

FDI-CORFO REPORT

NEW PRODUCTS AND MARKETS TO INCORPORATE DOUGLAS FIR INTO THE NATIONAL
PRODUCTION SYSTEM

DOUGLAS-FIR GROWN IN CHILE
BACKGROUND

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CHILE

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1. INTRODUCTION

This report is part of the project “New products and markets to incorporate Douglas-fir into the national production system”, which is being carried out by the Forest Institute (Instituto Forestal - INFOR), supported by the Production Fomentation Corporation (Corporación de Fomento de la Producción - CORFO) through its Innovation and Development Fund (Fondo de Desarrollo e Innovación - FDI).

In agreement with the initial objectives of the project, the goal of this document is to give a brief description of Douglas-fir, its current and potential planted area in Chile, and the industrial aspects of its wood, including the identification of the actors of its industrialization.

2. DOUGLAS-FIR GROWN IN CHILE. BACKGROUND

2.1. Geographical distribution of the species

Douglas-fir in Chile is distributed between 35° and 43° south latitude (VII and X Chilean regions). This area is divided in two zones: Maule to Malleco; and Cautín to Chiloé. Douglas-fir has a good performance in most of the areas where it has been planted. Based in INFOR’s statistics in the year 2000 Douglas-fir plantations reached 14,286 ha. The distribution of these are shown in Table 1.

Table 1
Douglas-fir plantations in Chilean regions

Region	Area (ha)	Percentage
VI	2	0.01
VII	8	0.06
VIII	237	1.66
IX	6,270	43.89
X	4,662	32.63
XI	3,107	21.75
Total	14,286	100.00

Source: Boletín Estadístico 79 - INFOR 2000

- **Potential Zones for Douglas-fir establishment in Chile**

Between the VIII and X Chilean regions, the potential zones for Douglas-fir establishment, the following areas are identified:

VIII Region: 15.36% of the area of this region is potentially suitable for Douglas-fir plantation. The potential zone is distributed mainly in the lower mountain range and in the Andes from the latitude of Los Angeles up to the south boundary of this region; a strip located in the 71° 67' west longitude; from the 36°87' south up to the regional boundary; and in the west of the Nahuelbuta Range.

IX Region: 53.79% of the regional area is potentially suitable for Douglas-fir plantation. This zone is located in portions of the Andes; in practically all the lower range; in the central valley from the north of the Toltén river up to the boundary with the X Region; and in the entire west side of the boundary with the VIII Region.

X Region: 43.77% of this region has all the requirements for the development of Douglas-fir. The potential zone is located between the north boundary of this region and the Chacao channel, in the coastal zone and middle east, mainly in the Chiloé Province at the east and north east of the city of Castro. Almost the entire Palena Province is not suitable for Douglas-fir.

The Table 2 gives a summary of the potential available area for Douglas-fir culture in Chile. Note that this area could also be available for other sort of plantations or land uses.

Table 2
Potential areas for Douglas-fir plantations

Region	Potential Area (ha)
VIII Bío Bío Region	585,810
La Araucanía Region	1,711,071
X Los Lagos Region	2,881,971
TOTAL	5,178,852

Source: Monografía de Pino oregón, INFOR-CONAF 1997

2.2 Description of the tree

Douglas-fir is a big size, cylindrical, lightly conical tree, with a straight trunk, a pyramidal crown and horizontal branches in great numbers. The bark is grayish, reddish brown (it turns thick and reddish brown at maturity) spongy, deeply grooved, rough, scaly and its thickness can reach more than 10 cm. The needles are linear, flat,

blunt at the tip or pointed on primary shoots, soft and flexible, yellow-green-, dark-green, or blue-green- colored, of a length of 1.5 to 5.5 cm by 1.5 cm wide (Monografía de Pino oregón, INFOR-CONAF, 1997)

In Chile, the vertical growth of the species culminates at 25 years and its volume growth at 40 years. The average growth rate varies between 11 and 18.9 m³/ha/year, and the average annual DBH increase between 0.44 and 1.66 cm/year (Revista Chile Forestal N° 252, 1997).

