

Forest Clusters: A Competitive Model for Latin America

Manuel Bonita
Fernando Correa
Pertti Veijalainen
Harri Ahveninen

March 2002

Inter-American Development Bank

Sustainable Development Department

Environment Division

Forest Clusters: A Competitive Model for Latin America

Manuel Bonita
Fernando Correa
Pertti Veijalainen
Harri Ahveninen

Inter-American Development Bank
Washington, D.C.

Sustainable Development Department

The principal author of the report was Pertti Veijalainen under the supervision of Harri Ahveninen of Jaakko Poyry Consulting. The work was finalized by Manuel Bonita and Fernando Correa. Key initiators of the study were Joseph Ramos of the Economic Commission of Latin America and the Caribbean (ECLAC) and Pekka Ylä-Anttila of the Research Institute of Finnish Economy. Important contributors included Matti Kirjasniemi of Jaakko Poyry Consulting and Christian Keil in the initial stages of the study.

At the IDB the work was supervised by Kari Keipi of the Sustainable Development Department (SDS). Bank staff providing comments and guidance in different stages of the study included Fernando Balcazar of the Bank's Representation in Colombia, Michael Collins of SDS, Marc Dourojeanni of the Representation in Brazil, Rolando Jirón of the Representation in Argentina, Trond Norheim and Shigeo Sakai of the Regional Operational Department 2 and Raul Tuazon of the Regional Operational Department 1 in Washington, D.C.

Peer reviewers and commentators from outside the IDB included Joshua Dickinson of the Forest Management Trust, Jorge Katz of ECLAC, Karl Kehr and Horst Wagner of the consulting team of Forest Sector Program of the World Bank in Nicaragua.

The study was made possible by a financing by the Finnish Consulting Trust Fund at the IDB.

The views and opinions expressed herein are those of the authors and do not necessarily reflect the official position of the Inter-American Development Bank.

Preface

Globalization has had a significant impact on forest- and forest industry-based development worldwide. It has brought about increasing international trade in forest and forest industry products, launched new diversified and value-added products, promoted advanced technologies, accentuated requirements for human resource development, and witnessed a substantial amount of company mergers and acquisitions. These effects, together with other economic forces, will impact affect the competitive positioning of the different producing regions in the future.

This study identifies the potential and assesses the opportunities for adopting the cluster model of forestry and forest industry in Latin America, especially in Argentina, Brazil, Chile, Colombia and Mexico. It is directed to potential investors and professionals who want to have a fast view of the applicability of the forest cluster concept as a vehicle for development. The region and its countries can benefit from this international market development if basic competitive advantages exist and sectoral efforts are aligned to enable the strengthening of incipient local and regional cluster formation processes. The Nordic countries offer a good source of lessons learned, having increased their market share in the global forest- and forest industry-based businesses thanks to their existing comprehensive forest sector clusters.

The report forms part of a series of analyses carried out in the Sustainable Development Department of the IDB. The first one dealt with policies that may change the current trend of converting forests to other uses in Latin America and the Caribbean. The study results were published in a book (*Forest Resource Policy*, K.Keipi (ed.), IDB 1999). The second project produced a report on biodiversity (*Financing Biodiversity Conservation*, Bayon et al., IDB 2000). The third study is scheduled to be published in 2002 on *Forest Financing in Latin America: The Role of the Inter-American Development Bank*.

Walter Arensberg
Chief Environment Division

Acronyms and Abbreviations

ASEAN	Asian Promotion Center on Trade, Investment and Tourism
CMPC	Compañía Manufacturera de Papeles y Cartones (Chile)
CEPAL	UN Commission for Economic Development of Latin America and the Caribbean
ETLA	The Research Institute of Finnish Economy
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
ha	hectare
ICRAF	International Center for Research in Agroforestry
IDB	Inter-American Development Bank
IUCN	World Conservation Union
LWC	Light weight coated
m ³	cubic meter
MDF	Medium density fiber
MERCOSUR	Common Market of the South
METLA	Finnish Forest Research Institute
NAFTA	North American Free Trade Agreement
NFP	Argentine National Forestry Plan
NGO	Non-governmental organization
NTFP	Non-timber forest products
OECD	Organization for Economic Co-operation and Development
OSB	Oriented strand board
PM	Paper machine
PNF	National Forestry Program (Brazil)
PRODEFOR	Forest development program (Mexico)
PRODEPLAN	Program for the development of commercial plantations (Mexico)
PRONARE	National reforestation program (Mexico)
R&D	Research and development
RCA	Revealed comparative advantage
SFM	Sustainable forest management
SME	Small and medium enterprises
SNASPE	National System of Protected Wild Areas (Chile)
t	ton
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Program
USAID	The United States Agency for International Development
PEFC	Pan-European forest certification
WB	World Bank

Table of Contents

Preface	
Acronyms and Abbreviations	
Executive Summary	i
Forest Clusters	1
The Cluster Concept	
Diamond Model for Analyzing Competitiveness	
A Lesson from the Nordic Forest Clusters	
Implications for Forest Cluster Development in Latin America	
Cluster Analysis for Argentina	9
Forestry Sector Overview	
Factors and Policies Affecting Competitiveness of the Forest Clusters	
Strengths, Weaknesses, Opportunities, and Threats in Argentina	
The Case of Brazil	13
Forestry Sector Overview	
Factors and Policies Affecting Competitiveness of the Forest Clusters	
Strengths, Weaknesses, Opportunities, and Threats in Brazil	
A Look at Chile	17
Forestry Sector Overview	
Factors and Policies Affecting Competitiveness of the Forest Clusters	
Strengths, Weaknesses, Opportunities, and Threats in Chile	
An Analysis of Colombia	20
Forestry Sector Overview	
Factors and Policies Affecting Competitiveness of the Forest Clusters	
Strengths, Weaknesses, Opportunities, and Threats in Colombia	
The Potential in Mexico	23
Forestry Sector Overview	
Factors and Policies Affecting Competitiveness of the Forest Clusters	
Strengths, Weaknesses, Opportunities, and Threats in Mexico	
Conclusions and Recommendations	27
References	30
Annex 1 - Elements for Latin American Forestry Sector Development	
Annex 2 - Diamond Analysis of competitiveness in Argentina, Brazil, Chile, Colombia and Mexico	
Annex 3 - Review of Nordic Forest Cluster - Example: Finland	
Annex 4 - Factors for Success in the Finnish and Swedish Forest Clusters - Their Applicability to Latin America	
Annex 5 - Environmental Policies in Finnish and Swedish Forestry - Their Applicability to Latin America	

Executive Summary

Overview

Studies from different parts of the world indicate the key factors that contribute to success in the forest business. These include sound macroeconomic and long-term forest policies, secure land tenure, support from related education and technology programs, and cooperation among the various industries involved in producing and marketing forest products and services. The Nordic countries' extensive experience in forest cluster development (that include management and the resource and successful competitiveness in global markets), presents an inspiring model for other countries to consider. In this paper, forest clusters are analyzed as a possible means of development for five selected Latin American countries.

