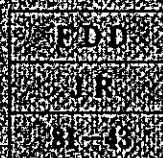
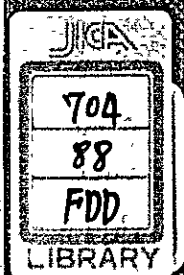


REPORT OF PRELIMINARY SURVEY
FOR
FORESTRY DEVELOPMENT
IN
THE REPUBLIC OF CHILE

August 1981

JAPAN INTERNATIONAL COOPERATION AGENCY



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PREFACE

It is with great pleasure that I present Report on Preliminary Survey for Forestry Development in the Republic of Chile to the Government of the Republic of Chile.

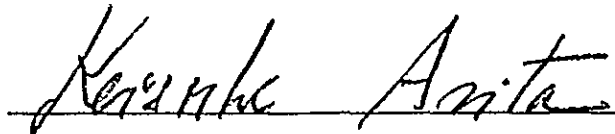
This report embodies the result of a preliminary survey which was carried out from 27th February to 19th March, 1981 by a Japanese survey team commissioned by the Japan International Cooperation Agency following the request of the Government of Chile.

The survey team, headed by Mr. Katsuhiro Kotari, had a series of discussions with the officials concerned of the Government of Chile and conducted an extensive field survey and data analyses.

I hope that this report will be useful as a basic reference for forestry development of Chile.

I wish to express my deep appreciation to the officials concerned of the Government of Chile for their close cooperation extended to the survey team.

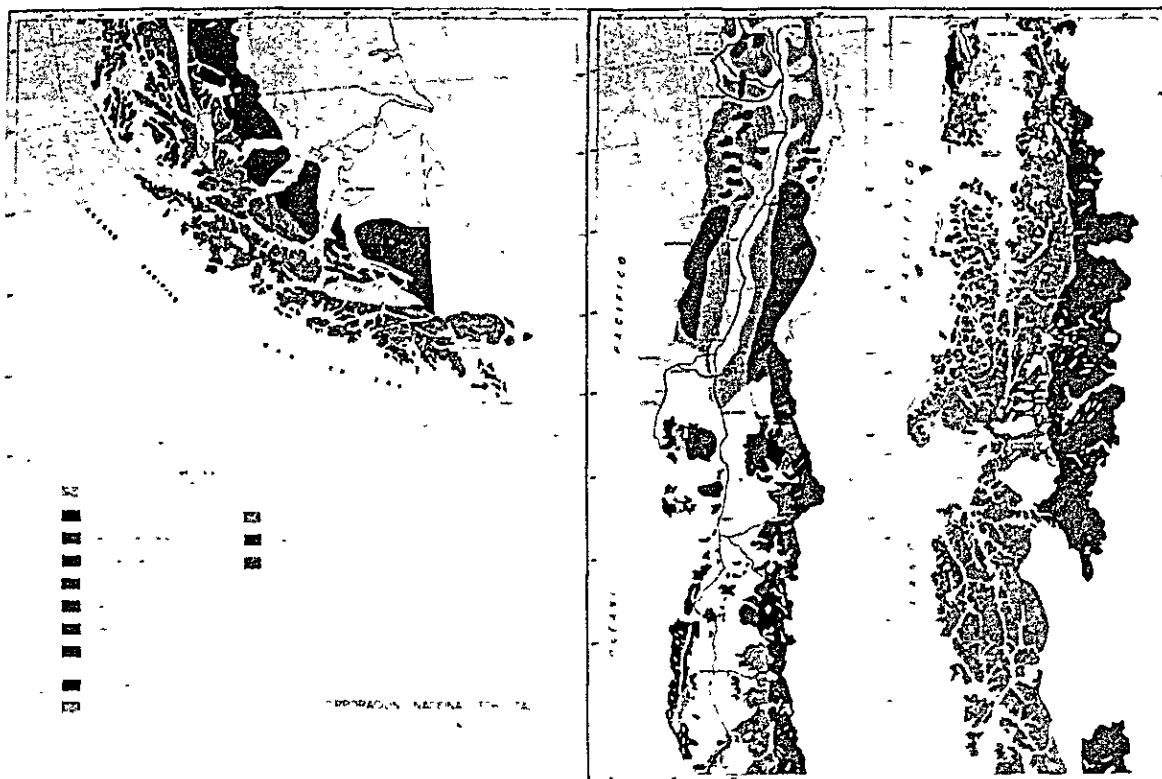
August, 1981

A handwritten signature in black ink, reading "Keisuke Arita", written over a horizontal line.

Keisuke Arita
President

Japan International Cooperation Agency

Forest Type Map

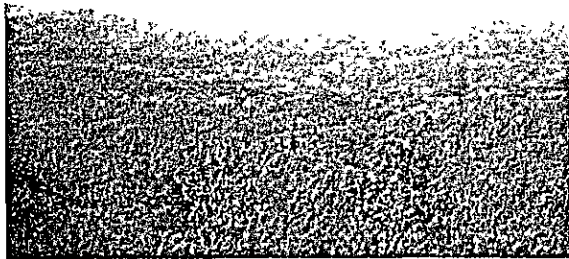


Radiata Pine Log

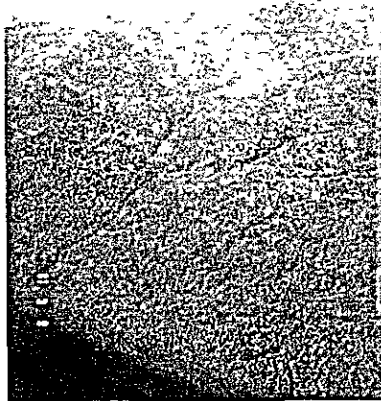
Radiata Pine Plantation of Forestal Arauco Ltda
(in Arauco)



Natural Forest around Valdivia



Natural Forest in Chiloé Island



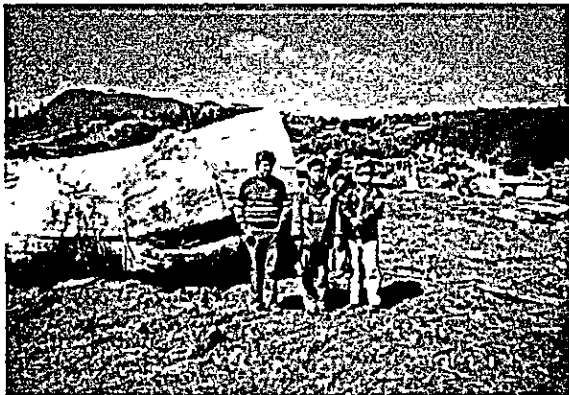
Lenga Forest (Natural Regeneration)
(in Coyhaique)



