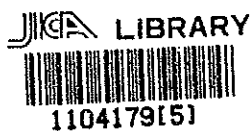


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**DEVELOPMENT OF HUMAN RESOURCES
FOR
THE FOREST MANAGEMENT
(STRATEGY FOR THE CHILE)**



24850

MARCH 1993

**JAPAN OVERSEAS FORESTRY CONSULTANTS ASSOCIATION
(JOFCA)**

国際協力事業団

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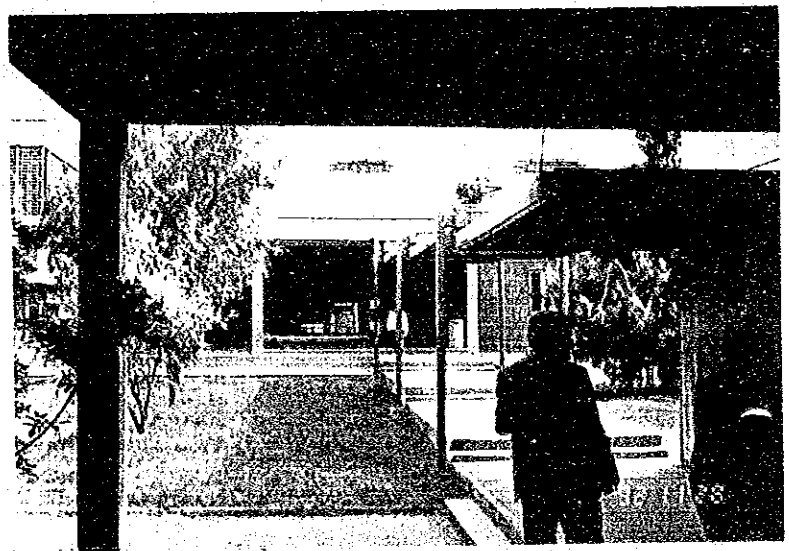
The CONAF Headquarters
(Santiago)



The sign of the CONAF Headquarters



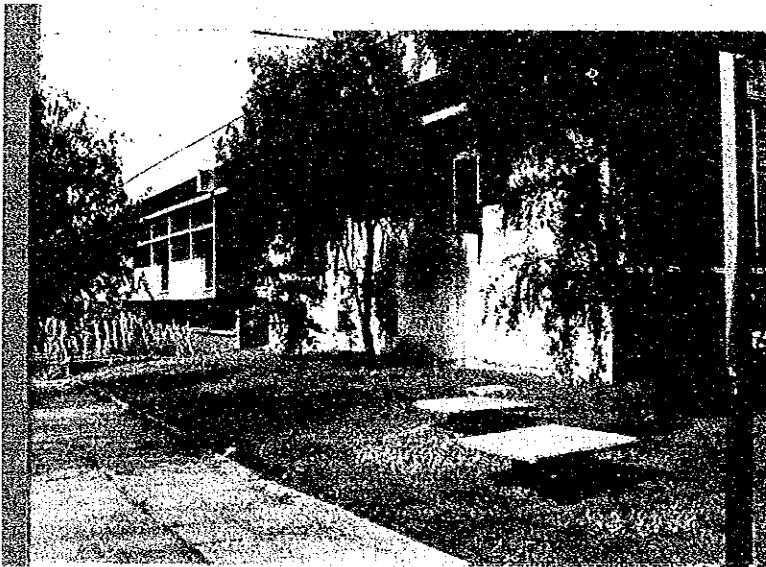
The Forestry Faculty,
University of Chile.



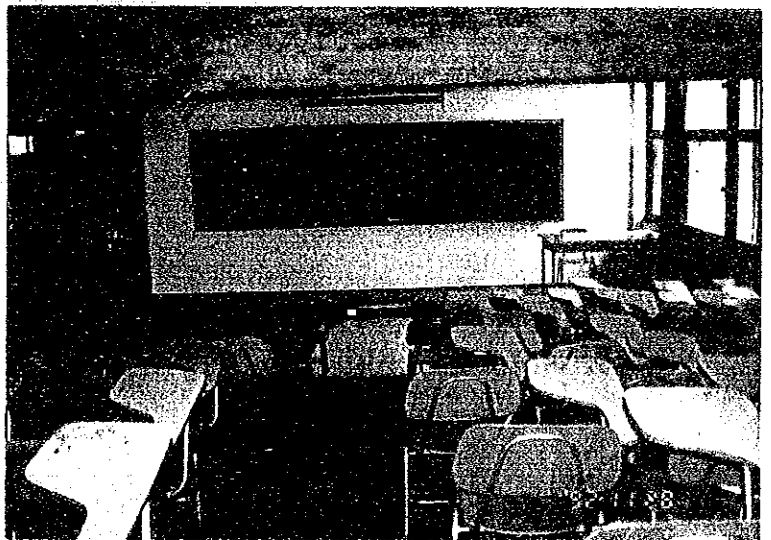
The Headquarters of University Chile



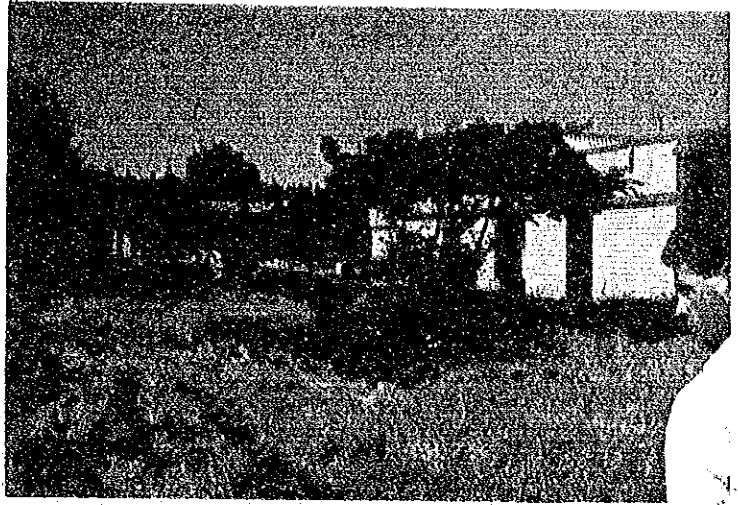
Interview with Dean (right) and
Deputy Dean of the Forestry
Faculty, University of Austral.
(Valdivia)



