

# **INTERNATIONAL TRADE AND SUSTAINABILITY OF THE CHILEAN FORESTRY SECTOR**

Raúl O’Ryan

Gabriel Fierro

## **ABSTRACT**

In this paper the vulnerability of Chile’s forestry trade to environmental threats is explored. The increasing concern for the environment by consumers, together with the life cycle approach to products has created a new context for forest exploitation. The new trend in consumer based voluntary instruments, requiring an increasing use of eco-labels and forestry certification schemes, that can be used as trade barriers, is discussed. In particular the uncertainty related to the definition of sustainable forestry management is examined. The link between this trend and the interests of social and environmental NGO’s, represents a potential threat to forestry sector development. These are not theoretical concerns, as exemplified by Chile’s forestry sector development in recent years: at the production stage, the use of chlorine has been banned increasing production costs; native forest exploitation and plantations have come under increasing scrutiny, based on allegedly, unsustainable forestry practices; forestry development in Magallanes is being put under intense pressure by NGO’s. The result is an abandonment of native forest by forestry firms, and the reduction in new plantations, even though most allegations have a weak base.

**Key words:** Environmental and Natural Resources, Forestry Policy, International Trade, Protectionism.

**JEL Classification:** F13, Q23

**INTERNATIONAL TRADE AND SUSTAINABILITY**  
**OF THE CHILEAN FORESTRY SECTOR**<sup>\*</sup>

## **1 Introduction**

Concern for environmental issues has increased significantly in recent decades. As a result new environmental agreements are signed periodically, and both national and international governmental regulations are being developed to ensure that the production, transport, use and disposal of goods and services are not harmful to eco-systemic balances or the preservation of human life. Developed countries have pioneered environmental protection measures. In less developed countries, particularly Chile, aspects relating to the protection and recovery of the environment are increasingly being incorporated into economic activities.

The trend towards globalization and economic integration processes seen in the world today affects the interests of various social groups in each country, giving rise to reactions against international trade liberalization. One of the arguments used by the power groups that are affected, supported by environmentalists, alleges ecological dumping or unfair competition owing to the lower environmental standards that foreign producers have to adhere to. These allegations are especially made against suppliers from developing countries. As a result, groups who do not want external competition, or even fear it, petition for bilateral or multilateral trade treaties to contain equivalent environmental regulations (this is known as harmonization of standards) (Bhagwati, 1996)). Alternatively, they lobby for trade barriers to be applied against producers from countries that have different or less stringent environmental rules. This has given rise to the concept of “green protectionism” (The Economist, 1993; Sheenan, 1994).<sup>1</sup>

Protection against foreign competitors may be open and formal, as in the case of marketing orders, or else may be practiced in a concealed and informal way. This arises when producers or other market agents directly or indirectly threaten their foreign competitors with a variety of types of trade restrictions, forcing them to take “voluntary” preventive actions which in the end raise their

---

<sup>\*</sup> The authors are grateful for the comments and suggestions from Aldo Cerda, the help of Georgina Paniagua and Lorena Cuenca, and the financial support of The Andrew Mellon Foundation. This paper will appear soon in the Book, *New Faces of Protection in Latin America and the Global Economy*, R. Fischer (ed), McMillan Press, Santiago.

<sup>1</sup> From the economic point of view, proposals for harmonization and uniformity of environmental standards have no justification, and would generate inefficiencies and welfare loss. For a recent demonstration, see Bhagwati and Srinivasan (1996).

costs and reduce their competitive power. In this type of protectionism, which is known as a contingent protectionism, the effects are achieved without any explicit punishment being applied to the exporter. As a result, it is not identified by the official national or international agencies that regulate or protect trade. An example of this type of protectionism are the threats faced in European markets by suppliers of wood pulp bleached with elemental chlorine, which has forced producers to invest in new bleaching technologies in order to maintain access to that market. More generally, the life-cycle approach is now the basis for new pressures on developing country producers, based on consumer preferences. These pressures include increasing requirements for sustainable forestry management, and the reduced use of resources and generation of pollution.

In Chile, where exports have been the engine of economic growth in recent decades, possible protectionist measures arising in countries that purchase its products are a permanent source of concern, especially since the activities that have developed most in recent years (mining, forestry, fruit growing and fishing) are based on the exploitation of natural resources and therefore highly prone to allegations of environmental damage.<sup>2</sup> In forestry, for example, environmental pressure groups accuse the lumber chip industry of razing native forests to the ground, and they denounce forestry firms for eliminating native forests to replace them with plantations of exotic species. The campaigns these groups organize usually attract strong public support, negatively affecting the image of the forestry sector both nationally and internationally, leaving it exposed to sanctions on environmental grounds in the markets in which it competes.

Against this backdrop, this paper seeks to answer the following questions. What trends in environmental concerns in the world affect the forestry sector? To what extent is the Chilean forestry sector vulnerable to future international trade restrictions based on environmental grounds? What consequences can be foreseen from such threats, and what are the costs for the country?.

The thesis of this paper is that, while the Chilean forestry sector does have some weak points, there are not enough objective conditions to justify any type of export restriction on environmental grounds. The main arguments are as follows: (i) the country has a well-diversified international forestry trade; (ii) national producers exploit their forests in a sustainable way; (iii) national producers of wood pulp (the forestry sector's main product) have made the necessary investments in modern low-pollution industrial plants; and (iv) although not perfect, there are well-established State institutions for regulating and controlling forestry management in Chile, modern legislation is being introduced to protect the environment, and new forestry projects have been made subject to this.

The problems of the forestry sector are fundamentally in the sphere of small-scale forest owners, where the entrepreneurs concerned have neither the technical capacity nor the savings to invest in long-term projects. The overall sectoral result is that, at least in the last two decades, both

---

<sup>2</sup> In fact the Chilean copper industry has already faced formal allegations in United States and was excluded from the General System of Preferences for environmental reasons, (O'Ryan and Ulloa, 1996).

natural and planted forests in Chile have continued to grow in terms of both stumpage volume and surface area. Moreover, the conditions exist for this to continue.

The paper is organized as follows. Section 2 reviews the sources of threats to forestry trade arising from environmental issues. Chapter 3 then provides data on the vulnerability of Chile's forestry exports, a comparison of production and selling costs of bleached kraft wood pulp in Europe in relation to other competitors, together with data on the country's forestry resources and on the legal and institutional framework of the Chilean forestry sector. Chapter 4 addresses the main sources of environmental dispute in the national forestry sector which are being brought to world attention by environmental groups, and discusses the actions taken by forestry firms to prevent future trade restrictions, as well as the costs of such actions for the country. Section 5 presents the main conclusions.

## 2 Environmental Threats to Forestry Trade

During the 1980s, and very forcefully in the 1990s, environmental concerns have turned towards global problems as well as local environmental impacts generated by consumption and production decisions in any part of the world. In particular, consumers in developed countries are increasingly concerned that their consumption decisions should cause the least possible environmental impact. This concern puts pressure on retailers who in turn pass the concern on to producers, who put pressure on raw material suppliers. Each of the stages of a product's life cycle – extraction, processing, transport, consumption and disposal – must be as safe as possible for people and the environment. Furthermore, the concern has been expanded so that the exploitation of a resource must be done in a sustainable way, which includes not only environmental goals, but also social and economic goals. Thus, if a given producer can convince consumers that competing products are produced in a non sustainable way -at any stage of the life-cycle- they will improve their competitive position in the market.

This section presents the new trends in environmental concerns, the increasing importance of the precautionary principle and the rise of NGO's and consumer groups as sources of pressure on forest firms. The importance of the life-cycle approach is discussed together with the impact of eco-labels and forestry certification initiatives on trade. The section ends with an identification of threats to trade in the forestry sector, related to environmental concerns.

### 2.1 New trends in environmental concerns

Governments in developed countries are imposing increasingly stringent regulations on their producers, and on ever more products, in order to safeguard the quality of the environment. In the 1970s and the early 1980s, the approach to the environment was corrective more than anything else, and had one major focus, the control of pollution discharges from industrial facilities. In recent years, a more preventive approach has been taken. National legislation and international treaties have increasingly adopted the "precautionary principle" which states that because of uncertainties, emission standards need to be established which protect health and environment with reasonable degrees of certainty<sup>3</sup> (Van der Zwaag, 1996). Thus a recent trend observed is that preventive action should be emphasized over and above the curative, since potential damage is difficult to predict and evaluate *ex-ante* (Turner, K. et al, 1993), and usually it is less costly to avert a problem than to act once it has occurred. Consequently, there are increasing requirements on firms to clean up their environmental act, even if the resulting damage is not well documented. NGO's and consumer groups have adopted this principle and push it forcefully, promoting different

---

<sup>3</sup> Of course what is "reasonable" depends on the available information and on who does the assessment. At one extreme the strict precautionary principle tends towards banning the discharge of substances with uncertain effects. At another extreme, abatement technologies and economic considerations may be combined to compare costs and benefits. The "critical load" concept is also used for this purpose.

environmental initiatives even when the evidence of environmental damage or health effects is fairly uncertain.

Firms in developed countries have reacted to this demand for better environmental performance by improving their productive processes and the quality of their products. During the 90's many firms have begun to build in environmental management as a significant part of the management of each firm. Although this process has allowed some firms to increase their profits by discovering new businesses associated with producing in a clean way (Moore and Miller, 1994 and Ditz et al, 1995, Gallon, 1997), it has generally imposed significant costs on the affected firms.

In general, developing countries have lagged behind developed countries in their care for the environment. As may be expected, industries in latter countries, which have seen their production costs rise to comply with increasingly stringent environmental standards, have lobbied to have these standards harmonized across the different countries, to reduce the alleged loss of competitiveness with industries in countries less concerned about environmental issues.<sup>4</sup> However, harmonization has been firmly opposed by those who defend free trade, on the grounds that it creates barriers to trade and would ultimately reduce world welfare (Bhagwati and Srinivasan, 1996). Notwithstanding, the World Trade Organization (WTO) has had to arbitrate in a series of cases where one country tries to impose import restrictions on a product based on the fact that its production does not involve similar safeguards to those in force in the importing country.

This however, does not mean that forestry firms in developing countries have a free hand. Quite to the contrary, a second important trend became apparent at the end of the 80's and especially in the 90's. Pressure started from NGO's and consumer groups related to the entire life-cycle of products (Roxo, 1999). Moreover, an increasing alliance between social and environmental NGO's has expanded concerns to include new issues. These organizations have campaigned strongly for the preservation of biodiversity and tropical forests, as well as safeguarding the rights of local and indigenous communities which are threatened by the exploitation of natural resources (IIED, 1996, p.39). Increasingly the environmental, social and economic dimensions associated to sustainable development are being considered together, not in isolation.