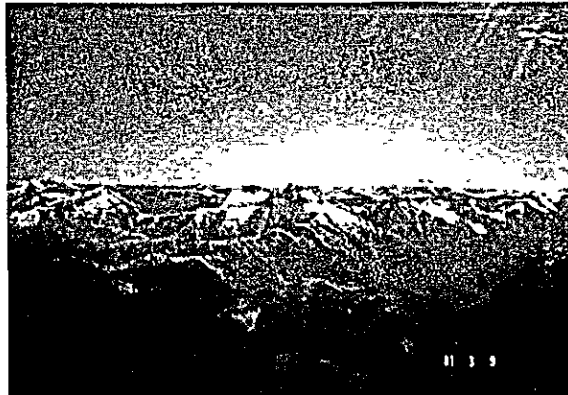
Rauli Log (Neltume)



Alerce Log from Dead Tree (in Contao)



The Andes



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I. INTRODUCTION

1. Purpose of survey

This survey was made to determine how usable tree species/stocks and other forest resources are distributed, how the environment for the investment in forestry development measures and allied facilities, etc. are in Chile, which has abundant timber resources for paper, pulp, etc; and to study the deployment feasibility in the forestry field of Japan's private enterprises.

2. Members and Itinerary of the survey team

2.1 Members

Assignment	Name	Present Position
Leader	Katsuhiko Kotari	Special Assistant to the Present, Japan International Cooperation Agency.
Cooperation Planning	Hiroshi Wakimoto	Deputy Director, Research and Extension Division, Private Forest Department, Forestry Agency, The Ministry of Agriculture, Forestry and Fisheries (M.A.F.F.).
Forest Resources	Hideo Tao	Assistant Director, Conservation Division, Private Forest Department, Forestry Agency, M.A.F.F.
Investment Condition	Harumi Kashima	Senior Officer, International Cooperation Division, Economic Affairs Bureau, M.A.F.F.
Cordinator	Ryo Kuroki	Senior Officer, Management Division, National Forest Department, Forestry Agency, M.A.F.F.