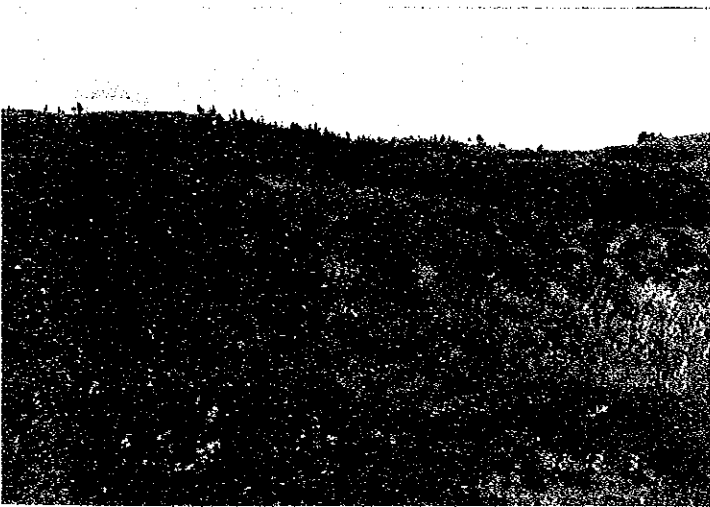
The Forestry Faculty, University of Austral



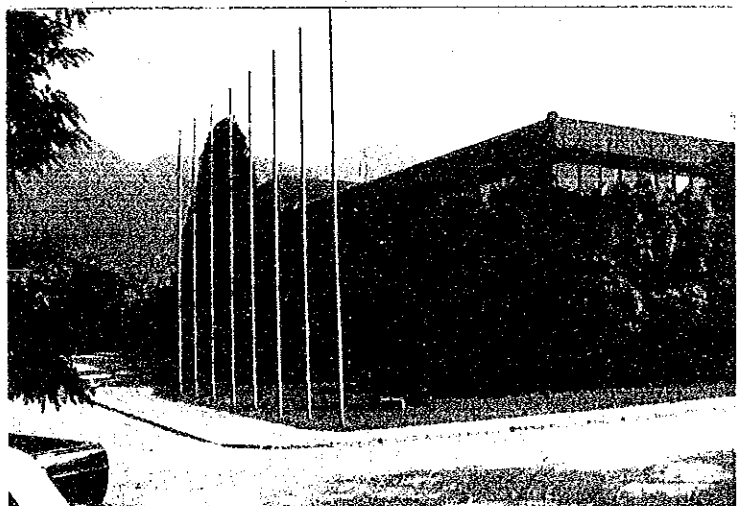
A classroom of the Forestry Faculty,
University of Austral.



The CONAF's Forestry School
(vocational training) in Concepcion.



A Eucalyptus plantation by
Volterra Co. in Concepcion.
One forester who graduated
from a university makes plans
and gives technical guidance.



The FAO Regional Office for Latin
America and Carib (Santiago)

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1. Introduction

The current rapid decrease and deterioration of forests are posing a grave threat to human beings, and the settlement of this problem has drawn world-wide attention.

Such a decrease in forests has exerted a serious influence on the social economy of developing nations that depend on agriculture, livestock farming and forestry. In addition, the decrease has also become the subject of discussion relating to the whole world, and allows no time for delay in settlement to protect the global environment from the extinction of living species in forests, global warming, and other difficulties.

In order to resolve the problem, diversified measures are required, and steps for the protection of forests and afforestation in developing nations are fundamental. However, it is an undeniable fact that in taking such steps, developing nations are short of local forestry officials, qualitatively and quantitatively, for forest management and afforestation.

Based on the recognition of problems mentioned above, this study aims at preparing and proposing, by nation, guidelines and methods for training forest management officials by taking national strategies into account after the current situation of forest management officials and their training systems in developing nations are surveyed and analyzed.

The study was conducted in Chile from the end of November through the beginning of December, 1992.

2. Current Situation of Forests

In terms of land use, the national land of Chile is classified into Classes I to VIII by natural conditions, including climate, topography, geology, and topsoil as well as social conditions, including roads and distance to markets. Of them, Classes VI to VIII are suitable for forestry. As of 1989, the territory of Chile except for the Antarctic area extends 75,703,000 ha, about twice larger than Japan. The area suitable for forestry is estimated at 33,800,000 ha (Table 1).

At the end of 1990, economic forests cover an area of 9,077,000 ha; of them, natural forests extend 7,616,000 ha, while man-made forests extend 1,461,000 ha. The breakdown of man-made forests by species is shown in Table 2. These economic forests are all privately owned.

In addition, the national assets (national forests) managed by the CONAF* are covered by the State-run National Protected Wildlife Areas System, consisting of national parks, forest reserves, and natural monuments.

At the end of 1990, there are 27 national parks occupying an area of 8,358,000 ha, most of which are concentrated in the southern part of Chile. There are 37 forest reserves occupying 5,352,000 ha, which are also concentrated in the south. Forest reserves almost consist of natural forests in the hinterland which should be conserved now and in the future in view of flood control and environmental protection. They include some forests whose ownership remains undetermined and those which should be sold to the private sector in the future. There are 19 natural monuments occupying 14,000 ha, intended to protect valuable and rare species of animals and plants, such as Alerce forests in the coastal area.

Table 3 shows statistical data on these national parks and forest reserves.

The area of forests in Chile as of 1990 is estimated at 22,802,000 ha by combining 9,077,000 ha of private forests as shown in Table 2 and 13,725,000 ha of national forests as shown in Table 3. This area accounts for about 30 % of the national land (75,703,000 ha) of Chile on the Continent of America.

Besides these, an area of about 11,000,000 ha is assumed to be usable as productive forests.

* CONAF: CORPORACION NACIONAL FORESTAL.

3. National Forestry Policies

Chile bases its forestry policies on the following two laws:

- 1) Forestry Law (1931, Decree No. 4,363 of the Ministry of Land and Colonization)
- 2) New Decree Law on Forestry Development (1974, No. 701, the Ministry of Agriculture)

The Forestry Law was enacted in 1931 with focus on national assets (forests) mainly for the purpose of forest protection and conservation, including the management of national parks as well as restriction on forest exploitation, including prohibition against cutting.

On the other hand, the Law on Forestry Development was enacted in 1974 in order to encourage the private sector to carry out economic forestry including plantation projects with the support of the government. Whereas the former emphasizes the conservation of the national land and the protection of the nature, the latter has the character of an economy law. Therefore, in 1974 when the latter was enacted, some items were shifted from the old forestry law to the new one.