Objectives and Analytical Framework

The basic objective of this document is to examine the potential for creating forest clusters in Latin America. These clusters are based on the experience of Nordic countries and on studies of six natural resource-based clusters, identified by ECLAC/CEPAL. Specifically, this study aims to (1) identify issues and opportunities for forestry and the forest industry as a vehicle for development in Latin America; (2) define lessons for forest cluster development in Latin America in the light of good-practice experiences in the Nordic countries; and (3) formulate policy recommendations for the selected Latin American countries on how to develop and environmentally manage different types of forest clusters.

In undertaking a study of the different forest clusters in both the Nordic and Latin American case countries, the basic working tool used to analyze competitiveness is the "diamond" model introduced by Porter (1990). The model allows planners to assess four determinants that shape the diamond of a cluster, i.e., the key firms, factor conditions, demand conditions, and related and supporting industries, as well as the three forces that shape the environment around the cluster, i.e., government, chance, and international business activities.

The model's main strength lies in its ability to allow policy- and decision-makers to focus on the factors that make the forestry sector and its clusters competitive in the global economy. It also shows how local forest clusters can contribute to sustainable development. The diamond model needs to be complemented by other analytical tools used in traditional sector planning, when resolving some particular forestry issues (e.g., the environmental or social roles of forests). Cluster development benefits from networking in the forest sector value chain. It accentuates a shared understanding of sector strengths, weaknesses, opportunities and threats, thus enabling dynamic policy interventions and participation by all types of stakeholders in forest sector development.

Most Latin American countries have been formulating their forestry and environmental policies since the 1990s based on the UNCED principles, and many, if not all, have adjusted their policies and legislation to these principles. Among the case countries, Mexico updated its environmental and forest policies, plans and legislation in the 1990s and prepared a Forest Development Strategy in 2001; Brazil and Colombia completed their national forestry plans in the year 2000, but Chile and Argentina lack a comprehensive national-level exercise in this respect. The national forestry plans tend to be based on the traditional sector approach rather than the cluster model; however, the Colombian plan already encompasses many of the concepts of a forest cluster.

Summaries by Country

Argentina

Argentina has the potential to be a major player in forestry in the long term despite its recurring financial crises. An urgent issue for the federal government now is to formulate a new, comprehensive policy for natural forest management, which would elevate forestry to the same category as agriculture and ranching. The current forest industry is almost 90% based on plantation wood and is dominated by small- and medium-sized enterprises (SMEs), that are mainly geared for the domestic market. The recent economic liberalization has allowed foreign investments (mainly Chilean) in large forest industries and these now play a major role in exports from forest clusters. These larger export-oriented industries are complemented by a number of progressive domestic enterprises. The government also needs to implement new policies to eliminate the illegalities and tax evasion that some SMEs resort to in order to improve their profitability at the expense of honest firms. Financing for SMEs is generally available but often considered too expensive and too demanding in their loan conditions.

Brazil

Brazil is already the leader in plantation development in Latin America and is able to maintain its position by means of continuous investments and research and development programs. Progressive SMEs have been able and are likely to survive, especially in local market niches. The new National Forest Program, launched in October 2000, includes a special sub-program for industrial and environmental plantations to help improve wood availability and environmental services in the future. Foreign investment has a long history in the area and is favored by the current open market policies. Brazil's two main forest clusters – the Amazon region and the South-southeast region – together offer a remarkable potential for forestry development. However, typical obstacles such as corruption, uncontrolled deforestation and unsettled land tenure issues have impeded much progress to date. Brazil also needs improved roads, ports, communications and training and support for its new forestry plan to move ahead in developing solid forest clusters.

Chile

The main forest cluster in Chile is based on forest plantations originally established with government incentives. This cluster is principally oriented toward export markets and is owned by a few internationally competitive enterprises, who also own 80 % of the total plantation area and determine wood markets and prices. The domestic market, while not large, is demanding enough to test the products. The present incentive scheme favors small landowners and environmental plantings. Diminishing availability and high prices for land, plus tenure disputes in indigenous areas partly explain the companies' expansion to other countries with access to cheap land. The number of remaining SMEs is small, but those left share a remarkable capacity to succeed. Chile's situation is similar to its neighbors in that it needs an infusion of technical knowledge and training in the forest sector. Chile needs less foreign technological solutions and more support for educating forest technicians and for research and development. It also needs better roads and port facilities to support its exports.

Colombia

The forestry sector of Colombia is considerably weaker than in Argentina, Brazil, or Chile. There are many areas that need strengthening before a competitive forest cluster can truly emerge, and the present socio-political situation hinders development. A positive factor for Colombia is its large tropical forest area, which has valuable species and an outstanding richness in biodiversity, but its development must be

supported by a coherent long-term policy and plan, which was finally launched in late 2000. Environmental policies and laws based on UNCED principles are largely in place and there are also government incentives at present that would support industrial plantations. As with most Latin American countries, Colombia needs to improve its roads and port facilities to enhance its competitiveness and needs support for research and development, as well as for vocational and educational training. The country must strive to attain a stable political environment in order to attract and mobilize more foreign investments for the development of its industrial forestry sector.

Mexico

Both the principal advantage and threat for Mexico is its membership in NAFTA and its proximity to North American markets and competition. It also has a large domestic market. The forestry sector of Mexico has a somewhat different character from those of the other Latin American case countries: it is almost entirely based on socially (community) owned natural forests, basically rich in resources but traditionally poorly managed. Legal restrictions related to land tenure have impeded forest plantation development, which is only now beginning as a result of recent forest policy and the Strategic Plan for Mexican Forestry, 2001-2025. There are some large areas of productive land available for forest plantation development. Industry associations exist and some are quite active, but generally the services they offer to members are few, and the cooperation between industry and government needs improvement. Mexico's natural forests are the main concern in the new forest policy, which is based on UNCED principles. In many impoverished rural areas of Mexico, forest industry SMEs constitute a good vehicle for sustainable development.. As elsewhere in Latin America, any internationally competitive large industry in Mexico will have to be based mostly on plantations rather than on natural forests.

The five countries analyzed in this study differ significantly from each other. In the short term, Brazil and Chile will be in the best position to expand their forest production, mostly due to existing, but still young, forest plantations and to a relatively stable macroeconomic development. Argentina has one of the best forest development potentials on the continent but unfortunately it is struggling with a political and financial crisis at the writing of this document, which may delay the medium- and long-term investments in the forestry sector. In Colombia, the past dynamism in forestry has produced good results. However, the current limiting factor is the civil violence and state of war in the country. In Mexico, the emphasis on continuing to resolve the land tenure situation and the existence of a new Strategic Plan for Mexican Forestry may provide the possibility of increasing investments in forestry and developing a vital forest cluster in Mexico. There is a great potential in all five countries to develop forest clusters along the Nordic model and thus benefit from a competitive position in global markets while still maintaining a sustainable base of production.