Moreover globalization of markets and increasingly better communications systems have made these pressures more effective. For example, in February 1998, Mitsubishi signed an agreement with the Rainforest Action Network (RAN) aimed at stopping the use of old growth forests, thus ending an eight year boycott campaign against its products. In August of the same year RAN launched a new campaign against an American paper company this time, for allegedly using trees from old growth forests. An additional problem was that the pulp was grown on lands whose ownership was claimed by local Indians . "The campaign failed to mention (however) that the dispute between (the firm and local community) had reached a negotiated solution... four months

---

<sup>4</sup> In the literature, the term "harmonized standards" is used in a wide variety of ways. In some cases it refers to equalizing environmental quality standards, but in others it refers to harmonizing specific instruments such as the level of taxes to be applied or technologies to be required.

earlier” (Roxo, 1999, p.1). According to IIEE (1996, p39) “pressure groups have noted improvements in environmental performance in Canada, and are turning their attention to social issues. WWF contends that massive clear cutting... is a serious threat to some First Nations...and that local agreements with logging companies have proved unsatisfactory.”

Three things stand out in these examples. First, that environmental concerns are now only part of the problem; social and economic issues are also critical. Second, there is increasing power wielded by environmental pressure groups that act both at the local and global level. Finally, local communities are now in the company of strong NGO’s that help them defend their rights, but that also have their own environmental agenda that can be different from the community’s.

The result is that multiple players, especially in developed countries, are receiving increasing pressures –from regulatory and non-regulatory agencies- to care about the sustainability of their production process. In addition to producers, the original targets of regulators, raw material suppliers and retailers have now been targeted also. B&Q for example, one of the largest British retailers reacted positively to these pressures by launching a comprehensive Environmental Policy. B&Q now requires suppliers to provide information about their environmental policy, supply auditing information, and allow B&Q to disqualify any suppliers which do not show improvement in their environmental performance (Roxo, 1999, p.2). In this way, the retailer passes the pressure they receive onto producers, who in turn place demands on their raw material suppliers, who often belong to developing countries. If a producer does not respond, it runs the risk of losing important markets or simply disappearing from the shelves. Pressure is thus put indirectly on all parts of the chain, in developed and developing countries alike.

In conclusion, the protection of the environment has entered into a new dimension in the last ten years. It has become a matter of competition between companies and even countries. New concerns have surfaced, new actors are entering the scene. Up to the 80’s, environmental protection had a strictly operational dimension for firms: there were environmental regulatory standards specific to the country, which had to be complied with. Usually these standards considered a specific phase of the life cycle of a product. Now, firms and countries must accept that this is not enough. Increasingly, the “environmental friendliness” of a product is being judged by standards external to the country where the product is produced. Moreover, environmental concerns extend to the whole life cycle of the product, and include, together with the environmental dimension, social and economic concerns. In the forestry sector in particular, NGO’s with capacity to undertake campaigns in the exporting and importing countries are having an increasing influence in the process of identifying products to be targeted .

## **2.2 Life cycle and eco-labels**

The growing environmental concern among governments and consumers has led to systems for certifying compliance with standards and environmental criteria at each stage of a product's life cycle. These are becoming increasingly important in the forestry sector, and as a result, firms in this industry are faced with new challenges. Eco-labels developed to certify that a given product is "environmentally friendly", based on a set of selected criteria. Initially these criteria were fairly limited, usually considering environmental effects of the use and disposal of the product or its wrapping. Additionally, they were meant to be applied to the cleaner fraction of each product category (not more than 30 per cent of the total), and as more products comply, the environmental target is set higher. Canadian Environmental Choice and the Japanese Eco-Mark are examples. They encourage the use of recycled products to limit waste generation and limit consumption of non-renewable resources.

However the recent trend has been to extend these schemes to more extensive life-cycle criteria. They increasingly include more than one, and sometimes all, the life cycle stages: production, transport, use and disposal. The inclusion of the production stage is of particular concern because of its potential trade effects. For example the Nordic Swan, the Swedish Environmental Choice Programme (SECP), the EU Eco-label Award Scheme, and the NF Environnement generally include production related requirements in their eco-label criteria. The first two actually include requirements for the whole life cycle of the product and the products considered include detergents, cleaning agents and paper products. Producers, both domestic and foreign, have modified processes and production methods to meet eco-label criteria and maintain their products on the market. SECP in 1996 had established 27 product groups and almost 700 products had been awarded eco-labels, including toilet tissue, paper towels, office paper and coffee filters. By the end of 1996, Nordic Swan considered 45 product groups and had labelled over 1,000 products.

A fundamental problem with labeling schemes is that the definition of the products to be targeted generally reflects the preferences of the importing country. In particular, different interest groups press to include the products they deem require attention. Additionally, even though when defining criteria for the award of eco-labels a participatory process is followed, including expert groups and public review, usually foreign producers are not included. This is not because they cannot participate, it is simply hard for foreign producers to set up the lobbying groups required in each country, in particular for exporters from smaller countries. As a result, self-serving environmentally based restrictions are imposed on foreign products.

For example, the EU Eco-label award scheme, which addresses the production phase of pulp and paper, is meant to encourage reduced consumption of non-renewable resources, to reduce the emissions of diverse gases to air, and the use of chlorinated organics, to reduce waste through recycling of previously used paper, and requires the application of sustainable forest management practices. It has been severely criticized by the governments of the US, Canada and Brazil, and also by Argentina, Japan the British paper industry and the Confederation of European Paper Industries. The main criticism are its lack of transparency since foreign producers are shut out of the process for drawing up the criteria; discrimination in favour of Nordic countries by



emphasizing recycled content; and eco label criteria that reflect domestic environmental conditions and preferences, among others (OECD, 1997. Pp. 40-41).

It is also interesting to note that successful eco-labeled products often exceed 30 per cent of market coverage. As a result, “they are no longer effective in identifying a small selection of products which are environmentally preferable, but tend to become a *de facto* voluntary standard (*ibid*, p.69).” In this case, the need for a transparent process becomes essential and the choice of product categories covered by the scheme also becomes critical. If the product group chosen is a product which is largely imported from foreign countries and if the eco-label contains production and process related criteria, the eco-label may constitute a barrier to competing in the market place for foreign products which do not conform to the eco-label criteria. The same may apply when retailers wish to carry a majority of eco-labeled products.

### **2.3 Sustainable forestry management and forest certification**

All pulp and paper companies have to meet a number of customer requirements such as bleaching processes without chlorine, and eco labels based on various criteria. Sustainable forest practices were mentioned earlier as a requirement for certification under the EU Eco-label. Growing international concern over the state of the world’s forests has now made the requirements of sustainable forest operations a key issue. This concern manifests itself in two ways: first, forest certification systems are being developed, and second, NGO’s routinely undertake campaigns against products considered unfriendly to the environment in any of the life cycle stages.

Forest certification systems are voluntary in nature and share the purpose of informing consumers about how well the forests from which the product to be bought originates, are being managed. Most of the systems include the same key elements and the difference among them is basically in the depth with which each element is addressed. The key elements are (Roxo, 1999, p. 3):

- Compliance with national laws
- Tenure and land-use rights
- Respect for community rights
- Economic and social development
- Economic viability in the long term
- Sustainable yield of products
- Protection of biodiversity, water and soil resources
- Assessment, monitoring and prevention of adverse effects.

There are currently many forestry certification systems being developed or already in place in the various regions of the world. They can be grouped in three categories, global, when applied internationally; and regional or national, when applied to specific regions or countries. There are only two truly global certification systems: the Forest Stewardship Council (FSC) and ISO 14000.

The first refers basically to environmental performance. ISO, is concerned more with the environmental management process. The current status of these systems is presented in Table 1 for a group of selected countries.

FSC is the most developed global certification system, and consists of a coalition of environmental and social NGO's, and economic interests such as retailers and some forestry companies, especially in developed countries. It was created in 1993 to coordinate the scattered certification efforts and avoid "an excessive diversity that might confuse consumers, and harm the credibility of the seals and their commercial effectiveness" (Scholz, 1994, p.39). It has established 10 Principles, each considering many criteria, that include the need to comply with rational laws and international agreements, define clear property rights, respect the rights of indigenous peoples, biodiversity conservation, care for water, soil and fragile ecosystems, conservation of primary and secondary forests, and restrictions on plantations, among others. It thus sets a similar playing field for all companies.

Up to mid 1999, a significant 16 million ha. had been certified internationally by FSC, by 167 companies/forest owners located in 30 countries. Sweden is the country with most certified forests (7.5 million ha), followed by Poland (3.0 million ha) , United States (1.5 million ha) and Brazil (0.6 million ha). The FSC is supported by buyers groups in several countries. The most relevant one is the 95 Plus group in the UK, established under initiative of WWF. Fifteen percent of wood consumption in UK is traded by this group.

FSC is resisted by the business sector, in particular by the strong American Forest & Paper Association (AF&PA). It is argued that the system is too complex and costly for small, independent forest owners, the process is dominated by NGO's, there is no governmental participation, and that significant differences among forests in different countries are not considered<sup>5</sup>.

Consequently, ISO 14.000 is the forest industry's preferred certification system. These are a group of standards related to Environmental Management Systems. These standards do not apply specifically to forest operations but have been used increasingly by forest companies. Recently the so-called "Bridging Document" <sup>6</sup> published at the end of 1998, established the general guidelines for forest firms seeking certification under ISO 14.000. Unlike eco-labels, which oblige compliance with the criteria of the entity awarding the seal, ISO only obliges compliance with the environmental standards of the origin country. Given that they set a clear framework and are not necessarily

---

<sup>5</sup> In a recent document, the AF&PA makes three objections to FSC eco-labelling: (1) the principles and criteria do not have a scientific base, and are not appropriate for american forests (2) requirements for monitoring in the whole production chain are unfeasible given the industrial organization of the sector; (3) the principles and criteria do not reflect american consumer preferences and discriminates against the use of renewable resources.

<sup>6</sup> Technical Report ISO/TR 14061, *Information to Assist Forestry Organizations in the Use of Environmental Management System Standards ISO 14001 and Iso 14004.*

uniform across countries, this initiative is preferred by industrial sectors, particularly in exporting countries. On the other hand it does not prescribe performance standards, so that two companies with different standards can both be certified.