The Law on Forestry Development is specifically intended to regulate and give guidance to individuals and private companies in forestry production activities through the review of their management plans, and provide them with incentives, including subsidies and tax exemptions. The process of promotion includes:

- 1) Determining Suitable Sites for Forestry: Land owners must make an application for the certification of a site to the CONAF by submitting a technical report prepared by a forester or an agricultural expert having competent knowledge.
- 2) Submitting a Management Plan for Approval: If his owned land is determined to be suitable for forestry, the owner must submit a forestry management plan prepared by a forester or an agricultural expert having competent knowledge to the CONAF for the approval within one year after the determination .

- 3) Afforestation Subsidy: An individual or a corporation which has carried out afforestation on the suitable site in accordance with the approved management plan may once receive a subsidy equivalent to 75 % of expenses on the afforestation and maintenance of the land.
- 4) Tax Exemption: The suitable land for forestry and standing trees in natural and man-made forests on the land may be exempted from land taxes on farmland. In the case of man-made forests, the land and standing trees may also be exempted from inheritance, transfer and donation taxes. In the case of natural forests, the land shall not be exempted from these taxes.

On the other hand, Chile has not established a system of designating certain areas as protection forests to serve public interests as Japan has. Restrictions on the management of private forests are checked by the CONAF when forest owners submit their own management plans. National forests are controlled by designating them as forest reserves.

For example, of natural forests, Alerce and Araucaria virgin forests, highland forests, forests in the southern marsh, and forests on the slopes near water systems are protected by prohibiting their cutting or developed without changing their configurations as far as the maintenance and management of these natural forests benefit the society.

In summary, the CONAF performs its major duties in the two following systems.

- Serving public interests --> protection and conservation of forest resources --> control and management of national forests --> administration and management of forest reserves and natural monuments (Forestry Law)
- Promoting economic activity --> improvement of forest resources mainly through man-made forests --> assistance in developing private forestry --> afforestation subsidy system, and tax credits (Forestry Development Law).

The CONAF bases its policy on the consistent and well-balanced achievement of these two roles.

Table 1 Chile's Land Use Classification

Usable Land	Area (thousand ha)	%
Farmland	5,480	7
Grassland	8,200	11
Productive Woodland	33,800	45
Others	28,223	37
Total	75,703 *)	100

Note: *)The continental area except for the Antarctic area.

Table 2 Economic Forests in Chile in December, 1990

Category	Area	%
Natural Forest	7,616,500	83.9
Man-made Forest	1,460,530	16.1
Breakdown of Plantations		
Radiata Pine	1,243,293	13.7
Eucalyptus	101,700	1.1
Atriplex	37,878	0.4
Tamarugo	20,600	0.2
Douglas Fir	11,343	0.1
Poplar	3,526	0.04
Algarrobo	3,201	0.04
Others	38,989	0.4
Total	9,077,030	100

Source: CONAF, INFOR

Table 3 Chile's National Forests in 1990

Category	Number	Area (ha)	%
National Park	27	8,358,367	60.9
Forest Reserve	37	5,351,805	39.0
Natural Monument	19	14,472	0.1
Total	83	13,724,644	100

Source: CONAF

4. Organization of Forest Management and Conservation

In Chile, forests covering an area of 13.8 million ha (41 % of all forests) are state-owned and managed by the CONAF, while 9.1 million ha (27%) of forests are and should be managed by large private companies and others for forestry. The remaining forests covering an area of 11 million ha are also privately owned, but intended to use for various purposes in the future: e.g., (1) purchase by the government as national forests, (2) management as man-made forests, or (3) conversion to agropastoral land. In the following, these systems of management will be examined.

(1) Natural Forests

Natural forests are managed by the CONAF. This organization has its central headquarters in Santiago as the capital, regional headquarters in 12 states and 13 metropolitan areas, 32 county offices throughout the country, and moreover 107 offices in administrative offices of natural parks. It has a staff of 2,500 in 1992.

The CONAF Central Headquarters consists of seven divisions, including personnel, financial affairs, and administration as well as four technical divisions. Their respective businesses are as follows:

1) Wildlife Division

This division is mainly responsible for managing and operating national forests extending 13,725,000 ha composed of national protected wildlife areas as national assets under the control of the CONAF, including national parks, forest reserves, and natural monuments. At the same time, it is also in charge of protection and control of wild faunas and floras, including conservation of valuable species, and an ecological survey of birds and animals.

2) Forest Fire Prevention Division

The CONAF has conventionally taken direct countermeasures against forest fires by locating monitoring stations in national park

areas, building its own radio networks of communication with local branches, and securing airplanes for fire-fighting. In recent years, it has shifted its commitment to enlightenment, extension and guidance so that fire prevention, detection and extinction will be carried out by private companies which possess or run man-made forests or their contractors.

3) Forest Administration Division

Under the Law on Forestry Development (Law No. 701), this division is mainly responsible for promoting the development of forest resources by the private sector. In 1989, it determined an area of 181,000 ha to be suitable for forestry (a total of 3,116,000 ha from 1974 to 1989), certified management plans covering an area of 437,000 ha (5,293,000 ha), and gave a subsidy of US\$2,555,000 (US\$67,243,000) for afforesting an area of 28,500 ha (573,820 ha).