Chapter 1

Forest Clusters

The cluster concept

Forest clusters in Latin America can be based on forest plantations, natural forests, or both. These forest clusters can also be viewed from the vertical and technological dimension, since they characteristically have similar processes in the vertical value chain as well as similar technological requirements. One useful way of identifying a forest cluster is analyzing its important players. For example, the role of pulp and paper manufacture may be the focal point of a forest plantation cluster or the potential of environmental services may be crucial for a cluster based on natural forests.

The forest cluster concept *strives to develop markets, development and improve competitiveness*. For example, certified sustainable forest management systems may be developed. Its products are able to compete in markets that accept forest-based products only from certified forests. Contrast this with the traditional objective of imposed policies, laws, and rules on sustainable forest management through demand and control mechanisms by the State. In many cases this approach is an obstacle, not a aid to joint-based development.

The cluster approach is *focused on linkages and interdependencies* among players in the value chain. It emphasizes the role of technological spillovers and cross-sectoral linkages of dissimilar and complementary firms as major sources of long-term growth. Thus it goes beyond the horizontal networks of firms that operate on the same end-product market and belong to the same industry group, and allows cooperation on aspects such as collective marketing and purchasing.

As a corollary to the above, the cluster approach is *focused on maintaining strong links that strengthen weak links that have hindered the attainment of competitiveness*. A competitive core player interacts efficiently with competitive suppliers (e.g., of machinery, other specialty inputs, or associated services), and would not want to be dragged along by non-competitive suppliers. Non-competitive suppliers must innovate or lose their place of importance in the cluster.

A further corollary is that the cluster approach is *focused on innovation* brought about by the interaction among the different players in the cluster. As pointed out by Hazley (2000) firms do not innovate in isolation. Rather, innovation always involves various agents from both the private and public sector. Innovative firms rely on sources of knowledge and competency complementary to their own capabilities. While innovation is stimulated by increasing global competition, the production of knowledge and the subsequent innovation process is based on the interaction and cooperation among those in the cluster.

Diamond model for analyzing competitiveness

To compare forest clusters in selected countries in Latin America with each other and with the developed forest clusters in Nordic countries, a cluster analysis based on the diamond model has been used in this study. The diamond model was introduced by Porter (1990) to structure the determinants of competitiveness in a cluster and to facilitate identifying differences across countries. Porter defined success in terms of a company's long-run profitability and high market share, which are attained by continuous innovation and upgrading. While Porter's studies are at the industry and firm level, a link is also drawn to the national level, since as Porter noted, "Nations succeed in industries if their national

circumstances provide an environment that supports this sort of behavior.” The institutional structure, domestic factor pools, and macroeconomic conditions of the country shape this environment.

Porter’s diamond model incorporates the forces that influence a firm’s ability to sustain and upgrade its competitive advantage. It includes four main determinants that shape the diamond, plus outside forces that shape the operating environment (see Figure 1.1).

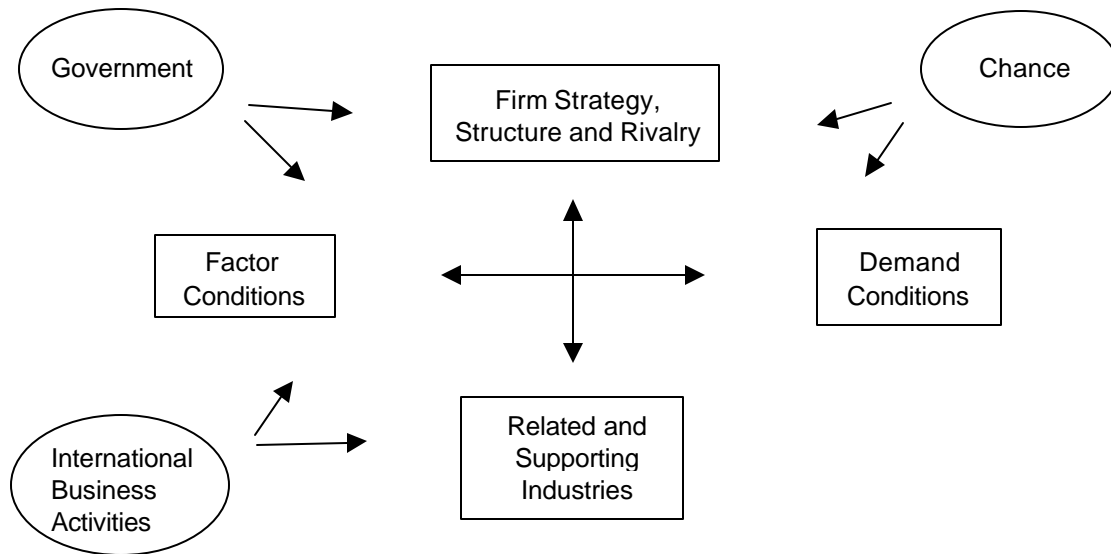


Figure 1.1 The Diamond Model (Porter, 1990)

The four main determinants are:

1. **Factor conditions.** Porter makes a distinction between two categories of factor conditions, as follows:
 - a. **Basic factors** are inherited, such as location, natural resources, climate, and population. The availability of basic factors with favorable characteristics provides an initial advantage to a country, but does not guarantee success in competition in the global economy.
 - b. **Advanced factors** have to be created, such as a communications infrastructure; sophisticated skills acquired through higher education, and advanced research facilities. The advanced factors are obtained and sustained by continuous investments by individuals, firms, and the country. Significant gains in competitive advantage by a country are made possible through these factors.
2. **Demand conditions.** Domestic demand remains important in spite of globalization. As Porter pointed out, a demanding customer in the home base is a genuine force behind innovation and technological development. This is because firms are most sensitive to the needs of their closest customers. Demanding domestic customers, through changes in their demand behavior, could become a gauge for predicting future global trends.
3. **Related and supporting industries.** Porter’s finding is that successful industries tend to form clusters. A competitive cluster includes a number of related and supporting industries that tend to be internationally competitive as well, because of the sophisticated demand they are facing. By having internationally competitive-related industries, firms in a cluster can gain competitive

advantages since they can focus on their core competencies, while relying on their suppliers for other activities.

4. **Firm strategy, structure, and rivalry.** Porter acknowledges that national characteristics partly determine how companies in a country are founded, organized, and managed. He argues that different management systems suit different industries. In addition to domestic demand, intense domestic rivalry is, according to Porter, another major source of competitive advantage because, since each enterprise has to operate under the same national conditions, the competition among domestic companies tends to be more intense and direct. While the firms in the cluster compete fiercely in the market place, they may also cooperate, for example, in research and development. Due to the accelerated diffusion of technology and knowledge spillovers, a successful cluster has internal synergies that further feed the innovation and upgrading process.