In addition to these global initiatives, there is an abundance of regional and national initiatives to certify sustainable forest practices, as can be seen in Table 1. They reflect national priorities, or the interest of specific groups within each country or Region. Though they have different degrees of merits and problems, they share the common difficulty of their limited geographical comprehensiveness. They are generally not known to consumers and stakeholders in other countries, and they give a clear advantage to national products in their own markets, which makes them an effective trade barrier for foreign firms.

**Table 1: Certification Initiatives in selected Countries**

<b>Country</b>	<b>FSC</b>	<b>ISO 14001</b>	<b>Regional or national certification initiatives</b>
Brazil	Seven companies have been certified (0.6 million ha.).	Four companies have been certified.	<ul style="list-style-type: none"> <li>• Brazilian FSC Under development.</li> <li>• CERFIOR, another important local initiative is being developed.</li> </ul>
Canada	Only three companies certified today . But by 2003 will move from 0.2 to 8 million ha.	Four companies have been certified, covering 2.5 million ha. In 2003 70 million ha. (60 of Canada) expected	<ul style="list-style-type: none"> <li>• Canadian standards under development since 1996. By 2003, eight million ha expected.</li> </ul>
Chile	No certified company. Strong opposition.	Three forest companies certified.	<ul style="list-style-type: none"> <li>• Fundación Chile has been unsuccessful promoting FSC standards.</li> </ul>
European Union			<ul style="list-style-type: none"> <li>• New Pan european Forestry Certification initiative was launched in 1998. It is a forest owners initiative, but others have joined.</li> </ul>
Finland	No certified company.	All large companies have certification.	<ul style="list-style-type: none"> <li>• Developed the Finish Forest Certification System. Includes economic, environmental and social stakeholders.</li> <li>• Expected to certify 50% of total area in 1999.</li> </ul>
Norway	No certified company	14.000 small forest	<ul style="list-style-type: none"> <li>• Developed the Living Forest</li> </ul>

		owners certified collectively under the Living forest project (0.9 million ha.)	<ul style="list-style-type: none"> <li>Project . Principles have been agreed upon by most stakeholders.</li> <li>By the end of 2000, ninety percent expected certified.</li> </ul>
New Zealand	Only two forest companies certified. Strong opposition.	Six companies certified (0.3 million ha.)	<ul style="list-style-type: none"> <li>The NZ Forest Industry Council is working on an ISO based tool.</li> </ul>
South Africa	Eleven certified companies (0.5 million ha.)	One firm certified (0.4 million ha.). A number of producers in the process of getting certification.	<ul style="list-style-type: none"> <li>National auditing systems being used.</li> </ul>
United Kingdom	No certification.	No certification.	<ul style="list-style-type: none"> <li>Developed the Woodland Assurance Scheme</li> <li>British working group developing national FSC certification standards.</li> </ul>
United States	Only 1.5 million ha. Certified.	No information.	<ul style="list-style-type: none"> <li>Sustainable Forest Initiative developed by the AF&amp;PA</li> <li>26 million ha covered by this initiative.</li> </ul>

Source: Based on Roxo (1999).

It can be concluded that the outstanding number and size of certified areas around the world and the projections for the future show that forestry certification has survived its difficult new-born period and is entering adolescent age. The issue now is not whether certification will be required, but rather what certification system(s) will be dominant.

## 2.4 Environmental threats to trade in the forestry sector.

The increasing concern for the environment, together with the certification initiatives, both eco-labels and forestry certification, pose potential threats to trade, and more generally to forestry activity. As discussed above, the protection of the environment has become a matter of fierce competition between companies and countries. A first important problem is that there is no consensus on who should define what to care about. Voids like these are rapidly filled in by interested parties. Both firms and governments of developed countries - concerned for the impact of regulatory requirements on the competitiveness of their industry, and aware of the difficulties of imposing similar environmental standards to producers in other countries – have begun to focus

their attention on voluntary instruments as a means of promoting better environmental stewardship in developing countries.

Certification systems can easily be used as trade barriers, since through them, consumer decisions can be channeled to locally produced goods. A public that is increasingly “better” informed through an eco-label, would either choose to consume what is produced in the country in a clean way, or else more environmentally benign –locally produced - substitutes. In practice, these voluntary instruments are thus made obligatory for firms in developing countries wishing to sell in these more demanding markets. The development of global, regional and national level certification systems can thus be used as a new and subtle form of protectionism, forcing third-party countries to comply with environmental standards that are similar to those in force in the purchasing country. They are, however, fully compatible with current WTO regulations as they are based on consumer decisions and so do not constitute technical barriers to trade.

Additionally, environmental and social NGO’s have been quick to propose certification standards based on their own criteria, and to promote effective boycott campaigns for products that in their opinion do not care for the environment. In many cases these are morally driven, rather than based on commercial interests. This does not make them any more desirable, since the tradeoff between environment, economic and social objectives is not necessarily done correctly by these institutions. However, their capacity to generate pressure on retailers and mobilize indigenous communities is of substantial concern for producers, especially in third world countries. Forestry decisions and ultimately trade are affected by these concerns.

Very strongly related to *who* is making the environmental requirements is the issue of *what* should be required. Defining what is actually understood by SFM is a second important potential threat to the trade of forestry products. For example, an important concern is the conversion of primary forests to secondary, or to non-forestry use. In particular many NGO’s strongly oppose the conversion of (any) primary forests. It is argued that this results in an irreversible loss of habitat and species diversity, soil erosion, destabilization of river basins and degradation of water quality, decreased access for the local population, a loss of cultural values and income, and an aesthetic degradation. Since developed countries, in general, have completed the process of converting forests to agricultural and urban uses, it turns out that this concern affects basically developing countries. These countries mostly continue to deforest in order to satisfy demand for forestry products and incomes, and to allocate land to other uses (IIED, 1996).

Plantations are also an important source of controversy. The replacement of primary forest by plantations leads to a loss of benefits specifically associated with primary forests which plantations cannot replace. In addition, normally there are social impacts on local and indigenous populations who often see their traditional forms of ownership impaired. Finally, deficient management practices are common in plantations and forests that are managed intensively. The trend towards monoculture, for example, requires external inputs, develops a very limited range of uses (only wood pulp, for example) and few users (normally a single large firm), and reduces both aesthetic and biodiversity. Again, doubts about plantations affect poorer countries. Although many

developing countries have significant comparative advantages as regards growth rates, availability of land and cheap labor, the development of plantations with lax controls can lead to social and environmental losses, and have become a target for environmental groups.

Unfortunately, defining SFM is very difficult. Forests cannot be characterized simply. The term “forest” embraces such different ecosystems as the Amazonian rainforest and the northern or Chilean forests of eucalyptus or pine plantations. And there are so many variables involved – environmental, social and economic- that a comprehensive assessment methodology is required. However such a methodology does not exist as discussed above. The dimensions and criteria to be considered are usually vague<sup>7</sup>. Moreover, apart from the problems of defining SFM criteria, there is also the question of the scale at which they are to be applied. SFM can be developed at a national or regional level, defining how much forest is left for preservation, how much for protection and how much for production. Once defined, the services of forests can be obtained at a meso scale, allowing each specific plot to develop according to a specific characteristic. For example, forestry firms could be allowed to develop plantations in a region, if, in other parts of the country, biodiversity concerns are addressed in forests that cannot be exploited. This concept is not accepted by many environmental organizations that evaluate each specific forestry project on its own merit. In their opinion, each intervention or project should be required to be multipurpose, i.e., to ensure all relevant services are accomplished at a microscopic level.

Different actors favor different criteria and scales of application. Establishing a consensus will be very difficult. Unfortunately this is not a scientific process, nor is it bias-free. Certification will ultimately depend on the criteria the certifying entities choose to favor.

An additional complication is that many indicators will be required. Different forests (tropical, boreal and temperate) mean different environmental problems and variables to be considered. Similarly, different social and economic conditions should imply differential treatment. Including this level of specificity in any indicator is far from trivial, in particular if it is meant to seek a common ground for evaluation.

The diffuse nature of the concept of sustainable forestry management, and the difficulties related to defining indicators, implies uncertainties for the forestry sector. This is a long term activity that requires fairly stable rules so that investment decisions can be taken with a minimum

---

<sup>7</sup> Criteria usually considered include: *Forestry criteria* that pursue maximum conservation of forested areas, accept plantation regimes, favour the natural regeneration of the forest and accept forestry production within a forestry management scheme; *Environmental criteria* that seek functional environmental equilibrium, avoiding negative impacts on soils, water resources, biodiversity and landscape. They reject the replacement of native forest by plantations, minimize reforestation with exotic species and try to prevent the use of chemical substances in forestry management; *Criteria with a social focus* that seek to defend indigenous groups and peoples linked to the forest, and promote improvements in their living standards and their participation in decisions on forestry management; *Legal criteria* that relate to the design and fulfillment of rules relating to forestry management plans and labor safety in forestry activity; and *Organizational criteria* that include monitoring and enforcement requirements and the design of management plans.

degree of certainty. Within the Forest Stewardship Council there are fierce debates about the contents SFM should support, and the multiplicity of initiatives and lack of defined criteria create room for pressure groups to lobby for specific criteria to be considered. Additionally, at the local level NGO's have their own priorities. The final result in each specific country is still being played out, case by case. This explains why many forestry companies prefer a system that regulates environmental management practices rather than performance.

In conclusion, informed consumers increasingly rely on environmental certification granted by developed-country entities based on criteria which, while trying to be objective, respond to the interests and preferences of the industries, consumers, governments and NGOs of those countries. As a result, plantations in particular, which are important development sources in many countries, have been called into question, and the exploitation of national forests has also been seriously affected. As it is very difficult to define SFM precisely –and to define appropriate indicators- forestry exploitation may come under attack from pressure groups that are hostile to forestry firms, both at the local and international level, thereby generating a negative image for the product in foreign markets.

In some cases, when concern for the environment or for affected local communities are not adequately built into the design of a forestry project, such pressures may be justified. However, disproportionate demands can also be made which respond more to the interests of a given NGO or some industry in particular, than to the welfare of the local community or protection of the environment.

The certification systems currently being developed do not solve these problems and may actually enhance them, depending on the final form they take, and the response from consumers. Additionally, campaigns by NGO's targeting specific products can make the forestry business more unstable, and as a result less investment in this sector can be expected. Trade may be affected, and forestry activity that would have developed in the absence of such pressures, may not do so.