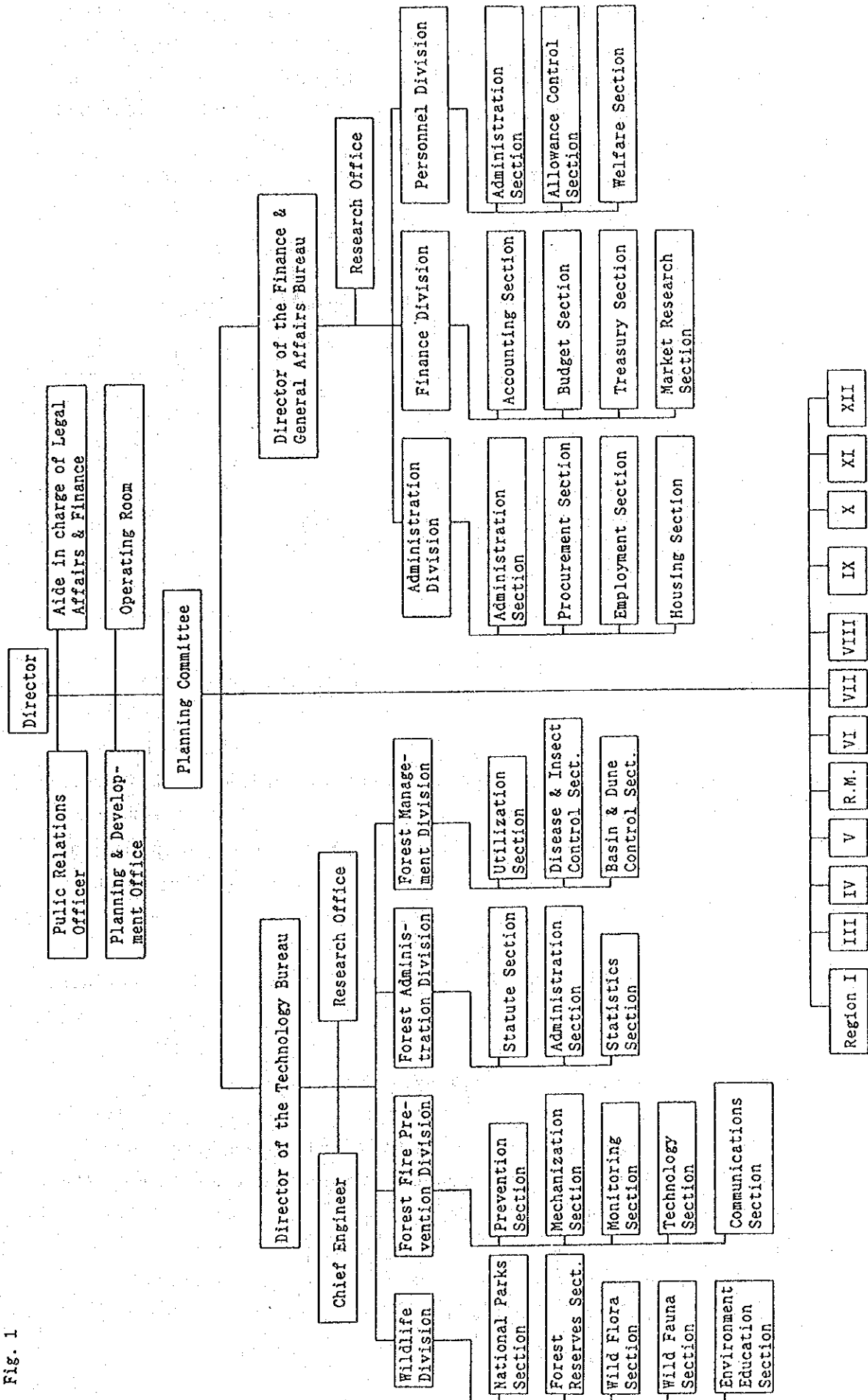
4) Forest Management Division

This division studies, evaluate and promote the management and use of forest resources, the prevention of damage to forests by diseases and insects, and watershed and dune control. It also implements various projects. Forestry technical experts from JICA in Japan are dispatched to this division, which was provided with computer equipment as part of technological cooperation in 1989.

An organization chart of the CONAF is shown in Fig. 1.

Since its establishment in 1931, the CONAF has played a leading role in promoting the development of forestry in Chile, and pushed forward the plantation of radiata pine and Eucalyptus species. After 1974, however, the government took policies for economic liberalization and reduction of governmental functions. In 1978, government projects for afforestation were totally suspended except for coastal dune forests serving high public interests.

Fig. 1



The CONAF has a total staff of 2,580 in December, 1992. Of them, about 300 members work in the central headquarters, while 2,200 members work in local agencies of the government. In the latter case, 680 members are assigned to local forestry offices, and 1,525 members are assigned to local fire prevention offices. The management staff and the staff of local fire prevention offices are shown in the following table.

	Management	Fire Prevention Offices
Headquarters	19	16
I	8	-
II	3	-
III	5	-
IV	9	37
V	12	279
RM	-	142
VI	9	233
VII	8	147
VIII	13	220
IX	14	139
X	17	200
XI	15	65
XII	20	47
XIII	9	-
Total	161	1,525

In this table, managers graduated from universities. University graduates as a whole amount to 320, of which 80 majored in forestry. The staff of 1,525 of fire prevention offices mainly consist of temporarily employed workers. In practice, the CONAF manages forests under the following various programs.

In practice, the CONAF manages forests under the following various programs.

1) Virgin Forest Conservation Program

Primeval resources distributed throughout the country cover an area of 13.6 million ha, being administered and conserved by the international and modern system.

This program is designed to protect, conserve and administer wildlife, improve knowledge of wildlife, including the distribution of wild faunas and floras and their habitats, and prevent species likely to disappear from disappearing.

Under this program, 30 national parks (8,33 million ha), 35 national conservation areas (5.26 million ha), and 9 natural monuments (14,000 ha) are designated.

2) Forest Fire Prevention Program

The system of forest fire prevention and fighting has been improved year by year.

The system has gradually been entrusted to the private sector, and companies are given guidance in preventing a fire in their own forests as well as small private plantations.

3) Disease and Insect Control Program

This program is intended to prevent and control damage to forests by diseases and insects. The CONAF implements the program in cooperation with several universities and private companies possessing their own forests.

Whereas seedlings are subject to damping-off, fungi and insects, planted trees are subject to diseases and insects. Diseases and damage by insects have conventionally occurred in only a few cases, because Chile is isolated from others by the desert in the north, the high ridge of the Andes in the east, the Antarctic glacier in the south, and the Pacific Ocean in the west.

In the large plantation of radiata pine in the central south, however, if planted trees suffer damage, there will be a high risk of expanded suffering. It is a critical problem to prevent and control diseases and insects.

A survey is frequently carried out in order to detect the occurrence and effects of diseases and insects. If they are found, an appropriate measure will be immediately taken.

At ports of entry, strict quarantine inspections are conducted.

4) Watershed Control and Dune Conservation Programs

The watershed control program is designed to rationally control many watersheds throughout the country, so that the normal ecosystem will continuously be well-balanced, and riverheads and soil will be conserved in normal condition.

On the other hand, dunes occupy an area of about 131,000 ha in Chile. The CONAF serves the conservation of dunes and the recovery of vegetation jointly with several companies. Assistance provided by Law No. 701 significantly stimulates and affects these efforts.