The outside forces that shape the operating environment are:

1. **Government.** The role of governments has changed markedly over the past few decades in accordance with the globalization of business and the changing mechanisms of creating competitive advantages. In the 1970s, governmental bodies “backed the losers” and in the 1980s, they “picked the winners”, e.g., by providing subsidies and protection, and limiting rivalry. In the 1990s they “let the market pick the winners”, realizing that firms create their own firm-specific advantages and that the role of government policies is not to intervene directly but to enhance the framework conditions for the firms. As previously pointed out, this does not mean that the role of government has significantly decreased; in many respects it may have become even more important. The task of the public sector in providing advanced and sophisticated factors of production (e.g., organizing education and constructing necessary technological infrastructure) become more important than before in a knowledge-driven economy.
2. Based on extensive cluster studies in many OECD countries (for examples, see OECD, 1999), the appropriate role of governments is no longer in providing direct subsidies, but rather in providing indirect measures to promote competitiveness, such as follows:
 - a. Establishing a stable and predictable macroeconomic and political environment.
 - b. Improving the availability, quality, and efficiency of general-purpose inputs and institutions.
 - c. Establishing rules and incentives governing competition.
 - d. Facilitating cluster development and creating forces for upgrading and innovation.
 - e. Promoting the development of human capital.
1. **Chance.** Porter pointed out that chance has played a crucial role in many of the industrial success stories. Chance events include “pure” innovations, technological jumps (rapid changes in specific technologies), price shocks, changes in political systems, economic collapse at national or regional level, wars, natural disasters, etc.
2. **International business activities.** International business activities were not originally part of the diamond model. They were added later as a result of discussions initiated by scholars in international business. Multinational corporations can be seen as extensions of national diamonds. However, while most firms indeed have a “home base”, there are truly global corporations with a corporate culture that is not much influenced by any single nationality.
3. In the comparative analysis of forest clusters, international business activities (IBA) and globalization of the forest sector are looked at as a part of the analysis of global market and business trends. This approach to IBA is also maintained in the country studies.

A lesson from the Nordic forest clusters

Description

The Finnish and Swedish forest clusters evolved from firewood and tar production over 500 years ago to the current era of sophisticated paper printing. The road from raw material producer to the world's leading paper machinery producer has been a long one. Until relatively recently, the Nordic countries produced fairly low value-added products, such as pulp and sawnwood. Paper production concentrated on the bulk grades such as newsprint. The machinery industry relied mainly on foreign technology produced under license. The majority of forest industry chemicals were also imported until the 1970s.

The development of timber-based forest clusters first started with the establishment of sawmills in suitable locations providing power (first, water-driven power and later, hydropower on rivers) and transport conditions (water transportation). In the late 1800s, with the development of pulp and paper technologies, the best sawmill-based growth centers grew further with the establishment of pulp and paper mills. These local growth centers, after reaching enough critical mass, started to attract related industries and services, which for their part supported the favorable conditions of further growth. This continued during the first half of the 20th century. The early integration of the sawmill and pulp industries gradually decreased the number of sawmills in rural areas which adversely affected rural employment.

In the second half of the 20th century, producers made a concerted effort to upgrade their product range, particularly the value-added quality of the paper grades they produced. This involved close co-operation with, above all, the machinery industry, but also with all the other related and supporting industries. The companies also had to develop considerable project management and engineering skills. As a result, Finland now has a fairly complete forest cluster and is highly competitive in the core products of paper, paperboard and sawnwood. In addition to this, it is an important global producer of many related and supporting industries such as timber harvesting machinery, pulp and paper making machinery, paper chemicals and forest industry consulting.

The development of exports of secondary and converted forest products (such as furniture, wooden construction elements, printed products, etc.) has been more developed in Sweden than in Finland. However, of all the Nordic countries, only Denmark's furniture industry has developed into a significant exporter (mainly benefiting from the close North German markets for high value-added products).

Figure 1.2 (on the basic elements of a Nordic forest cluster) does not include the numerous connections to other elements and services of many forest clusters. There are several missing environmental services – such as carbon sequestration, water and climate regulation; biodiversity conservation, and recreation – that are strongly linked with the ecotourism business. The non-wood forest products include primarily the collection of wild berries and mushrooms as well as hunting of moose and other wild animals. The link between forestry and agriculture is strong; private farm forests have been used as a bank to provide capital input for the investments in agriculture.

Porter uses the index of revealed competitive advantage (RCA) to calculate how deeply a country specializes in each cluster. The RCA index is calculated by comparing cluster exports as a share of total exports to the OECD average in each country. The higher the RCA, the higher will be the level of specialization. In terms of the RCA index, Finland has the highest level of specialization in the forest cluster out of all the OECD countries and Sweden the second highest. Forest cluster exports accounted for 34% of Finnish exports in 1997, whereas in Sweden they were 17% of the total merchandise exports.

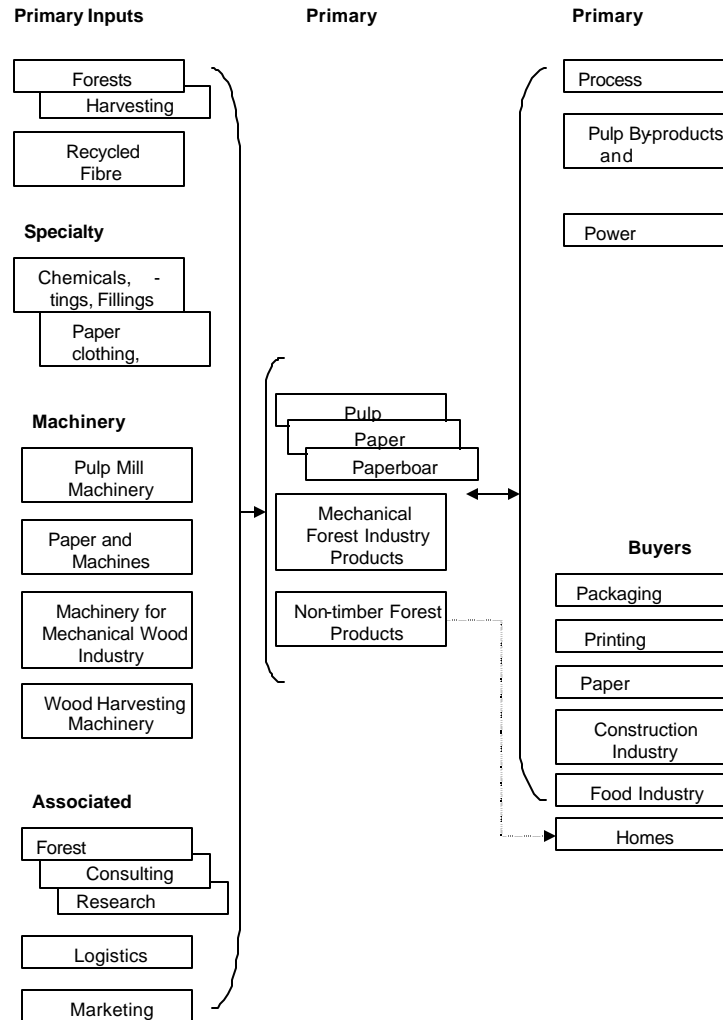


Figure 1.2 - Timber Based Elements of Nordic Forest Cluster

Applicability of the Nordic model to Latin America

It is an old adage that “experience is the best teacher” and it is always easier to learn from someone else’s experiences and thus avoid making the same mistakes than it is to try to learn by trial and error on one’s own. Thus it is with the Nordic experience with cluster forestry. There are several lessons learned that can be useful for Latin America.