### 3 Trade, Natural Resources and The Legal Framework of The Forestry Sector in Chile

In the last 20 years, Chile's forestry sector trade has grown spectacularly. There is a wide variety of products being exported to diverse markets all over the world. Additionally, plantations have allowed the recovery of previously eroded areas. Chile is becoming an important player in some products, it still has a great forestry potential and can produce at very competitive costs. The institutional arrangement, though far from perfect is fairly effective, and the legal framework required to protect forestry related values is currently under intense discussion. This chapter presents the main figures related to Chile's forestry sector.

#### 3.1 Growth, composition and destination of exports

Exports have been the engine of Chilean forestry development. The importance of trade for this sector is illustrated by the fact that, in recent years, over two thirds of national primary forestry output has either been exported directly, or else has been used in the production of other export goods (INFOR, 1995). As can be seen in Table N° 2, sales of Chilean forestry products abroad, grew by 127 per cent in 1995 dollars between 1985 and 1990 and by more than 160 per cent between 1990 and 1995. The US\$ 2,369 million exported in 1995 was 51.5 per cent higher than the 1994 figure and represented 14.7 per cent of all national exports.

**Table N° 2**

Chilean Forestry Exports. Fob Values. Us\$ Million (1995).			
YEAR	1985	1990	1995
VALUES	396	900	2,369

Source: Based on CONAF figures

Forestry sector exports are highly concentrated in chemical wood pulp. As can be seen in Table N° 3, in 1994 this product represented more than 45 per cent of total exports from the sector, rising to nearly 54 per cent in 1995. This large increase in the value of chemical pulp exports occurred mainly because average prices in 1995 more than doubled compared to the previous year. However, there was also a significant increase in physical sales. The remainder of forestry exports encompass a wide variety of products, each of which represents a minor share compared to chemical wood pulp. The product lines which follow in importance are lumber chips and sawn lumber, each of which represented about 10 per cent of total forestry exports in 1994 and 1995, and log exports which accounted for 6.2 per cent of the total in 1995. The category



“Timber products and others”, although important as whole, is made up of exports of hundreds of different products, none of which individually accounts for more than three per cent of total forestry exports.

**Table N° 3**  
Composition of Chilean Forestry Exports.  
1994 and 1995, Fob Values.

PRODUCTS	1994		1995	
	US\$ (millions)	(%)	US\$ (millions)	(%)
Wood in logs	113.9	7.3	144.3	6.2
Sawn lumber	158.1	10.1	222.9	9.4
Panels and planks	82.1	5.3	80.7	3.4
Lumber chips	163.5	10.4	232.8	9.8
Chemical pulp	717.7	45.9	1,270.4	53.6
Paper and cardboard	129.1	8.2	111.3	4.7
Timber products and others	169.9	12.8	306.8	12.9
<b>TOTAL</b>	<b>1,564.3</b>	<b>100.0</b>	<b>2,369.2</b>	<b>100.0</b>

Source: CONAF.

In terms of markets of destination, Chilean forestry exports shows a marked concentration towards Asia. As shown in Table N° 4, nearly 50 per cent of all foreign sales in value terms were sent to this region of the world in 1994 and 1995. Moreover, within this continent, sales have concentrated in three countries: namely, Japan which accounts for 46.5 per cent of exports to Asia, South Korea (24 per cent) and Taiwan (11 per cent). The next most important destination market is Europe, where 20 per cent of Chile’s forestry exports were sent in 1994. In Europe the main individual purchaser has been Belgium, with 35.6 per cent of total European purchases. Of the remaining 30 per cent of Chilean forestry exports, 17 per cent goes to South American countries, 12 per cent to the United States and a small proportion to Africa and Oceania.

**Table N° 4**

## Destination of Chilean Forestry Exports, 1994.

CONTINENTS / Countries	US\$ (millions) FOB	(%)
South America	260.2	16.6
North America	199.2	12.7
USA	176.2	
Others	23.0	
Europe	310.9	19.9
Germany	43.0	
Belgium	118.5	
France	30.8	
United Kingdom	44.6	
Italy	45.2	
Others	28.8	
Asia	770.6	49.3
South Korea	183.4	
Japan	360.5	
Taiwan	86.2	
Others	140.5	
Africa and Oceania	23.3	1.5
TOTAL	1,564.3	100.0

Source: Instituto Forestal, 1995.

As regards the destinations of the main forestry products, 35 per cent of chemical pulp is exported to Europe, 40 per cent to Asia, 13 per cent to South America and the remaining 12 per cent to other regions of the world. Lumber chips are sold entirely to Japan, two thirds of sawn lumber is sent to countries in Asia and Africa, logs are mainly sent to Asia, newsprint is sold almost entirely within South America and processed wood products are mainly sent to the USA. (INFOR, 1995).

In brief, combining the variety of markets to which exports are sent with the variety of products being sold, it can be claimed that exports of Chilean forestry products are relatively well diversified. This means that Chilean forestry firms have managed to open markets and have created the capacity to offer competitive products in all corners of the earth.

### 3.2 Competitiveness of chemical pulp exports

The current volume and the growth potential of Chilean production represents a significant threat for certain competitors in developed countries. This is particularly true in the case of chemical pulp, where Chilean production accounted for 7.4 per cent of world output in 1995 (see Table N° 5). If the new pulp plant in Valdivia, which has faced strong opposition by ecological groups, comes on stream, Chile's share of world production could increase significantly. If one also considers that the bulk of North American output is destined for domestic consumption in that region, the volume of Chilean production in the world long-fiber pulp market is of clear significance for its competitors.

**Table N° 5**  
World Production Capacity of Kraft Long-Fiber Wood Pulp  
Actual 1995 Figures and Projections For 2000

	Year 1995		Year 2000	
	kTons/yr	%	kTons/yr	%
Canada	6,984	36.35	7,159	34.94
USA	4,965	25.85	5,010	24.46
Sweden	2,495	12.98	2,780	13.57
Finland	865	4.50	1,330	6.49
Norway	160	0.83	160	0.78
Western Europe	665	3.46	695	3.39
Eastern Europe	251	1.31	251	1.23
<b>Chile</b>	<b>1,415</b>	<b>7.36</b>	<b>1,655</b>	<b>8.08</b>
Other Lat. Am.	450	2.34	395	1.93
Asia and Africa	265	1.38	280	1.37
Japan	335	1.74	335	1.64
Oceania	365	1.90	435	2.12
<b>TOTAL</b>	<b>19,215</b>	<b>100.00</b>	<b>20,485</b>	<b>100.00</b>

Source: (Hawkins and Wright, 1996)

Note: The projection for the year 2000 assumes that the Valdivia plant will produce 200,000 tons. The project contemplates producing 400,000 of long-fiber and 150,000 tons of short fiber cellulose per year. As a result, Chile's share of world production could rise to nine per cent. However, as of 1999 the project has been delayed for environmental and market reasons.

Apart from the magnitude of Chilean export supply, Chilean producers have cost advantages in the long-fiber chemical pulp market in Europe compared with Scandinavian producer countries. Similarly, in Europe and Asia Chilean producers have an absolute cost advantage over the big North American producers. Table N° 6 presents the costs of production of the main long-fiber cellulose-producing countries together with the cost of their products placed somewhere in the North East of Europe. As can be seen, production costs in Chile are the lowest in the world, and significantly lower than in the United States, Sweden and Finland. This enables Chilean producers to compete solidly both in Europe and in Asia. Chile's advantages over Scandinavian producers arise mainly from the lower cost of timber storage, based on the rapid growth of the forest providing the raw material.

**Table N° 6**

1996 Production and CIF Costs  
Long-Fiber Bleached Kraft Cellulose  
Main Producer Countries

	Production cost	CIF cost
	US\$/Ton	N.W. Europe US\$/Ton
Chile	305	391
Southern USA	329	405
Sweden	408	451
Finland	421	465
Eastern Canada	427	492
France	452	493
West coast of Canada	477	534
Western Canada (inland)	495	579

Source: (Hawkins Wright, 1996)

### 3.3. Natural resources

From the resource point of view, Chile has great potential for forestry development, because soils are naturally suitable for forestry in much of the country. In approximate figures, of a total continental surface area of 75.7 million hectares (Mha), it is estimated that 44.6 per cent (33.8 Mha) is suitable for forestry, 18 per cent is suitable for livestock and agriculture and the remaining 29.4 per cent is land which is unproductive from the agriculture or forestry point of view.

According to the recent forestry cadastre (Universidad Austral de Chile and others, 1997), the total surface area of Chile covered by forest is approximately 15.65 Mha, of which 86.5 per cent (slightly over 13.5 Mha) contains native forests<sup>8</sup> and the remaining 13.5 per cent (2.12 Mha) is planted. This means that only 46.3 per cent of land suitable for forestry is currently forested, so there is great potential for the development of new forests; moreover, inasmuch as this potential is not realized, the lack of tree cover leads to increasing soil degradation.

Of native forests, 29 per cent (3.92 Mha) is publicly owned and comes under the State-Protected Forestry Areas System (SNASPE). The remaining 71 per cent is privately owned. Although the total surface area of native forest within SNASPE is significant, representation of the different types of native forest is highly varied. Table N° 7 shows that for some forest types more than half the existing stock is within the SNASPE, whereas in other types the proportion is less than two per cent.

**Table N° 7**

**Total Native Forest Area by Forest Type and Percentage Included In Snaspe. 1996.**

FOREST TYPES	Total stocks [thousand ha]	% within SNASPE
Alerce	264	17.9
Cipres de las Guaitecas	972	69.6
Araucaria	254	48.4
Cipres de la Cordillera	45	6.3
Lenga	3,400	16.8
Coigue de Magallanes	1,800	50.5
Hualo (White Oak)	184	0.5
Roble (Oak) – Raulí – Coigue	1,370	1.7
Coigue – Raulí – Tapa	457	9.5
Open forest	342	2.0
Evergreen	4,350	34.3
TOTAL	13,443	29.0

Source: (Universidad Austral and Others, 1997)

<sup>8</sup> The cadastre uses the definition recommended by FAO: “The native forest is a natural ecosystem in which the tree layer consists of native species more than 2 meters tall and with a canopy cover of over 25 per cent.