5) Forest Development Program

This program is mainly intended to encourage the private sector to participate in activities in forest resources development and other forest-related areas.

The CONAF provides every quarter of the private sector with information on the technical, economic and legal aspects of development.

In accordance with Law No. 701, it is also responsible for approval, assistance, and regulation when an individual or a private company classifies sites for forestry, prepares a management plan, practices afforestation, and nurtures, harvests planted trees.

6) Forestry Development Program

Under this program, the CONAF gives guidance in breeding tree species and supplies seeds in order to secure good seedlings. It also trains workers at the request of the private sector.

7) Survey and Research Program

The CONAF entrusts survey and research to the private sector as well as government agencies, such as the Forestry Research Institute (INFOR) of Industrial Development Corporation.

There are about 20 afforestation projects. On-the-site tests under the following four projects covering arid and semiarid areas are being implemented.

- * Demonstration test for the use of natural resources in arid areas.
- * Demonstration test for the introduction of species into arid areas.
- * Agroforestry and hydrological test and research.
- * Survey and research concerning the risk of vegetation disappearance.

(2) Private Forests

Privately owned artificial forests are all distributed in the range of Regions V to X, and 85% of them are concentrated in Regions VII, VIII, and IX, and managed by large companies.

On the other hand, 99.9% of natural forests (economic forests) are distributed in the range of Regions VI to XII, and 83.2% of them are concentrated in the three regions of X, XI and XII. Many of natural economic forests are privately owned by large land owners.

In the case of forest management by large companies, one or a few foresters usually prepare a management plan, and give technico of each company education and guidance in implementing the plan.

(3) Other Forests

There are other forests, the use of which will be determined in the future: e.g., conversion to agropastoral land or man-made forests, and incorporation into protection forests. The current situation of their owners has not been reported in detail.

5. Forestry Education

(1) Forestry Education

There are 24 universities and colleges which provide forestry education started between 1945 and 1982 in Chile (Table 4). Of them, 10 universities provide over five years' courses, the completion of which ensures eligibility for engineers, while 14 junior colleges provide two to four years' courses. Although the number of universities and colleges are large, only four or five famous universities have facilities, faculty and students of quality. Others generally remain at a low level. This report will briefly introduce two typical universities, namely Faculty of Agricultural and Forestry Science, University of Chile, and the Forestry Faculty, University of Austral in Valdivia in the southern part of Chile, and moreover summarize the organizations and businesses of the forestry high school affiliated to the CONAF and the forestry research institute (INFOR).

Table 1 Universities Providing Forestry Education

Name	Location	Qualification Available	Period (years)
PRIVADA	VICTORIA	ING. FORESTAL	5
U. DE CHILE	VICTORIA	ING. FORESTAL	5
INT. INV. FOR.	TEMUCO	ING. FORESTAL	5
U. DE CHILE	SANTIAGO	ING. FORESTAL	5
U. AUSTRAL	VALDIVIA	ING. FORESTAL	5
EJERCITO	VALDIVIA	GUARDABOSQUES	1
U. T. E.	CONCEPCION	TEC. MADERAS	3
U. T. F. S. M.	VALPARAISO	ING. MAD. Y PLASTICOS	6
U. T. F. S. M.	VALPARAISO	TEL. MAD. Y PLASTICOS	4
U. CONCEPCION	LOS ANGELES CHILLAN	TEC. FORESTAL	2.5
U. T. E.	CONCEPCION	ING. EJEC. MADERAS	4
U. T. E.	TALCA	TEC. FORESTAL	3
U. T. E.	CHILLAN	TEC. FORESTAL	3
U. T. E.	PTO. MONTT	TEC. FORESTAL	3
U. T. E.	COYHAIQUE	TEC. FORESTAL	3
U. CONCEPCION	CORONEL	TEC. CELULOSA Y. PAPEL	2
U. T. E.	CONCEPCION	TEC. SECADO ENMADERACION	2
SAG-MIN. EDUCACION	CONTULMO	TEC. AGRICOLA SILVICOLA	2
ESC. AGRIC. "EL VERGEL"	ANGOL	TEC. AGRIC.	2
U. CONCEPCION	CONCEPCION	ING. CIV. QUIMICO CELULOSA Y. PAPEL	5
U. CATOLICA	TALCA	TEC. FORESTAL	3.5
U. CONCEPCION	CHILLAN	ING. FORESTAL	5
U. TALCA	TALCA	ING. FORESTAL	5
U. BIO-BIO	CONCEPCION	ING. CIV. IND.	6

(2) Problems for Forestry Education

In talks with people from universities, forestry research institutes, the FAO, and enterprises, various problems were pointed out in respect to forestry education on the university level and training on the vocational school level in Chile.

First of all, in higher education to foster high-class foresters, as already mentioned, there is a gap in the educational climate between famous universities and others. That is, although many

universities and junior colleges have forestry-related faculties in Chile, only some famous universities provide good facilities, and ensure advantageous qualifications after graduation. Others are generally inferior to them in terms of educational and professional careers. Therefore, it is important to improve the quality of higher education rather than to increase the number of universities. The following points should be noted.

- 1) As one of characteristics of forestry, the content of education tends to be extensive but shallow, ranging from afforestation to lumber use. Teachers, who specialize in their own limited fields of study, cannot respond to social changes and diversification. It is recommended that students should be led to actively learn things by themselves without cramming.
- 2) A cooperative system with private companies and consultants should be established in both research and education on the university level in order to promote exchange of information, transfer of technology, and conference.
- 3) The forestry faculty was traditionally under the strong influence of German forestry, and teachers and researchers were dispatched to German universities to gain qualifications. In recent years, many of them have studied in the United States and the United Kingdom. Thus, new generations have begun to think of forestry in a different way from old generations.
- 4) In many cases, budgets to universities are too deficient to replace obsolete experimental equipment and practice facilities. Students cannot master the use of the latest equipment during the education, and will be often embarrassed by such equipment after employment. In particular, office automation equipment and computers should be replaced with new ones.
- 5) Lectures tend to be overspecialized. Knowledge should be provided to students in view of actual conditions of the society. For example, in silviculture, many researches, accumulated knowledge, and lectures are biased for the plantation of fast-growing species partially by the influence of conventional forestry policies. There are a few unique researches concerning

natural forests and the plantation of indigenous species; in many cases, teachers and researchers depend on foreign literature. This is a critical problem for both researchers and teachers. It is needed to enrich the content of education as well as research in close cooperation with private companies.