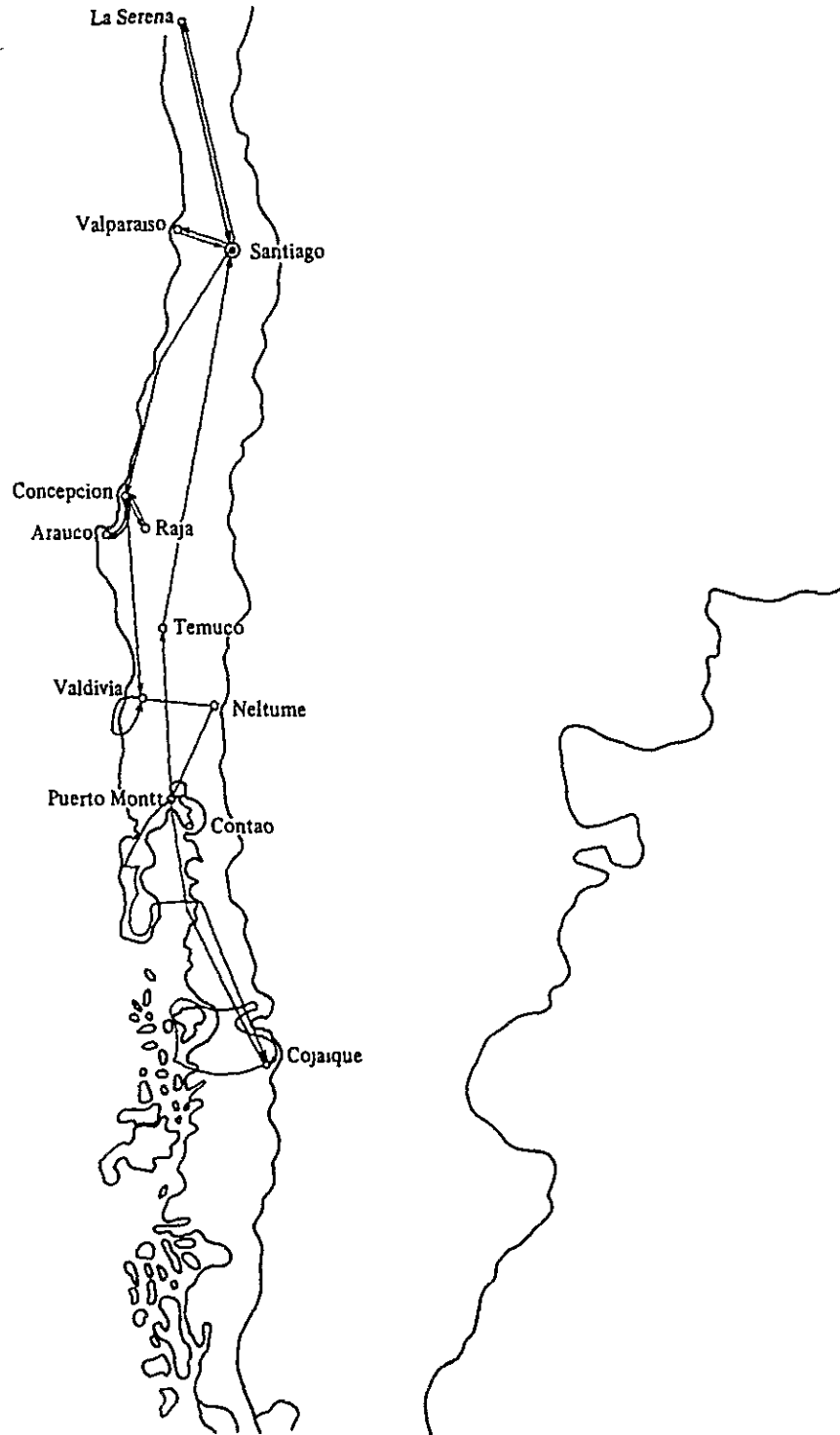
2.2 Itinerary

<u>Date</u>	<u>Survey contents</u>	<u>Overnight</u>
Feb 27, Fri.	Tokyo → Vancouver	(plane)
28, Sat.	→ Lima → Santiago	Santiago
Mar. 1, Sun.	Inspection tour of Valparaiso port	Santiago
2, Mon.	Courtesy visits to Japanese Embassy, National Corporation (CONAF), and Chilean Timber Corporation (CORMA); visit to Forestal Arauco Ltda; hearing at Sumitomo Trading Company	Santiago
3, Tue.	Courtesy visits to the Development and Production Corporation (CORFO) Chilean Forestry Institute (INFOR), Ministry of Agriculture, and Foreign Investment Committee; visit to CMPC Company; hearings at C. Itoh and Marubeni Trading Companies	Santiago
4, Wed.	Santiago → Concepcion ^{car} → Arauco Field survey (forest and pulp-plant of Arauco Company)	Concepcion
5, Thu.	Concepcion → Raja Field survey (pulp plant of CMPC Co.) Raja → Valdivia	Valdivia
6, Fri.	Visit to Austral Univ., survey of forest around Valdivia Valdivia → Neltume Survey of forest at Neltume	Neltume
7, Sat.	Field survey of forest of Panguipulli Co. Neltume → Puerto Montt	Puerto Montt

<u>Date</u>	<u>Survey contents</u>	<u>Overnight</u>
Mar. 8, Sun.	Puerto Montt → Contao Survey of local enterprise Regional Office of CONAF (Region X) courtesy call	Puerto Montt
9, Mon.	Puerto Montt → (aerial survey of forests) → Cojhaique Discussion with Regional Office of CONAF (Region XI) Visit to fishery project	Cojhaique
10, Tue.	Forest survey around Cojhaique (Aerial and ground survey), inspection of saw-mill Cojhaique → Puerto Montt → Temuco	Temuco
11, Wed.	Survey of forest of local enterprise Temuco → Santiago	Santiago (Leader joined)
12, Thu.	Visits to Chile University and Chile Founda- tion	Santiago
13, Fri.	Courtesy visit to Office of Planning (ODEPLAN) , consultation with CORFO. and CONAF, report to Ambssador	Santiago
14, Sat.	Material collection at INFOR, visit to a forest owner of Chiloe	Santiago
15, Sun.	Survey of forest around La Sereng	Santiago
16, Mon.	Material arrangement; Santiago →	(plane)
17, Tue.	→ Lima → Miami → Los Angeles	Los Angeles
18, Wed.	Los Angels →	(plane)
19, Thu.	→ Tokyo	

Fig. 1.1 Route Map

Route Map of the Preliminary Survey Team for Forestry Development
of the Republic of Chile



II. GENERAL OUTLINE OF REPUBLIC OF CHILE

1. Nature

1.1 Location

The Republic of Chile is situated on the south-west coast of South America, being sandwiched by the Andes Cordillera (east side) and the Pacific Ocean (west side). Its land extends in a long, narrow strip from south to north, a length of 4,250 Km from 18 to 56 degrees South Latitude, which corresponds to the distance from Luzon Island in the Philippines to the northern tip of Sakhalin in the Northern Hemisphere. On the other hand, its width from east to west is so narrow as 350 Km at the widest point and about 160 Km on an average. Its total area is 747,860 Km² or two times that of Japan's, while its population stands at 11,000,000, or one tenth of Japan's. Further, a heavy concentration of population in cities is seen with more than 4 million living in and around Santiago.

1.2 Topography

The topography of Chile is extremely mountainous. Longitudinally along the boundary with Argentina to the east runs the Andes Cordillera, while along the Pacific coast to the west extends the Coastal Chain in the country's central zone.

There are more than twenty mountain peaks above 6,000 meters in the Andes. The Aconcagua is 6,959 m, and the Ojos de Salado 6,880 m. Going Southwards, the altitude of the Andes decreases.

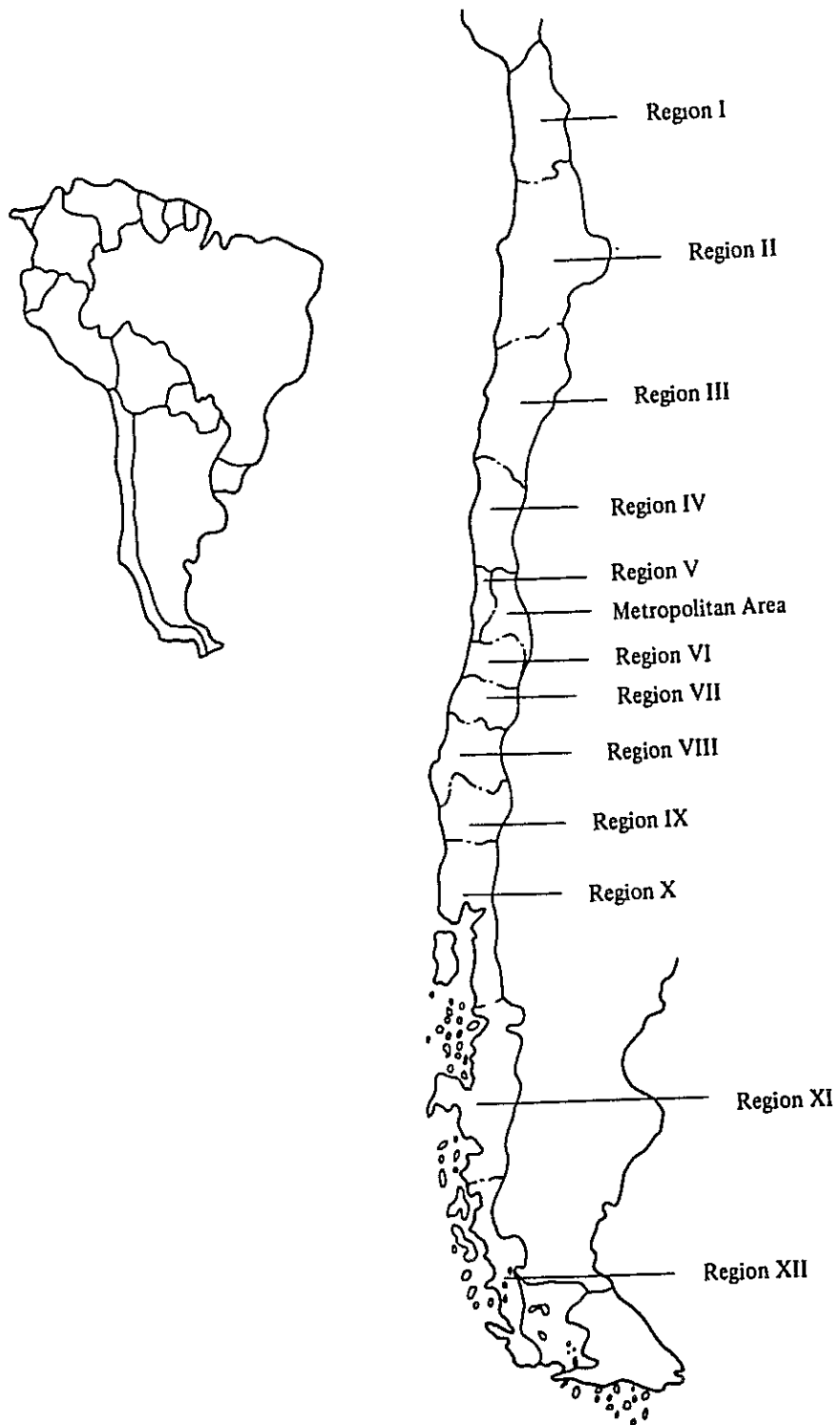
The Coastal Chain reaches an altitude of 3,000 m at some places, but are mostly about 1,000 m. They at one point disappear in the southern zone, but form Chiloe Island and more southern island groups. Further, the southern coasts and islands are topographically complicated due to subsided fjords.