2.3 Properties of the Wood

- **Wood description**

The heartwood is light brown-colored with a hint of red. The sapwood is softly yellow-brown- colored. Depending on the cut applied to the chunk of wood, a very attractive streak with uniform lines appears. The annual growth rings are well visible throughout the wood. In an annual growth ring, dark lines represent late-growth zones, (summer wood), bright areas between two dark lines are early-growth zones (spring wood). Medulary rays are visible and heterogeneous on end and top faces. This wood is easy to glue and to work with, although, when dry, it tends to split when nailed. Its weight, at 12% humidity, is approximately of 450 kg/m³.

- **Drying**

Douglas-fir wood doesn't present difficulties in drying. The main defects detected are due to collapsed cells and small ridges on the boards' faces. Once dried, the wood is very stable in regards to its dimensions and scarcely get deformed. During drying, the temperature shouldn't surpass 65° C.

- **Resistance and superficial treatment**

Because of natural resistance against fungi, insects and natural humidity, this wood is listed as non-resistant. Therefore, to increase its useful life outdoors, it is recommended to maintain the wood out of ground contact, under a roof or enclosed in any type of constructive protection, and with the appropriate superficial treatment. It can be used untreated indoors.

The wood is refractory to impregnation.

With regards to superficial treatment, good results are obtained with applications of varnish, lacquer, oils and different types of paints.

- **Wood utilization**

For its characteristics, this wood can be used in almost all types of applications, excepting when in permanent contact with humidity. Presently, Douglas-fir grown in Chile is used for housing structures, floors, beams and covering; for the elaboration of plywood and boards; for the fabrication of laminated beams; doors, windows; furniture; indoor finishing; toys and crafts.

3. OVERVIEW OF THE SAWMILL INDUSTRY IN CHILE

3.1 Sawmill industry. Background

- Sawmills

To situate Douglas-fir in the national lumber production, some general background of the sawmill industry follows.

Table 3 shows the number of sawmills, by production rank, operating during the 1995-2000 period

Table 3
Working sawmills by production rank

Production rank (m ³ /año)	1995	1996	1997	1998	1999	2000
TOTAL	1,118	1,105	1,077	1,034	982	987
>50.000	14	16	18	17	19	23
20.001 - 50.000	16	19	24	22	26	27
10.001 - 20.000	23	33	33	31	38	28
5.001 - 10.000	65	48	42	42	50	56
≤ 5.000	1,000	989	960	922	849	853

Source: INFOR-BOLETIN ESTADISTICO 81 "La Industria del Aserrío, 1999-2000"

- **Production capacity**

During the year 2000, the production of lumber was close to 5.7 million cubic meters. As shown in Table 4, approximately 59% of this volume was produced by sawmills with annual capacity greater than 50,000 cubic meters.

Table 4
Trajectory of lumber production by production rank (m³)

Production rank	1995	1996	1997	1998	1999	2000
TOTAL	3,801,790	4,139,952	4,661,329	4,550,737	5,253,668	5,698,114
>50.000	1,594,752	1,878,019	2,302,903	2,383,325	2,838,721	3,339,973
20.001 - 50.000	487,582	568,365	709,962	824,835	824,835	833,010
10.001 - 20.000	323,460	462,863	449,138	544,887	544,887	404,657
5.001 - 10.000	471,610	347,087	307,422	345,048	345,048	403,668
≤ 5.000	924,386	883,618	891,904	682,177	682,177	716,806

Source: INFOR-BOLETIN ESTADISTICO 81 "La Industria del Aserrío, 1999-2000"

- **National consumption of wood logs**

In the year 2000, the sawmill industry needed around 11.4 million cubic meters of bark-free logs (m³ ssc) .

The evolution of raw material use during the 1995-2000 period is shown in Table 5.

Table 5
Consumption of logs according to species (1995-2000) (m³ ssc)

SPECIES	1995	1996	1997	1998	1999	2000
Radiata pine	7,403,118	7,852,350	8,925,529	8,469,884	9,700,755	10,618,322
Chilean natives	773,599	757,818	714,635	627,922	612,777	625,014
Other exotics	145,615	132,097	152,209	109,907	120,222	161,605
TOTAL	8,322,332	8,742,265	9,792,373	9,207,713	10,433,754	11,404,941

Source: INFOR-BOLETIN ESTADISTICO 81 "La Industria del Aserrío, 1999-2000"

- **Raw material supply**

Of the 11.4 million cubic meters ssc of logs required, 59% are purchased from third parties and the remaining 41% come from industry-owned forests.