On the other hand, there are lots of companies involved in forestry and the forest industry of Chile, and now increasing. These companies generally ensure higher salaries than government agencies, universities, and research institutes, and offer attractive jobs to many foresters. However, their treatment of foresters and business strategies raise several problems.

In the case of full-time employees of typical leading companies, the composition of forestry staff often has a reverse pyramid structure; that is, foresters who received five-year education at universities represent the majority, while graduates from junior colleges or high schools represent the minority. The majority of senior employees who received advanced technical education join the management sector of the organization, and perform mainly desk work. They rarely undertake field operations. Field operations are mainly undertaken by part-time technicians and subcontractors.

For example, in a main company having about 100 employees, it is not rare to employ 4,000 to 5,000 temporary workers for field operations. Their assignments will be changed whenever they are employed by different companies. Accordingly, they cannot use their own skills, or become enthusiastic about their jobs. This reduces the efficiency of work and degrades workmanship in the field. The above-mentioned forestry high school affiliated to the CONAF provides systematic training for upgrading the skills of middle- and lower-grade technicians and workers, who, however, are not so enthusiastic about training because employment by companies is unstable.

6. Proposals

(1) CONAF's On-the-job Technical Training

As previously stated, the CONAF has forestry offices throughout the country, and a network of fire prevention offices, whereby forests are managed systematically and technically.

Foresters who graduated from colleges of forestry make a plan for forest management, and take the responsibility for on-the-job training of the staff and workers in the organization. This has obtained good educational results.

In the following, some problems to be improved will be considered in order to upgrade the quality of the staff and make forest management perfect.

1) Reinforcing the Survey of Forests and Assessing Forest Resources.

Techniques for surveying and analyzing forestry should be modernized. In this point, our cooperation with Chile is now under way in surveying forest resources. This will bear fruit in due course.

2) Taking a Wide Range of Approaches to Environmental Problems

Although the protection and management of national parks have so far obtained remarkably good results, environmental problems have recently been diversified. One of examples is to plant trees in semiarid areas as part of efforts to prevent the earth from being desertified. Having appropriate arid sites, Chile needs to improve its technical approach to this problem as soon as possible. In this point, a new cooperation program will be launched, and we would like to expect much from the program.

3) Improving a Technical Approach to Forest Fires

This is one of businesses which the CONAF gives high priority. However, damage by forest fires is still not small. If more effort is made to improve technology and reinforce manpower, loss

of resources and environmental value will be prevented, and an invaluable benefit will be brought.

Beside these, there remain various problems, which will be discussed as problems for the whole of Chile in the following sections.

(2) Training Forestry Technical Officers who Graduated from High Schools

On the other hand, to improve forestry operation and forest management, excellent forestry technical staffs who graduated from high schools are highly demanded as field supervisors. It is especially required to carry out the advanced and multiple applications of forests, the full conservation of valuable forest resources, the nurture and high-level use of resources for sustainable development, and the production of quality forest products and processed products to meet the needs of the market.

To satisfy the needs of the times, it is increasingly important to promote cooperation between high-level foresters as university graduates and middle-level technical staffs as high school graduates. For the former will take responsibilities for making a plan and developing technology, while the latter will mainly carry out the plan and technology in the field. Thus, they will make contributions to forestry in their respective ways.

This is a common problem to Chile and Brazil. High-class foresters as university graduates and low-class workers are well trained. In contrast with this, the education of middle-class technical officers in forestry is not satisfactory, and a weak part of the training system.

The FAO Santiago Office takes the same view of the present situation. It previously attempted to train middle-level technical officers only to become an engineer school. In its opinion, it would be better to improve and reinforce an existing organization because middle-level technical officers are highly demanded.

In this case, however, it is important for the CONAF and private companies to employ technical staffs who graduated from forestry

high schools by paying good salaries for their skills.

In particular, a current shortage of technical staffs to manage natural forests may cause good forests to disappear at a rapid pace.

(3) The CONAF's Forestry School (CENCAFE)

CENCAFE currently makes a contribution to social and labor policies by providing vocational training to the young who have no jobs to help their employment.

Its training courses are requested by companies, and very practical. This must be an important aspect of training.

(4) Training in the Area of Forest Product Processing

Major forest products in Chile include radiata pine, Eucalyptus and natural beech lumber. Lumber of these species is valuable, and can be qualitatively improved by methods of upbringing (nurture, etc.), harvesting (cutting), and processing (more applications). This area of training is significant, and attracts much attention of our Chilean counterparts.

(5) Silviculture of Local Species

Chile is an advanced nation in South America in terms of afforestation. Radiata pine and Eucalyptus as exotic species combined account for over 90% of all plantations in Chile. By contrast, plantations of local species are extremely few.

The use of local species should be increased to meet the needs of the times. Silviculture involves natural regeneration as well as afforestation. It is considered that natural regeneration becomes more important as the altitude and latitude rise.

Breeding techniques should also be included in silviculture. It should be kept in mind that the introduction of breeding techniques into afforestation will make much difference in the value of lumber up to 10 times or over 100 times in the long term even if the same

costs are incurred.

Practical and technical training in this area is extremely important and should be reinforced at both the university and high school levels.

(6) Mastering Advanced Technology at University

Like other nations, Chile faces the problem of obsolete and deficient research equipment in educational institutions.

There are needs for various types of OA equipment, computers, processing machines (for more applications), and analysis equipment (for environmental study), and training students in using them.

7. References (Forestry organizations and other information)

(1) The Faculty of Agricultural and Forestry Science, University of Chile

This university has the three faculties of agriculture, veterinary science, and forestry. The Faculty of Forestry has three courses in silviculture, forestry management, and wood technology. However, the faculty does not such a lectureship system with professors at the top in Chile as it has in Japan. Instead, the three courses have their respective research institutes, where many researchers qualified for doctors and masters carry out several research programs, and give lectures on their special subjects to students in the forestry class in accordance with the curriculum. The Faculty of Forestry, which has a history of 40 years, was moved to the present location 15 years ago.

The three institutes have 37 full-time lecturers (researchers) who give lectures in the specified term of the year, and about 40 part-time lecturers who are on the staff of the institutes as well as technical experts from private companies. The latter transfer the latest technologies for processing products and data which their companies possess. Part-time lecturers are usually employed under the one or two years' contract, and give a one or two hours' lecture per week.