Annual extraction of native forests amounts to 9.3 million m<sup>3</sup>, of which 6.1 million m<sup>3</sup> is destined for firewood and charcoal ((INFOR, 1993), mainly for domestic use in the south of the country, and 3.2 million m<sup>3</sup> for industrial use (INFOR, 1995). According to the same source, the industrial use of native wood splits in 2/3 for the production of lumber chips and 1/3 for sawn lumber and panels. Native wood currently accounts for just 15 per cent of the total consumption of the forestry industry, while the rest comes from Monterrey pine (*pino radiata*) and eucalyptus plantations. Thus, plantations are the fundamental source of timber for the forestry industry, and restrictions on their development for environmental or other reasons would have a significant impact on the sector.

From the global point of view, the extraction of 9.3 million m<sup>3</sup> of timber from native forests does not necessarily put them in danger. As that level of extraction is way below the annual rate of forest growth,<sup>9</sup> the country can be expected to expand its forestry stock in terms of native species. Of course, what is true for the whole is not necessarily true at the local level or for certain individual species; nor does it ensure adequate protection of the biodiversity associated with native forests.

When working with forests one should not forget that these are formed by living organisms which grow and develop in their respective ecological niche. For this not to happen, attacks by external agents have to be extreme (for example burning, driving out animals, or planting other species). The destruction of forests by natural causes and their subsequent recovery (which happens everywhere in the world) shows the strength they have to regenerate and/or adapt to new conditions (Veblen et al, 1996).

From the point of view of the characteristics and height of native forests, Table N° 8 shows that the surface area of adult and secondary forest with heights above 12 meters account for 42.2 per cent of total native forests, or more than 5.67 million hectares. Adult and developing secondary-growth forests less than 12 meters high account for 35.2 per cent of total native forests and cover a surface area of 4.75 million ha. The surface area covered by open adult and secondary forests is 1.25 million ha, equivalent to 9.3 per cent of all native forests.

Table N° 8 also shows that stunted native forests whose height does not exceed 8 meters cover 3 million ha, equivalent to 22.5 of total native forest of Chile. Open stunted forests covers a surface area equivalent to 841,000 ha, representing 6.3 per cent of total native forests.

---

<sup>9</sup> Assuming a conservative growth rate of native forests of 3 m<sup>3</sup> per ha/yr, total growth will be 40 million m<sup>3</sup> per year, i.e. more than four times the rate of consumption.

**Table N° 8**

Surface Area of Native Forest by Type of Cover and Height, 1996

TYPES	COVER	HEIGHT (meters)	SURFACE AREA	
			(Hectares)	(%)
ADULT AND SECONDARY FORESTS	DENSE	< 12	1,727,193.9	12.8
		> 12	3,677,337.2	27.4
		Subtotal Dense	5,404,531.1	40.2
	SEMI-DENSE	< 12	2,059,215.4	15.3
		> 12	1,710,208.1	12.7
		Subtotal Semi-dense	3,769,423.5	28.0
	OPEN	< 12	961,618.5	7.1
		> 12	290,375.8	2.1
		Subtotal Open	1,251,994.3	9.3
	SUBTOTAL ADULT AND SECONDARY FORESTS			10,425,948.9
STUNTED FOREST	DENSE	2 to 8	922,573.9	6.9
	SEMI-DENSE	2 to 8	1,253,330.3	9.3
	OPEN	2 to 8	841,304.8	6.3
SUBTOTAL STUNTED FORESTS			3,017,209.0	22.5
TOTAL NATIVE FOREST			13,443,157.9	100.0

Source: (Universidad Austral and Others., 1997)

Note: Dense forests are defined as those with a crown cover greater than per cent, semi-dense forests those with a crown cover between 50 per cent and 75 per cent and open forests those with a cover of less than 50 per cent. To be designated as a forest, the crown cover must be greater than 25 per cent.

As regards existing plantations, reports state that the annual rate of forestation in the last 20 years, which approaches 63,000 ha/yr, has generated a forest mass of over 2.1 million ha. The resulting availability of timber over the next two decades will make it possible to double current physical production volumes. In other words, the forestry industry could grow from using 17 million m<sup>3</sup> per year at present to over 36 million m<sup>3</sup> as from the year 2017 (INFOR, 1995). To ensure continuous supply, estimates of future timber availability are based on harvesting volumes equivalent to the annual rate of forest growth subject to the condition that timber supply never decreases.

### 3.4 Legal and institutional framework

The general legislation to prevent and rectify environmental problems in Chile is recent and still in a process of consolidation. In 1994, Law N° 19.300, the Environmental Framework Law, was passed. This legislation aimed to create an institutional framework to solve existing environmental problems and avoid the creation of new ones, by setting up the instruments needed to manage the environment efficiently and give adequate protection to natural resources. It provides a general body of legislation to which all sectoral environmental legislation could be referred. In its introduction, the Law declares that the protection of the environment shall be based on the principles of prevention, gradualism, responsibility for environmental damage, participation by all affected parties, economic efficiency and “the polluter pays” principle.

As far as forestry is concerned, the main aspects of Law N° 19.300 are as follows. It declares that the State will administer a National System of Forest Areas in order to “ensure biological diversity, supervise the preservation of nature and conserve environmental heritage”. In this sense it reaffirms and enriches a historical function of the Chilean State. Indeed, at the present time the National System of Forest Areas protected by the State already covers 14 million hectares (18.5 per cent of continental land area) whereby 61 types of natural ecosystems are protected. This system is composed of 31 national parks, 43 forestry reserves and 14 national monuments. The System currently covers more than 3.9 million hectares of natural forest, and a program is under way to protect 85 natural ecosystems that have been identified in the country. The Law also declares that the Chilean State will encourage the creation of protected forest areas under private ownership, some of which are very large.

The Law requires the State to draw up and maintain up-to-date an inventory of forest flora and fauna species and to enforce the rules on harvesting, capture, hunting, trade and transport. It also declares that the “use and exploitation of renewable natural resources shall be carried out in such a way as to ensure their capacity for regeneration and conserve the associated biological diversity...”

One instrument for regulating the use and exploitation of natural resources in a given area are “Management Plans”, which have to address aspects such as the maintenance of water flows and soil conservation, the maintenance of landscape value and protection of species which are in danger of extinction, vulnerable, rare or insufficiently known. In addition to management plans, which are obligatory for the most environmentally important projects, there is a system of environmental impact assessment (SEIA). All industrial projects in the forestry sector are subject to this requirement, and the system is being applied to all new projects of any size.<sup>10</sup>

The legislation regulating forestry management, both of native species and those introduced into the country, is old and has a complete institutional framework which has been operating for

---

<sup>10</sup> For example, environmental impact assessment has been carried out on the Río Cóndor project of Forestal Trillium, to industrialize a lenga forest of more 200,000 ha in Tierra del Fuego, and the Celulosa Arauco Valdivia Plant, which with an investment of US\$ 1 billion aims to produce 570,000 tons of chemical pulp per year.



several decades. The main legislation governing the forestry sector is Decree Law 701, which was passed in 1974. This modified and complemented the old Forestry Law which had governed the sector in Chile since 1931. The consequence of this regulation is that all forestry exploitation in Chile must follow a management plan previously approved by the National Forestry Corporation, with the obligation to reforest or regenerate the exploited forests (Fierro and Morales, 1994). In addition, several types of incentive exist for people who own forests or for those who wish to establish forests in suitable unforested areas. For over half a century, Chile has been developing regulations and institutions to protect soils and water and maintain or increase forest volume. However, issues relating to the replacement of native forests and the protection of biodiversity were not included among the goals of the public regulatory system for forestry exploitation.

In order to expand the surface area covered by native forests, the Government sent a bill in 1991 to the Chilean Congress aiming to “encourage the increase, protection and recovery of native forests”. This bill, while allowing the extraction of wood from some forests, gives special incentives to people carrying out forestation with native species and those who care for native forests in ways that enable them to be recovered or preserved. At the same time, it discourages those who wish to replace native forests by exotic species.

This legislation, was intended to balance the interest of industry and environmental concerns. However this effort has been unsuccessful. The bill has been under discussion for the last eight years, and has generated great controversy both among ecological groups -who oppose any replacement of native species by exotic species as allowed by the bill-, and by business groups - who in turn oppose any additional restrictions to their property rights-. This has had undesirable consequences. It has led to a situation of uncertainty for private owners of native forests, leading to a decrease in their commercial value. This environment is inadequate for the care, conservation, or expansion of forests, in particular in regions with many small owners<sup>11</sup>.

---

<sup>11</sup> There are over 50.000 forest owners in Chile.

## **4 Environmental Threats to Trade In Chilean Forestry Products**

The general threats to trade of forestry products discussed in section 2, have been observed in Chile: restrictions on production technologies, protectionist eco-labels, requirements for sustainable forestry management, NGO pressures and boycotts, threats to plantations and exploitation of native forests. In this section, a selection of problems related to these threats are presented.

### **4.1 External threats to forestry exports: the Case of Chlorine**

A good example of the problems posed by self-serving environmental concerns is the bleaching of wood pulp. The issue became fashionable in 1995, after a new control technology was developed which made it possible to measure concentrations of chemical compounds at the level of parts per quadrillion. An analysis of effluents from cellulose bleaching plants revealed that they contained traces of dioxins, chlorate compounds acknowledged to be dangerous for human and animal health. Obviously, the presence of the chlorate compounds was linked to bleaching done with processes using elementary chlorine ( $\text{Cl}_2$ ) or hypochlorite ( $\text{ClO}$ ).

This discovery coincided with great public concern for the environment, and it became the central issue for world environmental movements in their campaign against the effects of the cellulose and paper industry on the natural world.

In response to this challenge, governments and industry in developed countries set up control systems and developed new technologies to obtain bleached cellulose by reducing or eliminating airborne pollution and the contamination of water courses by chlorate compounds. There are two possible ways to do this: by treating residual water before releasing it into natural water courses, or by changing the process for obtaining bleached cellulose. In fact, the secondary treatment of residual water can almost completely eliminate toxic elements without modifying the production process.