Thus, the plain only extends between the two mountain ranges. According to the national land-use distribution announced by the Office of Planning (ODEPLAN) in 1968, two thirds of the country's land are not suitable for production.

1.3 Meteorology

Climate varies very much by region because of the long (from north to south), mountainous and varied topography.

Fig. 2.1 Map of Chile



The northern zone (The First through the Fourth Regions) is an area with scarce rainfall, being affected by the Humboldt current (cold ocean current). Therefore, subtropical desert extend there in this zone. The largest ones are the Atacama and the Talapara deserts. It is difficult to have agriculture or forestry in this zone, which, however, is an important zone because it has copper and other mines.

The Fifth through the Seventh Regions, including Santiago, are of Mediterranean climate with low rainfalls in summer and considerable rainfalls in winter. This zone has a tendency toward increased precipitation in its southern and coastal sections. Also its air temperature is so mild that it is not only the agricultural center of Chile but also is a prosperous stock raising area.

In the Eighth through Tenth Regions including Concepcion and Puerto Montt, we see warm and humid Westcoast marine climate with average precipitation throughout the year being influenced by westerly winds. This is the zone with the greatest precipitation in Chile and its climate is suitable for the growth of trees. Therefore, this zone is the center of the forestry activities.

In the areas from the Eighth to Tenth Regions, westerlies affects the weather, and the place has a steady rate of precipitation throughout the year. Temperatures and humidity are mild and the climate is west-coastal. Precipitation there is of the greatest amount in the country, and it is suitable for the growth of trees. The area, therefore, is the nucleus of Chile's forestry. The Eighth Region is a center of Radiata pine afforestation, while the Tenth Region is the area with the richest resources of broad leaf natural forest.

The southern-most zone, made up of the Eleventh through Twelfth Regions, are a cold area with precipitation to some extent. Also, natural broad leaf forests are located in this area, which, however, have hardly been developed. In the future development of these forests, the development of technologies for cut-over land reproduction will be needed.

III. THE FOREST AND FORESTRY SITUATION IN CHILE

1. Forest resources

1.1 Outline

According to the 1979 material of the National Forestry Corporation (CONAF), the total area of its forests (including lands suitable for forests) stands at 33.78 million ha or about 45% of the country's entire area* as shown in the Table 3.1. The northern zone has 9 million ha of natural forests, etc. mostly left undeveloped and containing such useful broad leaf trees as Coigue, Rauli, Roble and Lenga (mostly belonging to Fagaceae). There is 740,000 ha of artificial forest around Concepcion mainly containing Radiata Pine, which has already been exported to Japan.

Table 3.1 Forest Area of Chile

	Unit: thousand ha.
Land suitable for forest	33,778.5
Timber forest	10,930.0
Natural forest	8,967.5
Plantation	739.6
National Parks and Forest Reserves	13,141.4

Source: CONAF

* According to the report by Mr. Katsumi Yasuda, who is well-informed of the forestry situation in Chile through several visits, the area of Chilean forests has hitherto been said to be about 16,450,000 ha (7,130,000 ha of natural forests, 8,660,000 ha of brush lands, and 650,000 ha of afforested lands). We analyzed the relationship between this material and the material obtained in this survey, and found the area of afforested lands conceivably being increased by later afforestation, but were unable to distinctly clarify the relationship among other figures.

1.2 Natural forest

(1) Distribution

Natural forests are mostly distributed in the southern zone south of 34 degrees south latitude, but, if broken down by Region, they concentrate in particular in the Tenth, Eleventh and Twelfth Regions as shown in the Table 3.2. (83% in area and 88.7% in stock exist in these regions) The feasibility study of future development will conceivably be focused at the Tenth and Eleventh Regions.

Table 3.2 Outline of Natural Forest by Region

Region	Area	Stock
V	ha	Million m ³
	–	–
A.M.	2,700	–
VI	41,200	0.3
VII	196,400	6.4
VIII	401,700	24.1
IX	632,900	82.0
X	3,592,600	744.2
XI	1,686,000	42.2
XII	1,059,000	15.9
Total	7,612,500	915.1

- Remarks)
1. Source. 1978 Forestry Statistics by INFOR.
 2. These figures are not consistent with the figures for National Forest areas mentioned above.

(2) Tree species in natural forests

The natural forests of Chile consist of more than 70 tree-species, whose representatives are as shown in the table 3.3.

Meanwhile, cutting of *Araucaria* and *Alerce* is restricted to dead trees because of their recent scarceness in terms of resources as may be stated later under the paragraph on forestry policy. Both species are usable even if they are dead. Actually, even those which have been dead for 200 years are being utilized, and some of them are exported to Japan. However, it is considered difficult for them to become the object of future development because they are not mass-productive.

(3) Forest type

The forest types of natural forests are summarized as shown in Tables 3.4 and 3.5.

1.3 Artificial forest

The afforested land area in Chile is as great as 740,000 ha.

So far as tree species afforested are concerned, *Radiata* pine holds a 91% share. Other major species are *poplar*, *eucalipto*, *douglas fir*, etc. Distribution by state of afforested lands reveals both areal and stock concentrations in 8 states. (About 60% in area and about 70% in stock of *Radiata* pine concentrate in 8 states centered around Concepcion.)