Nordic countries have stable political systems and transparent governments who recognize their role in actively maintaining those factors that contribute to their competitive edge in the global markets. They also have a high priority for forest sector development. The contribution of the sector to society and the economy was recognized long time ago. The perception of the importance of environmental services has grown very much during the 1990s. The environmental certification of forest products is a must in several markets.

Socio-cultural factors in many Latin American countries may hinder their progress toward attaining this same level of government support, but it is a condition they should aspire to and work for, even it takes more than one generation. The newest forest policies and legislation have the beginning elements in place to bring about such a change – the challenge is in the implementation.

At the moment, the Nordic countries have their forest products utilization in check with the annual growth of the forest resources; their forest biomass continues to increase. Latin America generally has even more favorable biological conditions for forest production – better climate, suitable soils, and a large expanse of available land.

Similar to the Nordic forest clusters, Latin America has a mix of small and large industry players. In Finland and Sweden, many small landowners feed the wood market. Large pulp and paper companies do not rely as much on their own wood supply as in Latin America, but this situation is often similar in some parts of Latin America as well.

A diversified wood market tends to raise wood prices but, at the same time, the higher wood costs force the industries to develop new products, more efficient production processes, and to better integrate the use of raw material. Higher wood prices make forest management economically more attractive for private forest owners, and the income generated by the industries is more evenly distributed throughout the production chain as well as geographically in rural areas.

In the future, SMEs and large companies in a country could work together to strengthen the domestic wood market, or create it if it does not yet exist. Most SMEs could then specialize in supplying wood, rather than being pressured to develop wood processing capabilities for which they have limited or no resources to build to a competitive level. Large companies could assist the SMEs by transferring technology that their research and development facilities develop, such as in genetics and forest plantations technology.

The Nordic countries have an excellent network of educational and research institutions that provide know-how and trained and skilled human resources at all the required levels: academic, technical, and vocational. This can also be attained in Latin America through government support and programs, if it were made a goal of the given country.

It took decades, but the Nordic countries have been able to develop support and related industries that provide the inputs and services needed by the forest clusters, e.g., chemicals, machinery that is suitable to the kind of products that the companies want to produce for the market, and process automation. Latin American companies need similar inputs and services to be competitive and to develop domestic facilities similar to what the Nordic countries already have. What they can do is call for a transfer of appropriate technology and expertise through investments from advanced countries, or as part of trade agreements, or any other similar measures.

Implications for Forest Cluster Development in Latin America

In the present globalized economy, cluster analysis provides a useful theoretical framework for guiding long-term development success. The positive results achieved in the Nordic countries, where a cluster strategy has been applied in the forest sector, has demonstrated that increasing productivity and continuous innovations are crucial to secure a national competitive advantage.

Key elements for such progressive development and competitiveness are 1) the existence of modern forest industries, 2) profitable sales of forest products and services in world markets, 3) close collaboration with suppliers of required specialized inputs, 4) a network of related supportive industries and sound governmental supportive policies, and 5) an environment of both competitiveness and cooperation.

According to the diamond model of competitive advantage, primary attention should be paid to the four basic internal elements of the model: factor conditions; firm strategy, structure and rivalry; demand conditions; and related and supporting industries. Additionally, the three external forces that define the

operating environment should also be carefully scrutinized, namely governmental policies, chance, and international business activities.

It is important to understand the key success factors of the Nordic forest clusters in order to examine whether or not some of these elements are applicable to the reality of Latin American countries.

In the *Factor Conditions* analysis, some fundamental issues include establishing the sustainable management of forests (halting the deforestation and degradation of natural forests) and a stable property and tenure regime. These issues are frequently poorly solved in Latin American countries. Fast growing forest plantations have become an important new source of raw material, but they cannot be the only providers of stable forest products and services. In addition, other key factors include well-functioning markets, adequate pricing, and the equitable distribution of the socio-economic benefits of the forest business. Another important factor condition is having educated professional and technical staff and available skilled labor, both of which need to be satisfactorily available for a cluster to be successful.

The complementary development of forest industries with *Related and Supporting Industries* (such as machinery manufacturers, chemical industries, building enterprises, energy companies and others) is of high importance for having a wide range of specialized supporting inputs available. In Latin America, this aspect is poorly developed in forestry. Having a good infrastructure and an efficient transportation system (a well-developed road network on the main industrial concentration nodes as well as good port facilities) are also relevant factors. The infrastructure has been continuously improving in the region.

In *Firm Strategy, Rivalry and Structure*, special attention should be paid to several factors: the vertical and horizontal integration between manufacturers, the rivalry in research and development activities and the cooperation among large firms and between these companies and small- and medium-sized enterprises (SMEs), as well as between industry and the central and local governments. The countries in the region show relatively low levels of integration, the research is scant, and cooperation between firms is low in general.

In the *Demand Conditions*, important focus points for defining a progressive development should be 1) the nature of international competition affecting producers, 2) the demand projections for various products and services, 3) the investment decisions adopted according to competitive advantage, and 4) the permanent attempts to modernize the production of higher value-added products. The Latin American region has the advantage of strong and growing home markets.

In *Government Actions*, a significant element to consider is a sound supportive policy implementation for reaching progressive development. Especially crucial are a clear long-term forest policy and satisfactory legislation in a stable political environment. Governments need to support clear ownership and tenure of forests and increasing the participation of stakeholders in development programs. It is hard to see how long-term, stable environmental and forest policies can be implemented if land tenure and land use are not settled. In most Latin American countries it is also vital to concentrate efforts on fostering rural development to overcome poverty and underdevelopment. Eliminating the exclusion of indigenous peoples and women from the political process are important tasks in this process since they affect rural populations and forest-based development. Governments should also endorse research and development activities and support technology programs that help to permanently upgrade the industry's technological capacities.

In the *International Business Activities*, attention should be paid to globalization and to the analysis of global markets and business trends. Key elements to study in these analyses are the openness of national economies and their invested capital. There is important progress in free trade agreements for the region that may contribute positively to competitive forest cluster development.

A thorough demarcation and screening of the above-mentioned factors and elements of the cluster analysis – as has been done in Nordic countries – could be a powerful tool for setting the parameters for a long-lasting successful development of the forest sector in Latin American countries.