Meanwhile, Scandinavian industrialists developed two processes to reduce pollution by chlorate compounds during the bleaching process. The first of these is known as ECF (Elementary Chlorine-Free), which uses chlorine dioxide ( $\text{ClO}_2$ ) for beaching and cuts chlorate compounds by 90 per cent. The second process, known as TCF (Totally Chlorine Free), achieves bleaching without the use of chlorine. These techniques have spread rapidly: in Scandinavian countries over 95 per cent of cellulose plants were bleaching with ECF or TCF processes by late 1995. In Western Europe, over 66 per cent of bleaching is done with these methods, while in Oceania and Canada the figures are on the order of 42m per cent. In Latin America the figure is 32 per cent, while in the United States and Eastern Europe the figure is 17 per cent. In Asia and Africa, these technologies have virtually made no impact at all. (IIED, 1996)

European industrialists and environmentalists, especially in Scandinavian countries, have lobbied strongly for a worldwide standard requiring cellulose bleaching to be carried out using

ECF or TCF type processes.<sup>12</sup> At the same time there has been an intensive marketing campaign to persuade consumers to choose products that are bleached with these technologies. In particular, the requirement of Chlorine free products has been included in many important eco-labels. The result has been that in some periods Scandinavian producers have obtained higher prices for their products and, more importantly still, have obtained large profits by selling the technologies and equipment to bleach without elementary chlorine to the rest of the world (Porter and Van der Linde, 1995). Accordingly, for foreigners to be able to compete in Europe they have to adopt technologies developed by Scandinavian industrialists.

From 1985 onwards, simultaneous detailed studies began to be carried out in the medical and biological fields to prove the risks to human health and the damage to aquatic fauna caused by dioxins in the effluents from traditional cellulose bleaching plants. However, it has been impossible to prove that the traces of dioxins found can cause harm to human health (Expert Panel, 1995). Moreover, it was found that the harm caused to fish is identical to that caused by effluents from cellulose plants that do not carry out bleaching (Hodson, 1996), and that the damage found is transient and reversible (Carey et al., 1993).

The cellulose export industry in Chile, which represents more than half the value of forestry sector sales abroad, has made substantial investments in the field of air and water pollution, so as to meet the most rigorous international environmental protection standards. In this way it reduces the risk of being excluded from the European market. In particular, the three most recent cellulose plants built since 1990, and another that is scheduled to come on-stream by the year 2000, have incorporated leading-edge technologies and are comparable to plants in Scandinavian countries in terms of bleaching without chlorine gas (with ECF technology), and as regards the decontamination of liquid effluents, low water consumption and energy autarchy (Scholz and others, 1994). The environmental investment undertaken in these three plants amounted to US\$ 100 million, equivalent to six per cent of total investment (Econoticias, 1992).

In brief, this case shows how European producers, with the help of environmentalist groups, managed in practice to impose their processing standards on competitors from other parts of the world where environmental, economic and technological conditions are completely different. It is interesting to note that these producers, whose production costs are relatively high, have generated competitive advantages by differentiating themselves in terms of products bleached without chlorine and the marketing technologies and equipment required to achieve this.

#### **4.2 The problem of sustainable management of native forests and plantations**

The most controversial aspect of the forestry sector, which exposes it to possible trade restrictions, relates to allegedly unsustainable forest management. A report by the German Development Institute on the environmental challenges facing the export sector argues that Chile's

---

<sup>12</sup> Greenpeace, meanwhile, has lobbied for all Chlorine compounds in cellulose bleaching to be eliminated (Greenpeace, 1995).

forestry industry may be called into question because of “possible negative impacts on the ecological balance arising from the management of plantations” and by the exploitation of “plantations originating from the replacement of native forests” (Scholz and others, 1994, p.39). Additionally, ecological groups allege that there has been a steady deterioration and destruction of Chile’s native forests, and this is seriously harming biodiversity. The basic causes of this process include native forests being replaced by plantations and being turned over to agriculture, the production of fire wood and charcoal, and the production of lumber chips (Lara and others, 1996).

The first allegation was formalized as follows: “Since 1974, due to the passing of Decree Law 701 providing subsidies to forestry activity, extensive areas of native forests were replaced by plantations, and this became one of the main causes of the destruction of native forests. This situation persists to the present day”. It then continues: “Although there are no precise figures, global estimates suggest that between 1974 and 1992 over 200,000 ha of native forests have been replaced” (Lara and others, 1996).

In reality, the situation seems to be quite different. The Forestry Institute at CORFO, a national entity with a long tradition of research and diffusion of forestry information, studied this issue and concluded that in the 30 years prior to 1990 no more than 135,000 ha of native forests had been replaced by plantations, that the substitutions occurred in the period 1974-1983 and that since 1984 replacement has not been significant. Accordingly, the figures cited by Lara and others are most probably over-estimated. The apparent explanation of the difference between the two reports is that the values used by Lara and others include land turned over for crop growing and livestock breeding which cannot be considered as replacement of native forest by plantations. Moreover, the estimates that exist for land turned over to agriculture are subject to wide margins of error.

Environmental groups usually claim that plantations are negative for the environment, using a variety of arguments, including the following: the acidification of soils, that the water regime is disturbed and biodiversity is reduced. These arguments have been refuted by a number of authors, who claim that the soil acidity argument is not supported by any scientific study, and that their own investigations made in Chile show that the behavior of soil acidity after several decades of pine plantations is fully comparable with that of native species (Grass, 1992; Hartwig, 1994). The negative effects on the water regime are linked to the fact that plantations consume more water than native forests. This seems curious, because plantations tend to be installed precisely in areas of abundant winter rainfall. Plantation forests thus play a fundamental role in the interception and infiltration of rainwater. As regards biodiversity, when a plantation is established a change clearly ensues. However, it has been shown that the variety of flora and fauna actually depends on the shrub and litter layer, or *sotobosque* (vegetation that grows up between the trees of a forest), and this in turn depends on soil quality, climate and the amount of light the forest lets in. Thus in low-density pine plantations, the flora and fauna that develops is very similar to what appears under other types of forest in the same geographical area.

Nonetheless, plantations can cause environmental problems. As can happen with the plantation of any species, negative results may arise from “bad planning that fails to consider social

aspects, or a lack of correspondence between species, place and objectives” (FAO, 1994). In other words, plantations are not good or bad in themselves. As in any human intervention in nature, plantations must ensure compatibility between the site, the species to be planted and the goals being pursued.

In this same line, a recent publication by the “Defenders of native forests”, a militant pro-forest NGO, provides a synthesis of comparative research between plantations of introduced species and native forest. As regards effects on the soil, it concludes that forests of Monterrey pine (*pino radiata*) “do not have significant impacts, except for an increase in acidity at the humus level. However, forest soils in the south of the country naturally have a quite acid pH level”. As for effects on water, it suggests that plantations lead to greater run-off than native forests, however, it adds that “sediment concentrations found are not very high in any of the river-basins analyzed” (Otero, 1998).

In the case of Chile, the criticism against plantations (they have been called “green deserts”) appears to be biased, considering that over 90 per cent have been created on unforested land suffering from various degrees of erosion (Hartwig, 1994). Such plantations have halted erosive processes and help to regulate water cycles, thereby making a contribution to fixing carbon and releasing oxygen into the atmosphere. This has enabled a large forestry industry to develop and, as an important consequence from an environmental perspective, has made it possible to replace timber from native species in supplying the forestry industry. As a result, Chile’s native forests have begun to recover strongly.

In relation to firewood, the Instituto Forestal of CORFO [INFOR, 1993], estimated that the population extracts 6.1 million cubic meters per year from native forests, for this purpose. Currently this use accounts for 2/3 of the total quantity of wood extracted from these forests, so any reduction is welcome. Plantations have thus been instrumental in reducing the pressure on native forests for firewood.

With respect to lumber chip production, the use of native logs for this purpose is on the order of 2.2 million m<sup>3</sup> (INFOR, 1995), which in surface-area terms is equivalent to some 9,760 ha (assuming an average yield of 205 m<sup>3</sup>/ha). Allegations against this activity are based on the fact that “lumber chip operators fell trees to ground level or leave individual trees very badly damaged or as stumps”, and that “... most lumber chip operators are supplied by third parties”, most likely small- and medium-scale forest owners that might exploit the forest “with or without a management plan” (Donoso and Lara, 1996)<sup>13</sup>. In response to the first allegation, forestry companies cannot exploit forests without a management plan previously approved by CONAF, specifying the type of felling to be carried out. So if CONAF authorizes the firm to cut to ground level this is not a breach

---

<sup>13</sup> These same authors minimize the environmental effects of firewood extraction (that is almost three times more) stating that: “... it is frequent for fire wood to be obtained through low intensity interventions, frequently from shoots, which leave part of the timber volume standing and do not prevent natural regeneration”.

of regulations; it is because there are technical grounds to expect that forest recovery or regeneration is assured. On the other hand, owing to social pressures that have caused lumber chip exports to gain notoriety, CONAF staff are especially diligent in making sure that the forestry harvest by companies in this business adhere to what is approved in the respective management plan. Accordingly, the greatest problem are small-scale owners that need to turn their timber stocks into cash. On this basis, the main grounds for taking action against lumber chip operators is the number of allegations made by CONAF of “illegal felling”. For example, in 1990-1992 there were 1,242 allegations relating to the cutting of native species (CONAF, 1993), including 187,000 m<sup>3</sup> involving timber for lumber chips, or slightly over 62,000 m<sup>3</sup> per year. This figure is less than three per cent of the annual raw material input into lumber chip plants.

In conclusion, there is an image among environmental groups that forest activity in Chile – and particularly plantations- are undertaken in an unsustainable manner. However, the evidence seems to point in a different direction. Generalized mismanagement of the past (pre-1960), in particular to push the agricultural frontier, is all but over, in general plantations are being beneficial for the environment, and are not growing at the expense of native forests, but at the expense of previously eroded land. Consequently, there is no technical support for opposition to plantations on environmental grounds: they sequester carbon, they improve water retention, reduce erosion, and increase the amenity value of degraded hills and plains. Moreover, as mentioned before, the availability of plantations reduces the demands for firewood from native forests.

### **4.3 Obstacles to forestry development in Magallanes**

Another issue that has been in public debate in recent years is the exploitation of native forests in the Magallanes region, in the Chilean Patagonia. Environmental groups have mobilized public opinion campaigns that have obstructed the work of both already existing forestry firms and new start-ups. Furthermore a large forestry project in Tierra del Fuego which is about to obtain legal authorization to operate, has been threatened by environmentalists with an international boycott.

The Magallanes case is important because it has become a symbol for the institutions involved: the government, forestry firms and ecologists. For the Government, the case has allowed the new institutional framework for environmental protection in the forestry sector to be put to the test. For forestry firms, the case shows what lies in store for anyone attempting carry out a project to exploit native forests. For ecological groups, it will allow them to test the real support that they can raise for their cause abroad.