3.2 Douglas-fir lumber production

- **Lumber production**

Table 6 shows lumber production of Douglas-fir and other species from different regions during year 2001.

Table 6
Annual lumber production in Chilean regions by species, year 2001 (m³)

SPECIES	TOTAL	IV	V	VI	VII	VIII	IX	X	XI	XII	R.M.
TOTAL	5,872,017	660	23,585	172,190	855,694	3,794,903	337,654	608,287	22,797	53,999	2,248
<i>Populus nigra</i>	19,076	0	0	11,915	370	4,346	109	88	0	0	2,248
<i>Fitzroya cupressoides</i>	521	0	0	0	0	0	0	521	0	0	0
<i>Gevuina avellana</i>	58	0	0	0	0	0	0	58	0	0	0
<i>Drimys winteri</i>	6,232	0	0	0	0	0	0	6,078	154	0	0
<i>Castanea sativa</i>	619	0	0	0	0	205	414	0	0	0	0
<i>Pilgerodendron uvifera</i>	231	0	0	0	0	0	0	0	231	0	0
<i>Cupressus lambertiana</i>	1,730	0	17	0	0	777	26	910	0	0	0
<i>Nothofagus dombeyi</i>	42,098	0	0	0	0	3,754	6,753	26,951	1,622	3,018	0
<i>Eucalyptus globulus</i>	7,980	660	14	31	0	161	7,092	22	0	0	0
<i>Laurelia sempervirens</i>	1,759	0	0	0	0	100	588	1,071	0	0	0
<i>Nothofagus pumilio</i>	69,151	0	0	0	0	0	169	0	18,001	50,981	0
<i>Persea lingue</i>	115	0	0	0	0	52	0	63	0	0	0
<i>Podocarpus nubigena</i>	7,853	0	0	0	0	0	1,243	6,144	466	0	0
Native	1,780	0	0	0	218	689	275	598	0	0	0
<i>Aextoxicon punctatum</i>	2,864	0	0	0	0	151	309	2,404	0	0	0
<i>Pseudotsuga menziesii</i>	34,483	0	0	0	0	73	11,245	23,165	0	0	0
<i>Pinus radiata</i>	5,580,724	0	23,554	160,244	851,647	3,777,702	286,807	480,770	0	0	0
<i>Nothofagus alpina</i>	13,545	0	0	0	0	626	2,151	10,768	0	0	0
<i>Nothofagus obliqua</i>	39,895	0	0	0	3,459	3,005	17,595	15,836	0	0	0
<i>Laurelia philipiana</i>	24,171	0	0	0	0	2,089	1,803	17,956	2,323	0	0
<i>Weinmannia trichosperma</i>	2,168	0	0	0	0	509	0	1,659	0	0	0
<i>Eucryphia cordifolia</i>	14,964	0	0	0	0	664	1,075	13,225	0	0	0

Source: INFOR-UNIDAD DE ESTADÍSTICAS. 2002.

- **Companies producing Douglas-fir wood**

In Chile, around 40 medium-size and small-size enterprises produce Douglas-fir wood. Table 7 shows the three major companies concentrating 44% of the national production. The location of the major companies producing Douglas-fir is shown in Appendix 1.

Table 7
Major companies producing Douglas-fir wood in Chile

Registered name	Annual lumber production volume (m ³)
Soc. Aserradero Voipir Ltda. ¹	6,520
Forestal Integral S.A. ²	6,300
Agrícola y Forestal Flor del Lago ³	2,406

Source: INFOR-UNIDAD DE ESTADÍSTICAS. 2002.

- **Production capacity of producing companies**

The sawmills producing Douglas-fir lumber do not use all their capacity to process this single species, but rather combine it with Radiata pine and native species production. It is estimated that the basic capacity of these sawmills is of 110,000 m³ of lumber per year.

