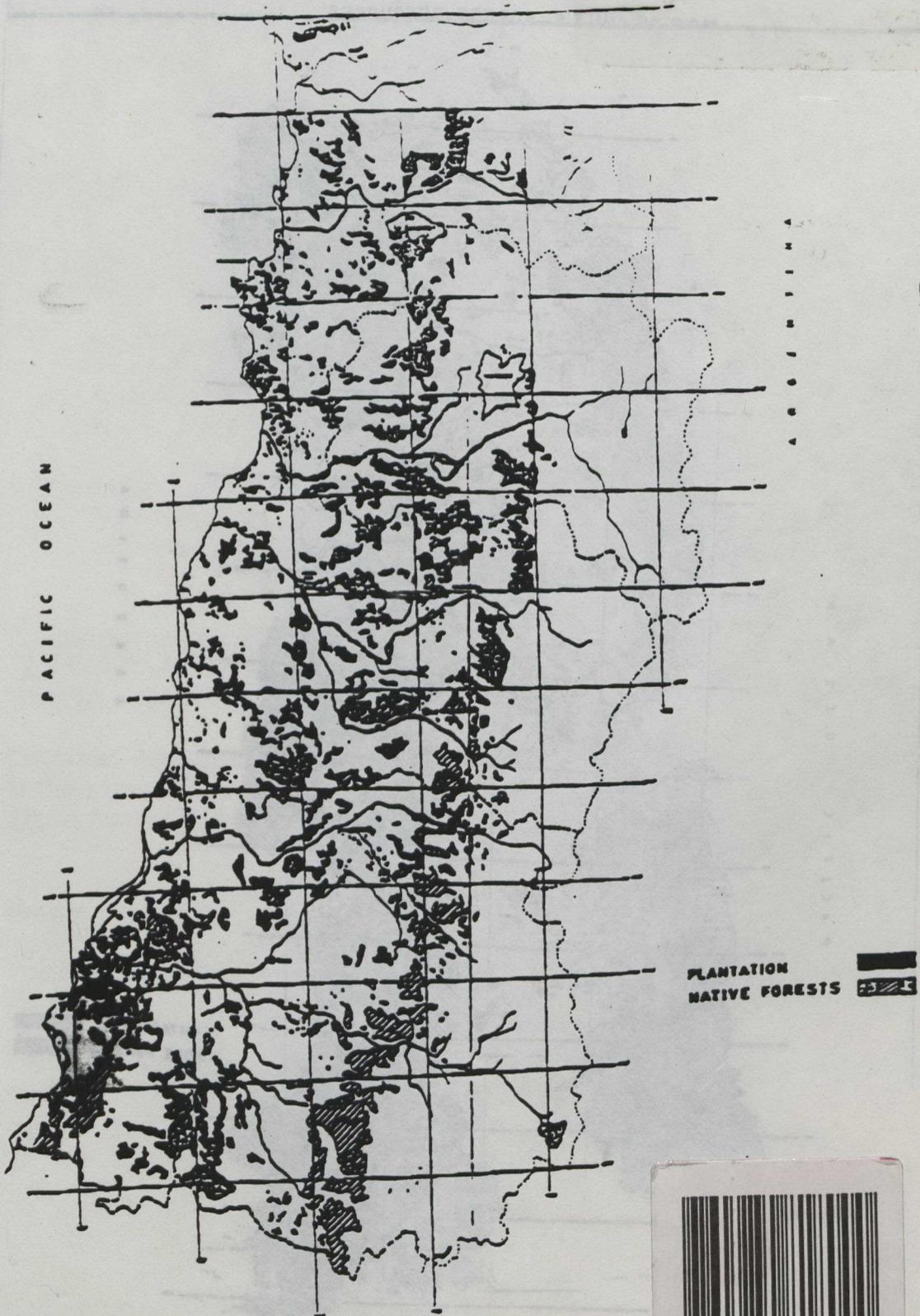
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