Afforestation (including natural regeneration) of broad leaf trees is currently being tested and studied vigorously at the Chile University, the Austral University, etc., while the United Nations also are promoting such a study. These are, however, not technically established except for the afforestation of *Rauli*, the natural reproduction of *Lenga*, and so forth which are positively performed in some quarters.

Table 3.3 Major Tree-Species of Natural

Needle Broad leaf	Local Name	Botanical Name
Needle	ARAUCARIA	<i>Araucaria araucana</i> (Mol.) KOCH
"	ALERCE	<i>Fitzroya cupressoides</i> (Mol.) JOHNSTON.
"	CIPRÉS DE LAS GUALTECAS	<i>Pilgerodendron uvitera</i> (D. SON) FLORIN
"	CIPRÉS DE LAS CORDILLERA	<i>Austrocedrus chilensis</i> (D. DON) FLORIN et BOUTELJE.
"	MAÑO DE HOTAS CORTAS	<i>Saxegothded conspicua</i> LINDL.
"	MAÑO DE HOTAS PUNZANTES	<i>Podocarpus nubigenus</i> LINDL.
Broad	RAULI	<i>Nothotagus alpina</i> (ROEPP. et ENDL.) OERST
"	LENGA	<i>Nothotagus pumilio</i> (ROEPP. et ENDL.) KRASSER.
"	COIGÜE	<i>Nothotagus dombeyi</i> (MIRB.) BLUME.
"	COIGÜE DE MAGALLANES	<i>Nothotagus betvoldes</i> (MIRB.) BLUME
"	ROBLE	<i>Nothotagus obliqua</i> (MIRB.) OERST.
"	CANELO	<i>Drimys winteri</i> FORST.
"	LAUREL	<i>Laurelia sempervirens</i> (R. et PAV.) TUL.
"	TEPA	<i>Laurelia philippiana</i> (PHIL.) LORRER.
"	LINGUE	<i>Persea lingue</i> NEES.
"	TINEO	<i>Weinmannia trichosperma</i> CAV.
"	LUMA	<i>Amomyrtus luma</i> (MOL.) LEGR. et KAUS.
"	ULMO	<i>Eucryphia corditolia</i> CAV.
"	OLIVILLO	<i>Aextoxicon punctatum</i> R. et PAV.

Table 3.4 Forest Type of Natural Forest in Chile

Forest Type	Distribution	Species	Area	Production Capacity
Alerce forest	39° 50' - 43° 30'	Alerce, Coigüe, Tepa, Manio de Hojas Cortes (Punzantes) Canelo	50,000 ha	700 m ³ /ha and more
Araucaria forest	37° 30' - 39° 40'	Araucaria, Coigüe, Lengua	140,000	600 m ³ /ha and more
Cypress (Cordillera) forest	32° S - 44° S	Cypress (Cordillera), Roble, Coigüe, Hualo	S/1	S/1
Cypress (Guaitecas) forest	34° S - 55° S	Cypress (Guaitecas), Lengua, Coigüe	250,000 80,000 (Blighting)	S/1
Coigüe de Magallanes forest	47° S - 55° 30' S	Coigüe de Magallanes, Laurel, Manio, Canelo	600,000	55 - 400 m ³ /ha and less
Coigüe/Rauli/Tepa forest	37° S - 40° S	Coigüe, Rauli, Tepa, Manio	S/1	400 m ³ /ha and less
Lengua forest	36° S - 55° 30' S	Lengua, Araucaria	1,500,000	55 - 430 m ³ /ha
Roble/Rauli/Coigüe forest	35° S - 40° 30' S	Roble, Rauli, Coigüe, Laurel, Lingue, Olivillo	S/1	S/1
Roble/Hualo forest	32° 50' - 36° 30' S	Roble Hualo	S/1	S/1
Energreen forest	38° 30' S - 47° S	Canelo, Ulmo, Tepa, Olivillo, Manio	1,700,000	300 - 500 m ³ /ha
Esclerofilo forest	31° S - 37° 30' S	Espino, Litre, Quilley, Allce, Felmo, Boldo	S/1	S/1
Chilean Palm forest	32° S - 34° S	Chilean Palm	10,000	S/1

Source: CONAF

Table 3.5 Forest Type and Distribution

Name of zone	Latitude (south)	Annual rain fall		Temperature (yearly average)(°C)	Distribution of major tree-species	
		place	mm/year		afforested tree	natural tree
North Zone (Desert/scare rain zone)	20°	Arica	0.9	18.1°		
		Iquique	2.6	17.5°		
		Antofagasta	9.7	16.6°	(Algarrobo)	(Tamarugo)
Centre Zone (Artificial forest/ bush/light rain zone)	30°	La Serena	118.4	14.9°		
		Valparaiso	462.6	14.4°	(Pinus radiata)	
(Artificial forest/high- land natural forest/ abundent rain zone)	40°	Santiago	366.8	14.2°	(Populus nigro)	
		Linares	1000		(Eucaliptus globulus)	
		Concepcion	1500			
		Temoo	1190	12.0°		
		Valdivia	2498	12.0°	(Rauli)	
		Puert Montt	1995	11.1°		
		(Andes)	5000			
South Zone	50°	Puert Aysen	2940	9.0°		(Rauli)
		Aysen)	150 - 400		(Coigue-Nothofagus dombeyi)	
		Magallanes)				
	60°	Punta Arenas	416	6.7°		(Tepa-Laurelia Phileppiana) (Tineo-Weinmamaia) (Ulmo-Eueryphia) (Manio-Podocarpus) (Lenga-N. Pumilio) (Coigue Magallanes)

(1) Tree-species afforested

As stated above, Table 36, a 91% share of the tree-species afforested in Chile is held by the Radiata pine (botanical name: *Pinus radiata* D. Don). Other species being afforested are Eucalipto (botanical name; mostly *Eucalyptus globulus* Labill), Poplar (mostly Alamo negro whose botanical name is *Populus nigra* L.), acacia (mostly *Aromo australiano* whose botanical name is *Acacia melanoxylon* R. BR.), Douglas fir (Oregon pine whose botanical name is *Pseudotsuga menziesii* (MIRB) Franco.), etc.

Further, in southern natural forest areas, Rauli is being afforested on the cut-over areas of natural forests, and, in addition, Lenga is being naturally reproduced. Results are good in general, but it cannot necessarily be said that reproduction technologies are established. This is a problem to be solved in future. Therefore, they are currently tested and studied vigorously at the Chile University, the Austral University, etc., while the United Nations also are proceeding with such study.