To appreciate the economic significance of the forestry sector in the region, forestry exports from Magallanes in 1995 were in excess of US\$ 20 million per year (four or five years earlier they were below US\$ 2 million), and the potential of lenga forests in the extreme South of Chile is sufficient to double or triple the value of current exports, an important impact in an economically depressed area. Before the final results of the forestry cadastre were known, the volume of native forest in this region, mostly lenga, had been estimated at more than three million hectares,

according to figures compiled by experts on Magallanic forests (Schmidt, 1994; Schmidt and Caldentey, 1994); the cadastre subsequently found 3.4 million ha. Of this amount, 570,000 ha is in State ownership and the rest is privately owned. The same authors claim that there is about 1.7 million ha of protected and non-commercial forest belonging to private owners. Finally, the authors estimate that the productive forest area under private ownership (whose preferred function is neither the conservation nor the protection of resources), is some 500,000 ha, and with this resource initially 1.5 million m<sup>3</sup> of timber could be extracted per year for industrial use (1/3 suitable for sawn lumber and 2/3 for lumber chips). The same authors argue that on a managed forest basis, future extraction could be on the order of 3 million m<sup>3</sup> per year with a proportion of 2/3 of sawn timber and 1/3 lumber chips.

By 1994, about 4,000 ha per year was being exploited and from this 380,000 m<sup>3</sup> per year of timber was being extracted for industrial use: 295,000 destined for lumber chips and 85,000 for sawn lumber (INFOR, 1995). With the new Magallanica de Bosques sawmill coming on stream, the proportion of sawn lumber in the region approached the estimated potential of 1/3. The Forestal Trillium project, recently approved both by the Magallanes Regional Environmental Commission and by the National Environmental Commission (CONAMA), aims to extract on the order of 350,000 m<sup>3</sup> of lumber per year. Thus, even including this latter project, extraction would still be far below the region's timber production potential.

The exploitation of forests in the Magallanes region has a history dating back more than 100 years. For more than 20 years there has been systematic research into the forest and the environmental effects of exploitation and harvesting techniques. Although scientific and technical research is not exhausted and uncertainty remains on certain issues, cumulative experience has made it possible to refine techniques for exploitation of lenga forest, providing reassurance on environmental protection. The results of exploitation adhering to these forestry prescriptions have been reported in the technical literature<sup>14</sup> and have been incorporated into CONAF requirements, with certain provisos for the design and approval of management plans.

The most important conclusion of the research carried out on these forests is, in the words of H. Schmidt, "the high capacity for regeneration among the lenga and coigue species in Magallanes, and the maintenance of accompanying *sotobosque* species". Moreover, he adds, "... in practically all exploitation situations in the past, there has been a good rate of natural recovery, and in the case of very intensive exploitations secondary forests have formed, characterized by high tree density with much greater growth than the natural forest" (Schmidt, 1994).

Accordingly, there is little justification for the fear that exploitation of lenga forests in Magallanes might be putting ecological balances at risk; still less that it will put risk the existence of the resource. The reason is that the surface area suitable for commercial exploitation is no more than one sixth of the total forest area, because no more than 60 per cent of the trees can be

---

<sup>14</sup> A selection of this literature can be found in Schmidt and Caldentey (1994).

extracted in any hectare exploited (thereby ensuring regeneration), and the regulations permit intervention on less than two per cent of a given forest property each year.

However, environmental groups continue to campaign against forestry activity in Magallanes, especially against the production of lumber chips and forestry development projects in the region.

Their criticisms have targeted the Forestal Trillium project in Tierra del Fuego. Recently, as a result of final approval of the environmental impact study by the Government of Chile and authorization to carry out the Forestal Trillium project, an international campaign has been announced in conjunction with environmental groups from other countries. In response to these announcements, the regional authorities have declared that the project is sustainable. Nevertheless, the project has become less attractive to the investors: for example the entrepreneurs had to make a commitment not to export lumber chips; a necessity from the forestry and economic point of view. In addition, they have suffered unnecessary delays (for example, as a result of injunctions filed against them which continue to delay the project). Another significant cost of the problems of the project arises from the negative signals for other forestry projects and for entrepreneurs from Magallanes and in the rest of the country.

Often, technical support for their claims are weak. Environmentalists' allegations are generally based on partial or biased information with scant scientific foundation, and they seek and find allies in respectable institutions to give credibility to their arguments.<sup>15</sup> As a result, the quality of the data becomes of secondary importance. Such is the case of a report by the Central Bank of Chile on Environmental Accounts and Native Forests (Central Bank of Chile, 1995). Although there is broad consensus that this study's gloomy projections for the future of native forests are mistaken (INFOR, 1995b; Susaeta, 1995) – it estimates for example that in the optimistic scenario there would be only 4 million ha of native forests by the year 2025 – the study continues to be used to justify the argument that native forest exploitation is not sustainable (see, for example, the article by Larraín and Menotti, 1998).

These obstacles exist because environmental NGO's want to block the exploitation of all primary forests in Chile, even when legislation and technical considerations make it feasible. Lack of agreement on what is considered "sustainable" is at the root of this problem.

#### **4.4 Impacts on the exploitation of native forest and on new plantations**

As a result of the highly uncertain climate that has been created in Chile, and in the world generally, regarding trade in products from native forests, and in order not to put plantation forest businesses at risk, large Chilean forestry companies have desisted from commercial operations on

---

<sup>15</sup> For example, the newspaper headlines stated, "Lenga Magallanes will run out in 25 years", to inform the study by the Office National des Forêts in France on the native lenga forests in Patagonia. This report states, among other things, that there could be supply problems for the timber industry in 25 or 30 years' time if a series of conditions are met. In any event, the forests that will be exploited to extract industrial timber are only about 500,000 ha of a regional total of 3 million ha (Vanniere and Maurette, 1995).



land containing indigenous forests, regardless of their state of conservation. This means that companies are not exploiting the economical potential of their own native forests and have ceased to invest in the development of management techniques and regeneration of native species. They have also ceased to invest in techniques for using native timber.

In this climate of uncertainty regarding the possibility of exploiting their native forests in the future, it is also understandable that small- and medium-scale owners perceive incentives for extracting the wealth of forest as quickly as possible, and this accelerates the rate of exploitation and reduces their interest in the husbandry and conservation of resources. Accordingly, the attitude of both large forestry firms and medium- and small-scale owners is tending to devalue Chile's native forests.

Obviously, banning all substitution of native forests by plantations of species that are non-native but appropriate to the conditions of the land, implies asset losses for private owners. Comparative profitability studies between forestry businesses on land covered by productive native forests (these are forests formed by abundant species, in which production would not have significant effects on global or regional biodiversity, nor on water courses or soil), put the cost of restriction at between US\$ 550 and US\$ 5000 per ha, depending on the initial type of forest, its initial state, its location and the discount rate (Géminis, 1995; World Bank, 1994). At the same time, in these cases the environmental benefits of maintaining the native forest would be very small or nil.

To get an idea of the importance of this type of prohibition, the surface area of productive native forests that could be replaced without causing environmental harm of any kind is estimated at 800,000 hectares or more (Géminis, 1995). An analysis carried out independently at the Centro de Estudios Públicos concluded that the present value of preventing such substitutions<sup>16</sup>, would be on the order of US\$ 520 million (Katz and Del Favero, 1995).

Finally, plantations are also affected. Most of the deforested land located in areas that are suitable for developing plantations, is distributed among hundreds of thousands of small property owners, many of which have problems with the legal titles to their lands (Hartwig, 1994). This fact, together with the inflexibility of the requirement of no replacement of native forests, independently of their state and size, implies that forestry companies cannot put together plots of efficient size for new plantations. For this reason, they have begun to plant abroad.<sup>17</sup> This is a potentially negative trend, since future exports will be affected.

---

<sup>16</sup> Assuming an annual rate of substitution of 20,000 ha per year for 40 years and a discount rate of 10 per cent.

<sup>17</sup> CPMC Vice-President, Eliodoro Matte, has stated "The truth is that there is no more room for planting in Chile. Today we are planting in agricultural areas that used to be sown with wheat or grazed by cattle. As a result, we have been planting pine in Argentina which has large land areas in the north" (Estrategia, 1996).

## 5 Conclusions

Environmental trends in the forestry sector are generating significant uncertainties to this activity, and in particular Chile is being affected. First, the precautionary principle has resulted in an intense scrutiny of the exploitation of native forests generally. NGO's, consumer groups, and industry and governments in importing countries are increasingly concerned that exploitation of forests must be sustainable. Second, a life cycle approach to forestry products has become dominant, requiring that products be environmentally friendly in all stages of the life cycle of the product. Since the WTO does not allow harmonization of production standards, consumer based instruments are increasingly favored as a way to get laggards to worry about the environmental impacts of their production activities. Eco-labels and sustainable forestry certification schemes have been developed, even when they do not have general acceptance. Moreover, they are much too blunt an instrument to take into account the immense diversity among forests in the world. As a result, they have been and may continue to be used as trade barriers. Additionally, NGO's which put pressure on forestry firms have specific preferences on this subject, desiring little or no exploitation of primary forests, and the rejection of plantations. Developing countries –which in many cases base the development of their rural areas precisely on these resources- stand to lose most. Not only economically, but also –ironically- in the quality of their forests.

These concerns are not theoretical. In Chile, environmental pressures have resulted in a variety of significant uncertainties for the Chilean forestry sector. Despite the fact that the development of forestry exports in Chile is based on sustainably managed plantations, the greatest source of vulnerability relates to native forests. In the face of the uncertainty surrounding the use of native species, the country's main forestry entrepreneurs have abandoned or frozen their activities in native forests and native timber. This is particularly true for those firms whose main business are plantations of Monterrey pine (*pino radiata*) and eucalyptus, and who do not want to jeopardize this activity.

This can be considered a great success for the defenders of Chile's native forests. The economic cost for the country, however, will be large –and were not evaluated before the environmental campaigns began. It has led to hundreds of thousands of hectares of land with little economic value, which are not fulfilling any function in protecting natural resources or biodiversity, yet cannot be put into production. There may also be an environmental cost. Forests of no economic value cannot depend on the active protection of their owners against dangers such as those caused by humans and this is specially true for small- and medium- scale forest owners. The uncertainty surrounding the future exploitation of their native forests, added to the fact that forestry firms (except for lumber chip operators) are no longer buying native timber, may lead them to accelerate exploitation of their forests or operate clandestinely; or, ultimately, they may get rid of them and prepare the land for agriculture. Plantations are also limited. Environmental pressures have made it increasingly attractive to divert investments to neighboring countries, that have less restrictions.