3.3. Commercialization of Douglas-fir wood products

- **Products:** The principal Douglas-fir wood products currently produced in Chile are:
 - **Surfaced or dressed lumber:** Surfaced and double-end-trimmed lumber to obtain uniform sizes and lengths. Available as kiln dried or non-seasoned lumber. The common commercial nominal sizes currently produced are:
 - Thickness: 1" and 2"
 - Widths: 4"-.5" - 6" - 8" and 10"
 - Lengths: 8' - 10' and 12'

Pattern lumber and mouldings: Common patterns and mouldings in current production are:

- Flooring:** Profiled to 22 mm thickness (7/8") and actual widths of 45 to 145 mm (1 3/4" to 5 3/4"), with exposed faces of 38 to 138 mm (1 1/2" to 5 7/16"). Commercial lengths of 2.4 meter a 3.6 meters (8' to 12').
- Ceiling:** Profiled to 9 mm thickness (3/8") and actual widths of 70 to 120 mm (2 3/4" to 4 3/4"), with exposed faces of 64 to 114 mm (2 1/2" to 4 1/2"). Commercial lengths of 2.4 meter a 3.6 meters (8' to 12').

¹ Manager: Sr. Lorenz Weber Sch. Address: Aviador Acevedo s/n, Villarrica. Phone: 56 -45 - 411192

² Manager : Sr. Johann Purstinger. Address: Fundo Porvenir, Trébol ruta 5 sur, Río Negro. Phone: 56-64- 361010

³ Manager: Cristian Wagner. Address: Fundo Flor del Lago, Villarrica. Phone: 56 - 45 411314

- c) **Interior Paneling, for vertical and horizontal applications:** Profiled from 16 to 22 mm thickness (5/8" to 7/8") and actual widths of 45 to 195 mm (1 3/4" to 7 11/16"), with exposed faces of 35 to 180 mm (1 3/8" to 7 3/32"). Commercial lengths of 2.5, 3.6 and 5.0 meters (8', 12' and 16').
- d) **Exterior shiplap siding:** Profiled from 22 to 45 mm thickness (7/8" to 1 3/4") and actual widths of 75 to 245 mm (3" to 9 5/8"), with exposed faces of 60 to 235 mm (2 3/8" to 9 1/4"). Commercial lengths of 2.4 meter a 3.6 meters (8' to 12').
- e) **Horizontal Drop Siding (known in Chile as "Tinglado"):** Profiled from 16 to 22 mm thickness (5/8" to 7/8") and actual widths of 145 to 195 mm (5 3/4" to 7 11/16"), with exposed faces of 130 to 185 mm (5 1/8" to 7 5/16"). Commercial lengths of 2.4 meter a 3.6 meters (8' to 12').
- f) **Quarter rounds:** Profile measurements of 16 x 16 mm (5/8" x 5/8") and 22 x 22 mm (7/8" x 7/8"), with the transverse cut forming a quarter circumference (hence its name). Commercial lengths of 2.4 meter a 3.6 meters (8' to 12'). Used principally for the edging around flooring and occasionally around ceilings.
- g) **Base mouldings:** Profile thickness of 16 to 34 mm (5/8" to 1 11/32"), widths of 145 to 195 mm (5 3/4" to 7 11/16"), Commercial lengths of 2.4 meter a 3.6 meters (8' to 12'). Used mainly for floor finishing.
- h) **Casing:** Profile thickness of 22 mm (7/8"), widths of 22 to 45 mm (7/8" a 1 3/4"), and commercial length of 2.50 meters (8'). Used for the finishing of door jambs and decorative elements in walls.

- **Prices**

The price on the internal market (within Chile) of Douglas fir wood, during the first semester of 2002, varied between US\$ 162.00 and 228.00 per cubic meter, plus taxes. Table 9 shows these variations.

Table 9
Internal sale prices of Douglas-fir lumber - FOB

Product	Price (US\$/m ³)
Lumber	162.00
Surfaced lumber	195.00
Pattern lumber	228.00

Source: : INFOR-BOLETÍN DE PRECIOS FORESTALES N° 92. Junio 2002

- **Internal consumption of Douglas-fir lumber:**

The lumber is sold mainly to the building industry, the rest being sold to warehouses, small companies and furniture manufacturers, as shown in Table 10.