Chapter 2

Cluster Analysis for Argentina

Forestry sector overview

Argentina's main strength in the basic factors for wood production lies in its vast potential for fast-growing industrial plantations, favored by a stable land ownership structure, an availability of a wide expanse of fertile land, and its favorable ecological conditions. In contrast, natural forests, which are mainly private, are not managed and deforestation from colonization continues.

Table 2.1: The forestry sector of Argentina in a nutshell

Forest resources and population		Principal forest products (1997)	
Total land area (continental block)	279.6 million ha	Industrial roundwood	7.687 million m ³
Forested areas	52.3 million ha	Sawnwood	1.171 million m ³
Closed (dense) natural forests	35.8 million ha	Firewood	3.742 million m ³
Plantation forests	0.85 million ha	Wood-based panels	1.183 million m ³
Protected areas	12.5 million ha	Pulp *	0.75 million t
Population	36.738 million	Paper and paperboards	1.159 million t

15% correspond to non-wood fibers

Source: Jaakko Pöyry

The wood supply for the forest industry is 80-90% based on plantations. Argentina has about 850,000 hectares of forest plantations, which is about 4% of the 20 million hectares of land suitable for plantation development. Preliminary estimates of an inventory of the plantations indicate that the net productive areas may be substantially smaller than the reported total. The environmental services and social benefits derived from the forests are not yet well recognized. Natural forests provide only a few products for forest industry, to be used principally for wood-based panels and furniture.

The export value of forest products from Argentina in 1998 amounted to USD 600 million, while the imports for the same year amounted to USD 1621 million. Pulp and paper account for 70% of the deficit.

The present legal framework for the promotion of industrial forest plantations in the country offers attractive incentives to forest industries and foreign investments and has contributed to notable increments in plantation areas. The recently launched National Forestry Plan (NFP) aims to promote national economic activities through joint investments in the private and public forest sector. The NFP aims at capacity enlargement in pulp, paper, and fiberboard; promoting exports of high value-added products; and developing norms for the use of wood in construction in Argentina.

Following the opening of its markets in 1992, Argentina has gone through a structural change, particularly in large industries. The pulp, wood-based panels and saw milling industries have been expanded and modernized, partly through foreign investment. These investments have also resulted in increasing the number of plantations. While the industry has shown a positive development, domestic markets for primary products (paper, boards, furniture, and wooden houses) have been relatively weak.

Potential forest clusters in Argentina

The following potential forest clusters show promise for the future:

1. The Corrientes and Entre Rios cluster, based on forest plantations that support mainly a pulp and paper industry, although it includes an environmentally significant natural forest
2. The Andean-Patagonia cluster, based on natural forests to be managed mainly for environmental services although they may support small mechanical wood industries. It also has an incipient industry based on plantations established on degraded pastures.
3. The Tucumán-Salta-Jujuy cluster in northern Argentina, based on natural forest but challenged by colonization and conversion of forest lands to agriculture.

Factors and policies affecting competitiveness of the forest clusters

Role of SMEs versus large industries

The joint industry of Argentina comprises over 3400 registered firms, of which 65 % are small sawmills with an annual production of 1000 m³ or less. In addition, there are non-registered companies, mainly sawmills and small furniture factories considered under “installed but not active capacity” in the official statistics. Two sawmills of varying capacity, Arauco in Alto Paraná and Perez Companc, are expected by 2002 to account for 25% (350,000 m³/yr.) of the sawnwood production. The Argentinean forest industry has a processing capacity for 11 million m³/yr. of round wood; currently it uses some 50 % of this capacity.

There are 17 pulp production units and 94 paper production units, of which ten account for 40% of the total production in paper and pulp. The Alto Paraná mill of Arauco produces 45% of the pulp in the country. Ten particleboard plants produce up to 450 thousand m³/yr., but are still well under their capacity.

The country has approximately 10,000 producers dedicated exclusively to the production of wood raw material (2 % of the 0.5 million agricultural producers).

The forestry and forest industry in Argentina is in a process of internationalization, which would lead to the dominant position of large industries and a restructuring of the SMEs in the main regional clusters. Progressive medium-sized industries have their own wood supply; those without their own raw material will have a hard time surviving. Most of the small industries are likely to disappear, especially if legal control over them is tightened.

SMEs are an important target for development schemes at both the raw-material production and industrial levels. Typical problems of the SMEs are (a) difficult access to credit, (b) a low level of business management skills, (c) deficiencies in the technology used and d) marketing their products. Credit as such is available, but the application procedures and needed guarantees constitute a problem. Technical assistance is available in business administration and management, but because of widespread tax evasion and other such practices, hands-on training is not common. In promoting marketing, industry chambers are in a key position. However, there is a problem of internal and external conflicts and a lack of government support. In the past, Argentina has received quite large loans usable for training in forestry and forest industry, but the central government has not been interested in giving priority to this use of international loans and increasing mostly its external debt.

Government strategies focus on the development of SMEs by promoting forest plantation development, expanding forest activities to benefit small and medium-sized owners, and not concentrating the

ownership of forest plantations to only a few large owners. Very small producers grouped together can receive, in advance, part of the cost refund for establishing new plantations.

Table 2.2 - Forest industry structure of Argentina

Industry	Production units	Annual production capacity	Average annual production	Direct labor
Pulp	17	1,163,000 t	68,400 t	8200 (pulp and paper)
Paper	94 (128 paper machines)	1,740,000 t	13,600 t	
Sawmill	2200	1,711,000 m ³	800,000 m ³	13,200 (incl. furniture)
Particleboard/ Fiberboard	10	730,000 m ³	93,300 m ³	2,258
Furniture	1100 (registered)			
Impregnation	22	432,000 m ³	19,600 m ³	265

Source Jaakko Pöyry

Comparative analysis of the forest clusters

Annex 2 shows the factors and policies affecting the comparative advantage of forest clusters in Argentina, as well as indicates the possible changes needed to improve competitiveness. Highlights of this analysis are provided below:

The country has excellent conditions for forest plantation development: a large expanse of fertile land located in a wide variety of climates that allows the establishment of different species, and government incentives that support the establishment of forest plantations. These incentives should be continued.

Argentina should develop a policy, and then demonstrate through pilot projects, the feasibility of sustainable natural forest management. It needs to also look into the potential of natural forests to provide environmental services.

There is a satisfactory road network and communications and other infrastructures whose development is continuing, plus a network of educational and research institutions. Training should be further strengthened, e.g., at the technician and vocational levels. Government support to infrastructure development and to educational and research institutions should be incurred, especially in existing forest cluster areas. Research topics should include developing standards and norms for forest products and forestry certification.

While Argentina's forest clusters get more involved in targeting the export market, an increase in domestic wood product consumption must be spurred by improved quality and standardization of the wood products. Only by catering successfully to demanding domestic customers can the forest clusters successfully meet the requirements of the global market.