Table 3.6 Outline of Afforested land (Jan. 1980)

Tree-species	Area	Percentage
Radiata pine	671,292 ha	91.0 %
Others	68,340	9.0
Total	739.632	100.0

Note) Source: CONAF

(2) Distribution by region, etc. of afforested lands

The distribution by region of afforested lands concentrates in 8 regions as shown in Table 3.7, which reveals that 60% in terms of area and 66% in terms of stock respectively of Radiata pine grow in the 8 regions. Radiata pine is a tree-species which demonstrates good results in areas with abundant rainfall during winter. Central Chile from the Fifth through Tenth region is located roughly on the same latitude as New Zealand and Australia which are suitable lands for Radiata pine. In particular, it grows well in an area around Concepcion, whose weather conditions, etc. are suitable. Some of the forests in that area show better results than

New Zealand. (Its average growth rate per ha is about 25 m³/year.)

According to the material of INFOR, the afforested area of Radiata pine will conceivably be extended further in future because, there exist about 5 million ha of lands suitable for Radiata pine, a vigorous policy in favor of afforestation under Law No. 701, etc. is being taken, and so forth. Further, since the afforestation of Radiata pine in Chile has hitherto mainly aimed at producing timber for pulp, tending is hardly performed at present. However, persons concerned have become more and more conscious that they should properly perform salvage cutting, thinning, etc. in future in line with production purposes.

Meanwhile, Douglas fir is being grown in highlands and such other places as are not suitable for growing Radiata pine because of its susceptibility to snow.

Table 3.7- Outline of Radiata pine forest by region

Region	Area	Stock
	ha	m ³
A.M.	750	0.1
V	10,697	1.0
VI	43,896	0.5
VII	115,105	14.4
VIII	402,692	52.7
IX	61,001	8.4
X	37,151	2.3
Total	671,292	79.6

Note) Source. CONAF

1.4 National park and forest reserves

An outline of national parks and forest reserves are as shown on Tables 3.8 and 3.9. Since in both of them cutting, etc. are restricted, they can not be the potential objects of future development.

Table 3.8 Outline of National Park

Region	Province	National Park	Area ha
I	Tarapacá	Lauca	400 000 *
		Isluga	400.000 *
IV	Limarí	Fray Jorge	6.845
		Talunay	114
		Punta del Viento	3.000
		Valle del Encanto	-
		Pichasca	-
V	Isla de Pascua	Rape Nui	6.800
	Valparaíso	Juan Fernandez	18 300
		Los Mineros	3
		La Campana	-
A.M.	Santiago	El Morado	3.000 *
VI	Cachapoal O'Higgins	Las Palmas de Cocalán	8.160
		El Bollenar de las Nieves	-
VIII	Bío-Bío	Laguna del Laja	11.600
		Ralco	-
IX	Malleco	Tolhuaca	3.500
		Nahuelbuta	5.932
		Contulmo	82
	Cuatín	Nielol	80, 65
		Los Paraguas	18.000
		Conguillio	28.000
		Huerguehue	3 900
		Villanca	13 780
		-	-
X	Valdivia	Pirihueico	-
		Los Alerzales	1.230
	Osorno	Barra del Río Buero	424
		Puyehue	117.000
	Llanquihue	V. Pérez Rosales	220 000
XI	Aysén	Lago Rosselot	12.390
		Lago las Torres	41.160
		Dos Lagunas	181
		Río Simpson	41 160
		Puerto Chacabuco	221
		Cinco Hermanas	227, 5
		Isla Guambin	10,635
		Quitralco	10 900
		Los Huemules	12.500
		Bahía Erasmo	28 320
		Laguna San Rafael	1 350 123
		Guayaneco	30 498
		XII	Ultima Esperanza
Magallanes	Torres del Paine		160.000
	Monte Balmaceda		7.900
	Palaíke		3.000
	Los Pinguinos		97
	Laguna Los Cisnes		25
	Alberto M. de Agostini		800.000
	Hernando de Magallanes		800.000
	Cabo de Hornos		63.093
	-		-
Total			6.403.171

Note) Source: CONAF

Table 3.9 Outline of Forest Reserves

Region	Province	Forest Reserves	Area ha
I	Tarapacá	Llaretales	—
II	Antofagasta	Llaretales	—
V	Aconcagua Valparaíso	Río Blanco Lago Peñuelas	10.175 9.095
VIII	Arauco	Contulmo	290
IX	Malleco Cautín	Malleco	33.640
		Malacahuello	30.000
		Vegas Blancas	250
		Nalcas	13.775
		Alto Bío-Bío Villarica	40.000 163.000
X	Valdivia Llanquihue Chiloé	Valdivia	27.000
		Llanquihue	50.000
		Alcaldeo de Rauco	9.481
		Gamboa	3.393
XI	Aysén	Lago Gerl. Carrera	178.400
		Las Guaitecas	850.000
		Coyhaique	6.052
		Isla Ester	2.651
		Lago Palena	49.415
		Lago Carlota	18.050
		Mano Negra	2.256
		Isla Magdalena	177.320
		Lago Jeinimeni	38.700
		Lago Cochrane	8.342
		Lago Ensueño	1.587
		Lago Quemus	2.000
		Puyuhuapi	189.700
		Los Mañíos	2.368
		Puerto Cisnes	163.000
		Taitao	915.000
Los Cuervos	12.700		
Cerro Castillo	179.500		
Río Pascua	122.700		
XII	Magallanes	Magallanes	13.500
		Navarino	10.500
		Yaganes	73.500
		Alcalufes	2.674.000
		Río Rubens	32.000
		Holanda	300.000
		Isla Riesco	303.750
		Languna Parrillar	20.814
Total			6.738.264

Note) Source: CONAF

IV. OUTLINE OF MAJOR PLACES SURVEYED

1. Radiata pine forest around Concepcion

The first thing we were impressed by in the afforestation lands of Radiata pine around Concepcion was their rapid growth. Afforestation technologies, mechanization technologies from cutting through processing, and so forth were at high levels. In addition, the infrastructure was also well maintained. Thus, it can be said that the forestry of Radiata pine around Concepcion is mature.

1.1 Plantation of ARAUCO Co. (Arauco)

The ARAUCO Co. (Celulosa Arauco y Constitución S.A.) together with Forestal Arauco, Ltda., its subsidiary, engage in pulp manufacturing, sawing, afforestation, etc. The Arauco Co. owns about 200,000 ha of forest, of which as much as 145,000 ha is afforestation land of Radiata pine.