It takes five years to complete the curriculum of the faculty. After they complete the basic and technical courses, students must study their respective majors for one more year in the institutes and submit their reports. Then, they will be qualified for foresters. The faculty distributes classes in ten semesters. Students receives lectures and practice for 30 to 35 hours per week in the ratio of 6 to 4. This university gives more weight to practical training, and imposes various types of practice to students during the long summer and winter vacations as well as the semesters. They are given four opportunities for practice in five years. In the first practice, they receive basic training as forestry workers in experimental plantations and others. In the second and third, the University gives them some theme, and in the fourth, students receive training from companies. Through these

efforts, cooperation between university and industry will be reinforced, and contribute to employment.

There are 70 to 80 freshmen at the time of admission, who will decrease as they advance. Of them, about 30 to 40 students graduate from the University. There is a master's course. Graduates will be qualified for masters, if they study their majors in specific offices for two or three years, give lectures to undergraduates, and submit their own monographs. There is no doctor's course. Those who wish to be doctors will go to German or French universities under contract. Many graduates get jobs through connection with companies built up during the study.

(2) University of Austral

This is a university located in Valdivia in the southern part of Chile. It has the ten faculties of 1) philosophy, 2) sociology, 3) economics, 4) natural science, 5) engineering, 6) Medicine, 7) oceanology, 8) fisheries, 9) agriculture, and 10) forestry. The Faculty of Forestry was set up in 1955, the second oldest following the Faculty of Agriculture. These faculties are somewhat different from those of Japanese universities.

Like the above-mentioned University of Chile, the Faculty of Forestry has the three research institutes of silviculture, forest management, and wood technology, and the forestry class (school) to which students belong.

The Silvicultural Institute has 20 researchers composed of 4 doctors, 2 masters, and 14 bachelors. The Forest Management Institute has 14 researchers composed of 4 doctors, 3 masters, and 7 bachelors. The Wood Technology Institute has 12 researchers composed of 4 doctors and 8 bachelors.

It takes five years to complete the bachelor's course, where one year is divided into two four-month terms, and therefore there are a total of ten terms. The ratio of lecture and practice is 6 to 4. The University attaches importance to practice, which ranges from seedling culture, planting, weeding, and nurture to plant classification and identification, forest plans, general practice,

and the survey and inspection of places across Chile.

About 300 students are enrolled in the Faculty of Forestry. Although 80 students annually enter the University, they will decrease under the credit system as they advance. Of them, about 40 to 45 students graduate from the University. The annual tuition is about 520,000 pesos. Whereas government agencies and universities offer a salary of about 200,000 pesos to new graduates, private companies offer about 250,000 to 300,000 pesos. Although many graduates previously joined government agencies, they have increasingly come to choose companies offering higher salaries in recent years.

The master's course accepts about 10 students per year, including many foreigners.

There is no doctor's course. Those who wish to be doctors will go to foreign universities on scholarships.

(3) Forestry Schools (CENCAFE) Affiliated to the CONAF and Extension Projects

Two forestry schools of this type are located in Santiago, and one school is located in every state. They train middle or lower-grade forestry technicians and workers with focus on practice.

The forestry school in Concepcion in the south where lots of plantations exist provides satisfactory training on a large scale. A total of 25 courses of training are available throughout the country, including seedling production, planting, nurture, logging and yarding, forest fire prevention, and erosion control afforestation. One course allows for 25 to 30 students. The school in Concepcion currently has three courses in which 75 students are trained. The staff of the CONAF account for about 50% of them, while employees of other enterprises and private companies account for the remaining half. It is said that there are some 80,000 lower-grade technicians and field workers who need training around the country. Of them, about 18,000 persons have been so far trained.

One course takes four months: one month for lectures and three months for practice. Whereas only lectures are given at this school, practice is carried out in other places. Lectures are given for 8 hours per day, and around 200 hours per month. The majority of lecturers are part-time middle-grade forestry officers from the CONAF and enterprises. Forestry education at this school is given as part of the CONAF's social work and extension activities. Trainees do not have to pay any training fee. The CONAF makes an annual plan for training, and implements it after obtaining the approval of the Development Bank and the Ministry of Labor which provide it with financial assistance.

Educational problems for this school are pointed out as follows.

Many of trainees are field workers, and generally do not have basic knowledge enough to follow the class. As a result, they are not enthusiastic about training. Rather, they have such a complaint that they cannot obtain special qualifications for better vocational treatment even if they graduate from the school. On the other hand, lecturers are not sufficiently capable of training them or responsive to social and technological progress. Equipment for practice is too obsolete to fit field operations.

In addition to the management of forestry schools, the CONAF carries out several projects for training and extension activities. For example, 1) technical guidance to forestry enterprises, and the monitoring and evaluation of the results; 2) advice on the operation and maintenance of small- and medium-sized sawmills; 3) guidance to petty farmers in afforestation and lumber use in the northeastern arid area; and 4) extension courses covering various enterprises.

(4) Forestry Research Institute (INFOR)

INFOR as an institute affiliated to Industrial Development Corporation provides and extends the accumulated results of several research projects to private companies and public organizations in the areas of afforestation, forest survey, forestry economics, and forest industries. In these efforts, it contributes to the development of national economy. Its businesses are divided into the following five sectors.

1) Economic Sector

This sector is responsible for the study, analysis and evaluation of economic activities in utilizing forests, and the publication of the results. For this purpose, seven researchers are engaged in research and extension. They give instructions for management analysis required for business development to not only large enterprises but also small forest industries and small land owners. They also help them cope with the impact of their businesses on the environment by providing them with necessary information. To be concrete, they:

- i. Provide general information on the economy of the forestry sector;
- ii. Show projections of domestic and foreign lumber markets;
- iii. Recommend possible investment in infrastructure to improve factory facilities of small- and medium-sized enterprises in the prospect of raw material available and sales;
- iv. Evaluate projects for utilizing forests from a socioeconomic point of view; and
- v. Analyze the impact of forestry projects on the environment.

2) Forest Industry Sector

In Santiago and Concepcion, this sector carries out researches on the general use of lumber, secondary processing of various types, and the use of special forest products, and the results are reflected in training and guidance. It has eight researchers, who study chemical treatment of various types or the use of extracts, and give advice on the design and construction of facilities for forest industries. They contribute to the diversification of exported products and their qualitative improvement as well as the domestic consumption of forest products. They conduct researches and provide information in the following fields.