Argentina's forest clusters are dominated by small- and medium-sized enterprises (SMEs), which are geared for the domestic market, but the liberalization of the economy has allowed large, export-oriented forest industries to establish and play a major role in the forest clusters. There is a need to improve the information flow among firms involved in different stages of the production chain, as well as to strengthen the industry associations.

To remain competitive, forest industries need to replace obsolete technologies. Transfer of technology can be effected through trade agreements and by foreign companies that are investing in the country. In the future, research and development in domestic support and related industries could be put to bear on this problem, but transfer of foreign technology and expertise can meet the immediate concern faster.

Strengths, Weaknesses, Opportunities, and Threats in Argentina

The diamond analysis of Argentina's forestry sector reveals a number of strengths, weaknesses, opportunities, and threats to the country's ability to compete in global markets with its forest products. Listed below is a summary of these factors for consideration.

Strengths

- ? Wide climatic variety allows the diversification of plantations according to the requirements of the industry; soils are very suitable for plantations of fast-growing species; there are hardly any pests to threaten plantation development
- ? No pests or diseases of economic importance in forest plantations
- ? Good infrastructure and services (road and waterways network, ports) in the main forestry regions
- ? Large well-educated population with high purchasing power
- ? Relatively solid plantation-based industry, particularly pulp and boards

Weaknesses

- ? Poor quality of wood in currently harvested plantations
- ? High cost of road and rail transport
- ? Outdated labor laws that promote an excessive work force and low productivity in the industry
- ? Too strong currency compared with productivity
- ? Vertical integration only in a few companies; horizontal integration almost non-existent
- ? Industry associations weak; coordination deficient
- ? Low technological level of most SMEs
- ? Financing of forest industry SMEs is complicated and inadequate.
- ? Lack of a well-defined forest policy that considers the interests of all the actors (i.e. private forest owners, SMEs, industry, government, related sectors, etc.)
- ? Deficient and outdated legislation for management of natural forests, whether publicly or privately owned

Opportunities

- ? Carrying out the National Forestry Plan could become a major activity in the forest industry in the next 15 to 30 years, both for the markets of Mercosur and globally
- ? Vast expanse of land (20 million hectares) suitable for forest plantations outside of agricultural land; tenure conditions better than in most other countries in Latin America
- ? Substantial potential to increase domestic demand for forest products
- ? Excellent conditions for recreation and ecotourism in several regions
- ? Liberal legislation for foreign investment

Threats

- ? A broad overall forest policy (not just on incentives) is not formulated or being carried out
- ? Unsustainable practices in natural forests leading to deforestation, losses in biodiversity, and erosion problems
- ? Training programs are not sufficient or not being carried out.
- ? Expansion of large companies is out-competing SMEs in raw material supply and in the market (e.g., in Misiones and Corrientes).
- ? Illegal SMEs and illegal practices (mainly in mechanical industries of SMEs, e.g., tax evasion, not reporting the total number of workers, and not paying social costs) are not the best way to maintain competitiveness.
- ? Productivity in existing mills cannot be improved without a major structural change.

Chapter 3

The Case of Brazil

Forestry sector overview

The main characteristics of the Brazilian forest sector at the end of the 1990s are presented in Table 3.1.

Table 3.1: The Brazilian Forest Sector and some socio-economic indicators in a nutshell

Forest resources and economic indicators		Forest products (1997)	
Total land area	845.7 million ha	Roundwood 1997	220 million m ³
Natural forests	546.4 million ha	Industrial roundwood	84.7 million m ³
Plantation forests	4.7 million ha	Sawnwood	19.1 million m ³
Protected forest area	39.0 million ha	Wood-based panels	4.0 million m ³
Participation of forest sector in GDP	2.2%	Wood pulp	6.2 million t
Population	163.1 million	Paper and paperboards	6.5 million t
Forest labor		Total exports of wood-based products	USD 3.3 billion
- Direct employment	0.7 million		
- Indirect employment	2 million		

Source: Jaakko Pöyry

Forest clusters in Brazil

Two forest clusters have been identified in the country based on both the regional and vertical dimensions:

1. The South-Southeast forest cluster comprised mainly of large pulp and paper plants, modern sawmills, and panel plants, all based mainly on industrial roundwood from about 4 million ha of *Eucalyptus* and *Pinus* plantations.
2. The Northern (Amazon) forest cluster comprised of traditional forest companies, mainly SMEs, whose main activities consist of production of sawnwood and plywood from selected natural forest species.

Factors and policies affecting competitiveness of the forest clusters

The role of SMEs versus larger industries

Throughout Brazil numerous SMEs provide employment for approximately 3 million people and are able to remain competitive by occupying specific domestic market niches. For example, Brazil's large domestic market for furniture is dominated by many SMEs, which exhibit some vertical integration in their production chain to meet the demand and remain competitive. In contrast, Brazil's export market is dominated by large, globally competitive pulp and paper and integrated forest enterprises. There is very little integration between the SMEs and the larger industries and cooperation between the two groups should be encouraged through industry trade associations and activities. The country's SMEs in general

have weak horizontal integration and limited vertical integration. Nonetheless, they are an important component of both forest clusters in Brazil.

Comparative analysis of Brazil's forest clusters

Annex 3 summarizes the factors and policies affecting the comparative advantage of the Southeast-South and Northern forest clusters in Brazil, respectively. The large differences in the nature of these two clusters resulted in their separate treatment in the analysis. The two tables also indicate the possible changes needed to improve competitiveness of the respective forest clusters. The tables are self-explanatory but important highlights are provided below.

South-Southeast forest cluster

The main players of the cluster are large, export-oriented, and globally competitive pulp and paper and integrated forest enterprises, as well as numerous SMEs. The firms should enhance their cooperation and inter-industry relation for better synergism in resolving common problems through trade associations and federations.

A strong factor of the cluster is the availability of large, geographically concentrated, and privately owned forest plantations. The advanced factors are also favorable, e.g., a well-developed infrastructure, an abundance of skilled professionals and workers, and research expertise, especially in forest plantation development. However, there is a need to strengthen technician- and vocational-level training, as well as develop local technological solutions to problems peculiar to Brazil. Top-level research and development experts and production engineers should be trained in Brazil.

There is a large domestic market. In addition, the large industries gear their production for export markets. SMEs are able to remain competitive by securing specific market niches.

Domestic producers of machinery and chemicals, as well as consulting and other specialized services, are available, but research and development needs to be encouraged and supported to develop sophisticated machinery suitable to the kind of products that the cluster wants to produce.

The government completed a new, progressive forest policy in 2000. It needs to crystallize its role in facilitating cluster development and creating forces for upgrading and innovation.

Innovation in forest plantation development (e.g., genetic manipulation), is a chance event that has strengthened the cluster.

Northern forest cluster

The traditional companies and SMEs that operate in the cluster have weak relations, which should be strengthened, e.g., through activities of industry and trade associations.