Table 10
Destination of lumber production

Consumer	Volume (m ³)	Percentage
Builders	17,242	50%
Privates	7,586	22%
Warehouses	4,827	14%
Other distributors	2,414	7%
Furniture manufacturers	2,414	7%
TOTAL	34,483	100%

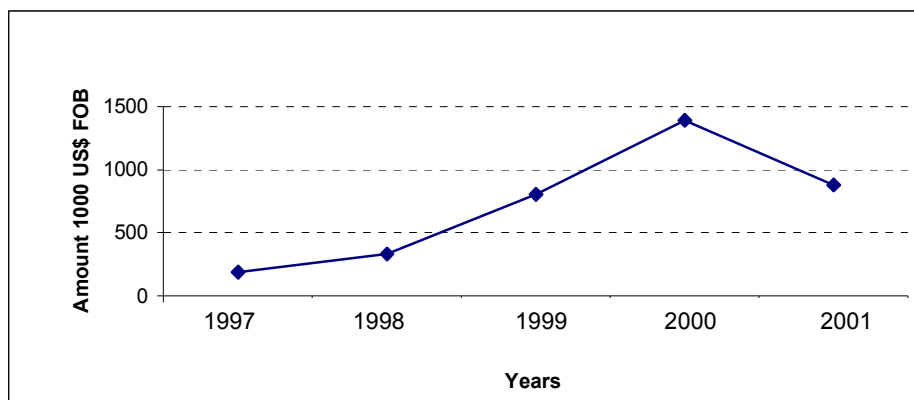
Source: INFOR-UNIDAD DE ESTADÍSTICAS. 2002

3.4 Douglas-fir wood product exports

- **Evolution of exports**

Douglas-fir wood is highly priced on world markets, which is a good reason to encourage plantations of this species. However, as it is shown in Figure 1, the amount of exported Douglas-fir products has actually decreased since the year 2000.

Figure 1
Evolution of Douglas-fir exports



Source: INFOR-BOLETÍN ESTADISTICO EXPORTACIONES FORESTALES AÑO 1997-2001

It is important to note that this information is mainly based on primary product exports, which are low added value products; eg. Lumber in boards and pattern lumber.

- **Exported products**

The main Douglas-fir wood products that were exported in the year 2001 are shown in the Table 11.

Table 11
Douglas-fir wood products exports

Products	Volume	Amount of export (US\$)
Rough sawn dimension lumber & timbers	3,585.5 m ³	797,000.00
Tongued and grooved patterns	74.66 m ³	53,372.00
Dressed lumber	73.49 m ³	21,661.00
Mouldings	11.35 ton	7,267.00

Source: INFOR-BOLETÍN ESTADÍSTICO N° 80: EXPORTACIONES FORESTALES CHILENAS. Diciembre 2001

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APPENDIX 1

GEOGRAPHICAL MAP OF CHILE CONTAINING DOUGLAS-FIR PLANTATIONS AREAS AND INDUSTRIAL PLANTS.



Area growth of Douglas fir

Area of industry

Daudet*. (Buenos Aires, 16 de diciembre de 1998).

APPENDIX 2
TECHNICAL CHARACTERISTICS OF SAWMILLS

CHARACTERISTICS OF SAWMILL MACHINES

BAND SAW HEADRING

Length of cart (with accessories)	12 m
Engine power	50 hp
Blade width	6"
Blade thickness	1,2 mm
Blade length	8 m
Gauge	30
Hook angle	26°

BAND RESAW

Engine power	50 hp
Blade width	7"
Blade thickness	1,2 mm
Blade length	8,5 m
Gauge	35
Hook angle	26°

MULTIPLE CIRCULAR SAW

Engine power	150 cv
Saw diameter	470 mm
	380 mm
Saw thickness	3 mm
Hook angle	22°

EDGER SAW

Engine power	50 hp
Saw diameter	400 mm
Z	20
Blade thickness	3 mm
Hook angle	20°

CROSS CUT SAW

Engine power	25 cv each saw
Saw diameter	700 mm
Z	84
Thickness	3mm
Hook angle	10°

PLANER MACHINE

Rotary cutting knife length	60 - 150 mm
Rotary cutting knife diameter	120 - 160 mm
Number of rotary cutting knives	5
Z	6 y 8
Revolutions	6.800 rpm
Number of engines	9