Looking into the future, the risks facing the forestry industry depend on decisions taken in Chile, and internationally, on forest use. The definition of SFM, the establishment of indicators appropriate to the different conditions of countries, and the development of the certifying schemes that allow SFM are all key. In this area, both the State and private individuals need to assume an active role. They must participate in international forums where these issues are discussed and decided. In Chile, research is required on the reality of timber stocks, sustainable exploitation methods, systems of management control and protection. Scientific evidence supporting how Chile is managing its forests is important. Finally, the legal and institutional framework that will govern the recovery and development of Chile's native forests and plantations must be defined clearly. These actions will reduce uncertainty and allow the effective development of a sustainable forestry sector in Chile.

## References

- Bhagwati, Jagdish (1996). The demand to reduce domestic diversity among trading nations. in *Fair trade and harmonization: prerequisites for free trade?*. J. Bhagwati and R.E. Hudec (eds.), The MIT Press, USA, Volume 1, pp. 9-40.
- Bhagwati, Jagdish and T.N. Srinivasan (1996). Trade and the environment: does environmental diversity detract from the case for free trade? in *Fair trade and harmonization: prerequisites for free trade?*. J. Bhagwati and R.E. Hudec (eds.), The MIT Press, USA, Volume 1, pp. 159-223.
- Banco Central de Chile (1995). Proyecto de Cuentas Ambientales y Bosque Nativo. *Gerencia de Estudios, Departamento de Cuentas Ambientales*, Santiago de Chile.
- Donoso, Claudio and Antonio Lara (1996). Utilización de los Bosques Nativos en Chile: Pasado, Presente y Futuro. in Armesto, J.; C. Villagrán and Mary K. Arroyo (eds). *Ecología de los Bosques Nativos de Chile*. Vicerrectoría Académica, Universidad de Chile; Editorial Universitaria, Santiago de Chile, pp. 363-387.
- Carey, J. H. et al. (1993). Recent Canadian Studies on the physiological effects of Pulp Mill Effluent on Fish. *National Water Research Institute*, Burlington, Canada, cited in IIED (1996).
- EULA – Chile (1995). Diagnóstico del impacto de posibles restricciones ambientales sobre el sector exportador chileno. *Report prepared for the National Environment Commission*, Universidad de Concepción.
- Corporación Nacional Forestal (CONAF) (1993). *Aplicación de la Legislación Forestal en Chile 1974-1992*. Informe Estadístico N° 39.
- Decreto Ley N° 873 (1975). Aprueba Convención sobre el Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestre. *Published in the Official Gazette of the Republic of Chile*.
- Ditz, D., Ranganathan, J. and Banks, D., (eds) (1995). Green Ledgers: Case Studies in Corporate Environmental Accounting. *World Resources Institute Books*.
- Econoticias (1992). 175 millones de dólares en mejoramiento ambiental invirtió la industria chilena de celulosa y papel en la última década, *Ambiente y Desarrollo*, p. 75.
- Expert Panel (1995). Summary comments of the Expert Panel Review to the US Environmental Protection Agency's Draft on Characterization of Potential Health Risks of 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds. *Environ Corporation*, Arlington, USA.
- Estrategia (1996). Eliodoro Matte Larraín. Nuestra definición estratégica es clara: nos mantendremos en el área forestal.
- FAO (1994). *La CNUMAD en acción en el sector forestal*. Rome.
- Fierro, Gabriel and Ramiro Morales (1994). El Subsidio Forestal: Evaluación y Propuesta. *Revista Ingeniería de Sistemas*. Vol. XI (2).

- Fischer, Ronald D. (1996). The Theory of Contingent Protection, *Center for Applied Economics*, University of Chile. Santiago, Chile.
- Gallon (1997). The Gallon Environmental Letter, *Canadian Institute for Business and the Environment*, vol. 1 (20).
- Géminis (1995). Bosque Nativo en Chile. Análisis de desafíos y perspectivas. Discusión del proyecto de ley y formulación de una propuesta alternativa. Santiago, Chile.
- Grass, Antonio (1992). Efectos Ecológicos de las Plantaciones de Pino Radiata. *CORMA Bulletin*.
- Greenpeace (1996). *Body of Evidence*. Greenpeace UK, London, UK, Cited in (IIED, 1996).
- Hartwig C., Fernando (1994) La tierra que recuperamos. *Editorial Los Andes*, Santiago, Chile.
- Hawkins Wright Ltd. (1996). Outlook for Market Pulp Demand, Supply and Prices
- Hodson, P. (1996). Mixed function oxygenate induction by pulp mill effluents: Advances since 1991. *Environmental Fate and Effects of Pulp and Paper Mill Effluents*. Edited by M. R. Servos et al., St. Lucia Press, Delray Beach, Florida, USA, cited in (IIED, 1996).
- Instituto Forestal (INFOR) (1993). *Evaluación del Consumo de Leña en Chile - 1992*. National Energy Commission, Santiago, Chile.
- Instituto Forestal (INFOR) (1995a). Estadísticas Forestales 1994. *Boletín Estadístico* N° 40, Santiago, Chile.
- Instituto Forestal (INFOR) (1995b). Cuentas Ambientales y Bosque Nativo (Estudio del Banco Central). *El Mercurio*.
- International Institute for Environment and Development (IIED) (1996). *Towards a Sustainable Paper Cycle*. London, U. K.
- International Study Group on Sustainable Forest Management (1996). White Paper for the Second Meeting: 28 February to 1 March, *Standards New Zealand Secretariat*.
- Katz, Ricardo y Gabriel del Fávero, editores (1995). Proposición conceptual para el uso de instrumentos económicos aplicables al bosque nativo. *Documento de trabajo* 238, Centro de Estudios Públicos.
- Lara, Antonio; Claudio Donoso and Juan Carlos Aravena (1966). La Conservación del Bosque Nativo en Chile: Problemas y Desafíos. in Armesto, J.; C. Villagrán and Mary K. Arroyo (eds). *Ecología de los Bosques Nativos de Chile*. Vicerrectoría Académica, Universidad de Chile; Editorial Universitaria, Santiago, Chile, pp. 335-362.
- Larraín, S. and V. Menotti (1998). Implicancias de la Globalización Económica y el Libre Comercio sobre la Biodiversidad y los Bosques de Chile. in La Tragedia del Bosque Chileno, edited by *Defensores del Bosque Chileno*. Santiago, Chile, pp. 329-339.
- Moore, C. and Míller, A. (1994). Green Gold”, *Beacon Press*, Boston, Estados Unidos.
- OECD (1997). EcoLabelling: Actual Effects of Selected Programmes, Paris, *OCDE/GD(97)105*.
- O’Ryan, Raúl and Andrés Ulloa (1996). Amenazas al comercio internacional chileno por consideraciones ambientales. *Center for Applied Economics*, University of Chile. Santiago, Chile.

- Otero, Luis (1998). Efectos de la sustitución de bosques nativos por plantaciones de especies exóticas en Chile. in *La Tragedia del Bosque Chileno*, edited by Defensores del Bosque Chileno. Santiago, Chile, pp. 295-297.
- Porter, M.E. and C. Van der Linde (1995). Green and Competitive: Ending the Stalemate. *Harvard Business Review*.
- Roxo, Alberto (1999). Forestry Certification as a Market Instrument- Latest Developments and Challenges Ahead. FAO Advisory Committee on Paper and Wood Products, Fortieth Session- Sao Paulo.
- Sheenan, M. James (1994). The Greening of Trade Policy. Sustainable Development and Global Trade. *CEI Environmental Studies Programs*, USA.
- Schmidt, Harald (1994). Silvicultura y sustentabilidad en bosques de lenga de producción en Magallanes, in *Seminario sobre Medio Ambiente, Biodiversidad y Actividades Productivas*, Santiago, Chile, pp. 107-117.
- Schmidt, Harald and Juan Caldentey, (1994). Silvicultura de los bosques de lenga. Notes for the third course. *CONAF, Corma-Austral, University of Chile*. Punta Arenas.
- Scholz, I., Block, K., Feil, K., Krause, M., Nakonz, K. And Oberle, C. (1994). Medio Ambiente y Competitividad: El Caso del Sector Exportador Chileno. *Instituto Alemán de Desarrollo, Estudios e Informes N° 13/1994*. Berlin.
- Susaeta, Eladio (1995). La Responsabilidad del Banco Central. *El Mercurio*.
- The Economist* (1993). The greening of protectionism, pp. 19-22.
- The World Bank (1994). Chile. Managing Environmental Problems: Economic Analysis of Selected Issues. Latin America and Caribbean Regional Office. *Confidential Report N° 13061-CH*.
- Turner, K., Pearce, D. And Bateman, I. (1993). Environmental Economics, an Elementary Introduction, The John Hopkins University Press, Baltimore.
- Universidad Austral de Chile (1997). Pontificia Universidad Católica de Chile y Universidad Católica de Temuco. Catastro y Evaluación de los Recursos Vegetacionales Nativos de Chile. Proyecto CONAF - CONAMA - BIRF. Informe Nacional Con Variables Ambientales.
- Vanniere B. and A. Maurette (1995). Auditoría Ambiental de los Bosques Nativos de Lenga de la Patagonia. Office National des Forêts de Francia.
- Veblen, Thomas T.; Thomas Kitzberger, Bruce R. Burns and Alan J. Revertus (1996). Perturbaciones y Dinámica de Regeneración en Bosques Andinos del Sur de Chile y Argentina. In Armesto, J.; C. Villagrán and Mary K. Arroyo (eds); *Ecología de los Bosques Nativos de Chile*. Vicerrectoría Académica, Universidad de Chile; Editorial Universitaria, Santiago, Chile, pp. 169-198.

## List of Tables

1	Certification Initiatives in selected Countries.....	54
2	Chilean Forestry Exports. Fob Values. Us\$ Million (1995).....	56
3	Composition of Chilean Forestry Exports .....	57
4	Destination of Chilean Forestry Exports, 1994.....	58
5	World Production Capacity of Kraft Long-Fiber Wood Pulp.....	59
6	1996 Production and CIF Costs .....	60
7	Total Native Forest Area By Forest Type and Percentage Included In Snaspe. 1996 .....	61
8	Surface Area of Native Forest by Type of Cover and Height, 1996 .....	62