The afforestation land of Radiata pine we inspected was well-grown, its breast height diameter of 30 years-old pine was 42 cm, and its average stock per ha was more than 600 m³. (See photo.)

Further, the Arauco Co. was ambitious in developing natural forests, and showed keen interest in the bid for national forests of Lengua being contemplated in the Twelfth Region. Of late, they visited Japan for market research on naturally grown wood.

1.2 Raja Plant of Paper and Carton Manufacture Co. (C.M.P.C.) (Raja)

The Paper and Carton Manufacturer Company (Compañía Manufacturera de Pales y Cartones, S.A. - C.M.P.C.) is Chile's largest consolidated pulp and paper mill founded in 1920. Their 1979 output was announced as 280,000 tons of pulp, 65,000 tons of newsreel, 216,000 tons of other papers, and so forth. Last year, their forestry branch became independent as the Minico Company (Forestal Minico, S.A.). The forest under their ownership is about 100,000 ha, most of which is afforested lands of Radiata pine. About 900,000 m³ were cut last year.

The Raja plant is a modern plant of chemical pulp. Production started in 1959 mostly using Radiata pine as material. The pulp production capacity is 440 - 500 t/day.

2. Natural forest in the southern zone

In this survey, we inspected natural forests around Valdivia, Panguipulli (Neltume), Chiloe Continental, cojhaique and on Chiloe Island, etc., all of which strongly impressed us by their rich forest resources.

Outlines of places surveyed are as follows:

2.1 Natural forest of Panguipulli Wood and Forestry Complex (Neltume)

The Panguipulli Wood and Forestry Complex (Complejo Forestal y Maderero Panguipulli – COMFOMAP) was founded as a national company belonging to the Development and Production Corporation (CORFO), but, at present, it is Chile's largest private company engaged in producing raw materials from natural forest, lumbering, and so forth. The Company owns about 310,000 ha of land, of which natural forests take up as much as about 150,000 ha with about 68 million m³ stock. The annual cut volume is about 150,000 m³, most of which is selectively cut good trees. Logging is mostly done by oxen, though partially by tractor or winch. Sixty percent of the tree-species composition is shared by Coigue, and the remaining percentage by Rauli, Tapa, Roble, etc.

A natural forest at Neltume which we inspected was explained as being composed of 400 m³ of Coigue, 150 m³ of Rauli and 50 m³ of Tapa per ha (600 m³).

By the way, it is note-worthy that Rauli has been afforested since 1975 on cut-over lands, though on a small scale, and demonstrated good results.

2.2 National Forest around Cojhaique (Region XI) (Lenga forest)

Around Cojhaique, there are many Lenga forests, which will conceivably be able to become objects of future development.

In a national forest we inspected, Lenga was naturally reproduced. Results were so favorable that natural regeneration of Lenga is considered to have been technologically established. (See photo.)

V. FUTURE TASKS AND DIRECTION OF COOPERATION

1. Meaning and tasks of cooperation

1973 was a turning point. Since then international society and economy have been forced to make big turns, whether willingly or unwillingly, and every country, irrespective of its degree of development, has been urged to solve many problems in various industrial fields which had hitherto been unknown.

As a result, countries have emerged which may change their policies to extremely protective trade for self-defense, and there also have been many countries with heightened factors of social unease, being severely affected in their economies due to the drastic hike of oil prices. Meanwhile, these changes cannot be said to have emerged all of a sudden. Rather, inherent social, economic and political factors of unease have come to the surface at that point, being motivated by the oil problem.

Amidst such global movements, in Chile, the object country of this survey, which is located in South America on the South-west Pacific, a coup d'état broke out. It is fresh in our memory that Chile's future was a matter of global concern at the time. That difficult situation was overcome by the later establishment of the regime of open liberalism, and many believe that Chile's reconstruction under the military government of General Pinochet has begun in the right direction. A clear liberalizing policy is being pushed forward to the civil government and will be brought about in time.

Now, it is difficult to push effectively and positively cooperation between two countries especially through private enterprise activities unless the politico-social stability of the party countries is secured. It can, however, be said that, at least at the time when this survey report is prepared, the parties concerned of both countries have reached the conclusion that it would contribute to the further progress of both countries to materialize this cooperation through continued persistent consultation on the way of pushing this forestry development survey as a starting point.

By the way, the meaning of development cooperation in Chile is considered to be extremely great from the following points of the survey results.

1. Japan's demand-supply of timber requires the import of overseas timber for the time being. Both quantity and quality of forest resources in Chile is considered to fully meet our expectations.

2. It will be some time before Japan's type of timbers import will be similar to that of the products imported in Euro-American advanced countries' as a matter of course, since Japanese people's tastes and building style are peculiar at present. Chile has a flexible policy of exporting logs to Japan in this transitional period from log import to product import.
3. Chile is now changing its policy for development from the heavy preference to underground mineral resources to preference to multilateral resources above the ground. In the field of forestry, there are many areas suitable for the afforestation of Radiata Pine in particular. Such areas are being extended by various means. Furthermore, the southern zone is in a stage where the development of existing useful broad-leaf tree forests has just started. And it is judged that there is great potentiality for the export to Japan of timber from such forests including Radiata Pine through such development.

The sign of the imminent development of forest resources also gives us big expectations.

4. Japan's major industrial forces are private enterprises, and this likely will not be changed in future, too. If this development cooperation by a private enterprise is materialized, it will support from the flank the switchover to a policy under private sponsorship which is one of the recent major policies of Chile.

As stated above, we referred to the importance and speciality of Japan's cooperation with Chile. Together with these, the following points should be mentioned as problem:

- a. It can be neglected that the shipping cost of such heavy articles as lumber shares a large percentage of the article's price even if shipped in the form of manufactured products. In this point, Radiata Pine or useful broad leaf trees to be imported from Chile as a result of cooperative project need a longer distance for maritime shipping than timber currently being imported from most other countries. Nevertheless, if Japan is to rely for its forest products upon South American countries, the importing condition from Chile facing the Pacific Ocean is not necessarily unfavorable.
- b. The heavy burden of infrastructure for cutting, logging and trading (in connection with ports and harbors) of timber is in many cases said to be vital to the enterprises concerned. From this point of view, Chile's conversion policy to a lower government budget is a potential factor for Japan's enterprises to hesitate to participate

in development. This point, however, can be solved to some extent through consultation between the two governments and also through the enterprises' desire for appropriate utilization of the Japanese system.