- i. Introduction of enterprises involved in drying, processing and preserving lumber, and their details.
- ii. Physical properties of materials and processed products.
- iii. Applications of lumber to various types of construction.
- iv. The use of lumber as fuel and its evaluation.
- v. Various chemical products extracted from lumber and their properties.
- vi. General information on technological development in the forest science.
- vii. Technical support to sawmills.

3) Afforestation Sector

The Santiago, Concepcion and Coyhaique Branches developed research programs for the conservation and nurture of natural forest resources and the nurture of man-made forests under different conditions of location. Eleven researchers specifically carry out researches on the selection of species, the development of silvicultural techniques, the control of soil and water resources, breeding and improvement, and forest diseases and damage by insects, and extensively report the results. Tests for adaptation are mainly conducted in Concepcion and Coyhaique, and the results are provided in technical training courses.

4) Forest Management Sector

There are 16 researchers in this sector. They undertake quality control by monitoring, the analysis of forest productivity, and the development of simulation models of growth in order to quantify forest resources, develop surveying methods, and forecast the future stock of lumber resources.

They specifically conduct researches and provide information in the following fields.

- i. The facts about the regeneration species which grow vigorously in natural forests, and the development of simulation models for rational management and development.
- ii. The development and administration of forests by building a remote sensing system with satellite-sent images.
- iii. The separate preparation of distribution maps of natural and man-made forests.
- iv. The possibility of supplying raw material to the forest industry.
- v. The productivity of land on an application basis.
- vi. The preparation of a scheme drawing for administering forests.
- vii. A list of available properties of different species.
- viii. The compilation of Basic material for companies to plan and evaluate land.
- ix. The evaluation of forest resources by application.
- x. The development of methods for studying forest types.

5) Finance and Administration Sector

This sector offers services related to clerical administration and finance through five experts. They are responsible for:

- i. Supplying equipment and manpower requested by the technical sector;
- ii. Preparing, printing and selling literature and documents; and
- iii. Providing data through the computer center.

INFOR has thirty years' experience of research on inventory, forest planning, and lumber processing, about twenty years' experience in the administration of natural forests and the forest chemical industry, and ten to twelve years' experience in new fields, including the simulation modeling of forest growth and stock, and the study of diseases and insects harmful to forests.

(5) References to Forest Conservation and Administration

1) Countermeasures against Forest Fires

As one of its important commitments, the CONAF also promotes the general conservation of forests, though it is likely to be shaded by the economic development of forestry.

Its comprehensive measures for forests cover the prevention of forest fires, the prevention and control of diseases and insects harmful to forests, the maintenance of the normal ecosystem, the conservation of soil and basins, and the recovery and protection of dunes.

In this section, only forest fires will be discussed.

Fortunately, the occurrence of forest fires has recently been decreasing throughout the country. The CONAF educates and enlightens the public in preventing fires in national parks and other forests. It is ready to provide technical support any time to those who live in forest areas.

Local police stations cooperate with the CONAF, and instruct local residents to report a fire first to the police immediately after they detect it. Fire lookouts are located in national parks and others, while the CONAF's local branches have their own communication networks (radio) and fire-fighting airplanes.

Large companies in the south ask forest fire-fighting teams (contractors) to patrol their own forests from October to May in the dry season. Such teams are equipped with light planes, helicopters, and vehicles.

Farmers are obliged to report it to the CONAF and the police when they burn pastures. If they neglect this duty, they will be punished.

Planned burning required for agroforestry is carried out in over 20,000 cases covering an area of 500,000 ha per year.

In October, 1988, the CONAF made a range of new regulations for the use of fire in agroforestry. They classify needs for and restrictions on burning at various levels, and the CONAF regulates and supervises burning plans in accordance with the classification.

The classification, being based on frequency, necessity and dangerous conditions of burning, divides areas into three levels of regulation, namely maximum, medium, and minimum except for some special districts.

Prior to the season when fires are likely to occur, the CONAF must make arrangements for necessary persons and equipment. It uses "the warning index to stop burning", and makes it known to the public everyday through local radio stations and other communication facilities. Thus, it can transmit the degree of danger to those who plan to burn pastures on a specific day.

Many of local communities where forests exist fall under dangerous areas requiring the maximum level of regulation.

Table Areas Damaged by Forest Fires in hectares (1987 - 1988)

Region	Fire Cases	Plantation				Natural Vegetation				Total
		Pine	Eucaly.	Others	Total	Thin	Shrub	Grass	Total	
III	2	-	-	-	-	-	20	10	30	30
IV	48	-	2	2	4	40	292	254	586	590
V	1,186	77	181	22	280	330	662	811	1,803	2,083
RM	479	1	28	-	29	150	573	1,280	2,003	2,032
VI	202	188	11	-	199	124	884	364	1,372	1,571
VII	405	590	38	-	628	970	1,812	700	3,401	4,119
VIII	1,718	15,327	2,016	360	17,703	2,248	5,532	6,674	14,454	32,157
IX	520	1,179	91	-	1,270	1,646	1,164	1,396	4,206	5,476
X	410	225	8	2	235	12,992	1,595	213	14,800	15,035
XI	174	-	-	1	1	896	1,367	2,070	4,333	4,334
XII	63	-	-	-	-	112	168	1,028	1,308	1,083
Total	5,207	17,587	2,375	387	20,349	19,517	14,069	14,800	48,386	68,735

Table Forest Fire Control (1987 - 1988)

Region	Frequency of Report	Area Covered (ha)
III	50	662
IV	366	4,816
V	141	2,235
RM	1,973	23,509
VI	1,729	19,559
VII	2,612	29,673
VIII	6,183	130,760
IX	4,662	147,066
X	3,703	44,365
XI	374	1,708
XII	120	4,698
Total	21,913	409,051

2) Actual Conditions of Land Ownership in Region IV

The forms of land ownership in Region IV are largely divided into two, namely hacienda and agricultural communities. Both of them emerged when the Spanish king granted an extensive area of land to Conquistadores.

In the case of haciendas, the land received from the king has continuously been inherited to date without being divided. A hacienda purchased an adjoining piece of land from the agricultural community to expand the area. Every hacienda had the three working classes of peon, inquilino, and tenant.