- c. In pushing the timber trade, Chilean enterprises positively desire stabilized transactions with enterprises concerned on the Japanese side. On the other hand, since Japan's economy, especially housing construction and lumber processing both closely connected therewith, does not necessarily embrace a factor which enables stabilized transactions, it is not necessarily easy for the respective enterprises to independently make firm promises for stabilized transactions on a long-term basis. From the standpoint of countries with resources, however, it is also clear in general that the cutting of forests in their own country without being guaranteed of a specified price level and stabilized amount of export is unfavorable for enterprises in the producing country unless their internal demand is elastic. Therefore, this problem may be rather said to be a problem which should be solved on the Japanese side, if Japan must depend upon exotic timber to meet her demand.
- d. The survey results revealed that Chile has some partial movements in some areas to be developed which fear the unfavorable relationship between environmental preservation and forest cutting. This point, however, should also be processed in a form of harmonizing development and the preservation of the country, and may be solved by further developing current development technologies.
- e. The positive cutting and afforestation of Chilean forests, especially of Radiata pine, are being processed in comparatively convenient places.

Further, Chilean forests have sufficient surplus capacity of export, and Chilean lumber and pulp industries will depend upon foreign capital for their development. The latter tendency will be intensified in future. As a result, further export will be made to Arabian countries, West Germany, etc. in addition to neighboring Argentina and Brazil which have actually been importing Chilean sawn lumber, pulp, paper, etc. And export to the latter countries will further be extended. Also, for Asia, exports of forest products to Japan, China, Korea, etc. are being pushed. However, with progress in its foreign trade policy and domestic timber industry, Chile's response will likely change.

Under such circumstances, enterprises with their branch offices in Chile, especially Japanese firms, seem to be hesitating because of their dismay in judging such circumstances and of the seriousness of the confronting problems. Nevertheless, Chilean government organizations' strong concerns about Japan were fully felt

by this survey.

2. Direction of cooperation

Based upon the meaning of and the problems in cooperation stated hitherto, this Survey Team would like to suggest the direction as to cooperation in development as follows:

(1) Development of southern broad leaf forests and afforestation of cut-over areas

As stated above, Chile can be said to have a policy to respond the same way to foreign enterprises as to domestic enterprises in all respects. Therefore, in developing broad-leaf forests, it is conceivably necessary to cooperate in development after fully estimating the cost sharing of road construction, etc. for the development, forecasting how far ports and harbors for shipping cut lumber will be improved, and selecting the most suitable places out of the vast broad leaf forests. It is conceivably possible for Japan's private enterprises to cooperate in heightening the current productivity of broad leaf forests, after concretely determining the lands to be developed (to include the natural forest projects in Panguipulli, Sarao, Chiloe Island and Chiloe Continental which are currently planned by the Chilean government as stated in the detailed discussions) and fully accepting the intentions of executive bodies, financing improvement costs, etc. of infrastructure for materializing these and also of investment/financing to cut-over land regeneration. Therefore, a study which does not miss these opportunities is necessary. In this case, JICA's positive support of enterprises for test afforestation and experimental afforestation is needed.

Further, in such cases, from the viewpoint of the current tempo in road and port construction in Chile as stated above, a considerable investment will be needed for the time being. Even being supported by JICA, independent execution by an enterprise will encounter considerable difficulties. Therefore, a thorough study will be needed in advance on the performance of any company to be invested in by several enterprises or performance on the basis of a positive joint venture with some Chilean enterprise. Also, in light of the rich forest resources in Chile, it will be necessary to study some counterparts of Japan's public corporations as potential developers with due regard to their relationship with existing projects within Chile, if we sincerely consider Japan's status quo where her future stabilization of timber demand-supply is keenly hoped for.

(2) Afforestation of areas afforestable of Radiata pine and cooperation by the pulp industry

Chile intends to extend more productive afforested lands through gradually selling her national forests to private enterprises. These will be afforested with the help of domestic

and foreign capital. At the same time, Chile desires investment from overseas for pulp, fiber board and other forest product industries needing large investment in equipment which is not developing satisfactorily at present. It was found that the Weyerhaeuser Co. of the U.S., and Canadian and other overseas enterprises had, to meet such desires, partially cooperated in Chile's afforestation and industrialization with tendencies to further expansion. Japan's pulp enterprises, in the past, made surveys on the presumption of the development of broad leaf forests and cooperation in afforestation on Chiloe Island. Since then, they have been doing their best for materialization. For the present, however, they are hesitating with the start of their projects due to changes in Chile's port policy and economic situation. It is considered necessary in future, too, to continue studying Chile's conclusions including cooperation among several enterprises of Japan. Further, it is also considered necessary to study coppices in zones where Radiata pine is afforestable (for example, the test afforestation at Temuco for which an additional survey request was made by a Chilean enterprise), and to study the industrialization (pulp) plan there, too. Like this, it is considered necessary in future to study surveys which would satisfy Chilean expectations towards Japan by organically connecting the mining/manufacturing branch and the afforestation branch within JICA. Meanwhile, in such cases, a full preliminary survey of the object area is necessary because of the Chilean custom that any enterprise intending to execute development is responsible for obtaining ownership of the object land.

(3) Cooperation in developing port and other infrastructure connected with social development

In consideration of, not to speak of the world-wide long-term prospects of timber demand-supply, Japan's future demand-supply of lumber especially broad-leaf trees, the development/preservation of Chilean undeveloped areas particularly the southern forests can be said to be an extremely important problem for both Chile and Japan. As stated above, however, Japan's cooperation as much as possible in developing Chile's roads, ports, and other infrastructures in the field of her social development can be said to be a prerequisite for and even the key to forest development. In the course of cooperation, it goes without saying that Chilean ideas should be fully valued, while it is conceivably necessary, too, to think of fostering infrastructure improvement through yen loan basing upon the concrete survey and cooperation in development survey projects under the positive urging of Japan. This would conceivably make Japan's enterprises, which are rather obliged to pay attention to imminent loss or profit, support the more wholesome progress of Chile's open and free economic system. Such support in itself would be more appropriate as meaningful cooperation by Japan's enterprises.

We are now thinking of such cooperation as stated above. And we would like to emphasize the necessity of the following:

To concretely clarify the results of this survey to enterprises, based upon actualities; and at

the same time

To materialize enterprises' concerns in concrete forms;

To push consultations with Government agencies concerned with facilitating continued planning to develop the specified areas and execution thereof; and

To make a second survey.

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