A positive factor of the cluster is the availability of large areas of natural forests that provide a vast reservoir of raw material and the potential for environmental services. However, forest management has been neglected, and problems have arisen in matters pertaining to land claims, tenure inequities, and deforestation. There is a need for policy reform to remove perverse incentives that promote deforestation, to establish efficient local administration, and to stabilize land ownership and land use.

As opposed to the South-Southeast cluster, road and communication infrastructure is poor. Other weaknesses in the advanced factors include obsolete machinery and the inadequacy of workers' training,

extension, and research and development. All of these weaknesses need to be corrected to improve the competitiveness of the cluster.

There is a large domestic market and the larger industries gear their production for the export markets. SMEs are able to remain competitive by securing specific market niches. There is a need to produce more high value-added products, as well as to promote the marketing of lesser-known species.

The mechanical wood industry has been unable to improve its processing technology. Research and development, especially in this area, need support. At the moment, most of the processing of primary products into secondary products (especially furniture) takes place in the South-Southeast cluster.

There has been no real change in the attitude of government policy and decision makers towards environmental sustainability. The government needs to crystallize its role in cluster development and to harmonize its contradictory programs. The NFDP, approved in 2000, has the basic policy and technical elements to do this.

Strengths, Weaknesses, Opportunities, and Threats in Brazil

The diamond analysis of Brazil's forestry sector reveals a number of strengths, weaknesses, opportunities, and threats to the country's ability to compete in global markets with its forest products. Listed below is a summary of these factors for consideration.

Strengths

- ? Forests cover a vast territory – 65% of the total land area or 550 million ha. Brazil has the largest tropical forest biomass in the world – a huge reservoir of wood and a huge potential for environmental services.
- ? Large and geographically-concentrated resources of fast-growing forest plantations, both hardwood and softwood, which produce an ample assortment of different forest products
- ? Abundance of skilled forest professionals and workers, including a specific academic education for pulp, paper, and mechanical forest industries
- ? Already established modern forest industries, especially for pulp and paper, panels, and recently sawnwood, which are efficient and competitive in global markets; numerous SMEs, which give employment to close to 3 million people
- ? A fairly well-developed technological and industrial base for production and development of forestry and forest industry machinery
- ? Environmental standards of the modern Brazilian industry are comparable with those of the US and Europe.
- ? Large and expanding domestic market for forest products. Highly diversified industrial production, increasing urbanization, and a

Opportunities

- ? Sufficient availability of raw material for significant expansion of productive capacity in the Amazon, if the forests are managed sustainably
- ? The new forest policy calls for an expanded plantation program, due to the current high demand for the production from existing plantations
- ? A more efficient development of forest planning and integration of forest activities with agriculture and grazing is badly needed. The plans should also incorporate anti-poverty campaigns and promote rural employment and income. The new forest policy addresses these issues, and is participatory by nature.
- ? The pattern of geographical concentration of the forest industries provides a good basis for more advanced linkages between different actors in the forest cluster.
- ? Productive enterprises can be specialized, but diversification gives a more solid basis for better utilizing wood resources (vertical integration) and protects businesses from international price fluctuations on forest products. The diversification of pulp and paper companies, which are establishing large sawmills and wood-based panel plants, is a good

modern and dynamic agricultural sector – which demands different types of forest products – are driving forces for the enlargement of local markets.

- ? The traditionally protected Brazilian economy is under a gradual liberalization, some structural adjustments, privatization of state industries, and more favorable conditions for investments (Plan Real in application).
- ? Ongoing investment programs and active involvement in international trade agreements, e.g., MERCOSUR, provide good prospects for increasing international business activities.

Weaknesses

- ? Corruption is still a factor in natural resource management, particularly in land tenure. Corruption increases land grabbing and illegal possession.
- ? Brazil has a strong historical deforestation tradition (even for Latin America), which tends to dominate land-use policies.
- ? A very inequitable land tenure structure promotes deforestation of new areas subject to logging
- ? Lack of a clear long-term forest policy at the national and regional levels, defining explicit goals and appropriately financed implementing programs. Numerous forest policies and programs aiming at different goals were formulated and applied during the last four decades; the newest was launched in late 2000. The interests of all stakeholders were not incorporated in these policies and programs. Instead, the policies focused on a few short-term benefits, which were of high priority for different governments.
- ? Government institutions have a bureaucratic orientation and do not efficiently apply laws and programs established by the federal and state governments.
- ? The role of natural forests as a source of products, services and income in rural areas has been widely neglected. They are not sustainably managed and environmental services are not duly priced.
- ? Incentives for agriculture and grazing very often have led to unjustifiable deforestation on marginal land.

example of this tactic.

- ? There are good prospects for expanding the manufacture of high value-added products, such as furniture, pulp and paper, specialty panels, and others.
- ? Furniture companies constitute a good example of well-developed cooperation and the efficient integration of SMEs into a competitive production chain. Good opportunities exist for increasing integration (vertical and especially horizontal) among larger companies and also between these and SMEs.
- ? Macroeconomic stability, if it can be maintained, is expected to attract foreign capital for new forestry projects.
- ? Brazil potentially has a major future role as a global player, especially in pulp but also in mechanical forest products.

Threats

- ? Land claims and forest tenure disputes have not been solved, e.g., there remains conflict in land ownership between indigenous communities and landless peasants, which constitute a clear threat to attracting investments in several states of Brazil.
- ? Chance events (for example, the outbreak of BSE in Europe), increases protein demand from non-animal sources (e.g., soybean), or imports of beef from non-BSE countries like Brazil, causing a need for land, which is met by deforestation.
- ? Immigration to forest areas cannot be controlled because socio-economic conditions in the source areas have not improved and land reform on existing agricultural land is not being carried out.
- ? Stumpage prices of natural forest species has not been raised sufficiently to promote sustainable management of natural forests. If private landowners had a reason to consider forestry as a profitable business, land-use change would emerge as a rational alternative.
- ? There's been no real change in the attitude of politicians and principal interest groups towards environmental sustainability.
- ? The forest policy "vacuum" that prevailed during most of the 1990s has not been overcome, affecting the implementation of the recently endorsed "National Forestry Program".
- ? The global, national, and regional interests

- ? The traditional mechanical wood industries, which are dominant in numerous states, frequently use obsolete technology and equipment. Their competitiveness is limited.
 - ? Insufficient production of high value-added forest products, especially from the Amazon forest cluster. Most of the products are exported as raw material to be processed in other countries.
 - ? Weak integration of forest industries, especially between large companies and SMEs; weak cooperative relationships between forest enterprises.
- between biodiversity conservation and socio-economic development in the Brazilian Amazonia may lack adequate reconciliation, coordination, or financing, thus leading to further unnecessary destruction of natural forests.
- ? Inadequate road network and port facilities are clear bottlenecks for further expansion of forest industries, especially in areas located far away from main trade destination points; however, expanding the road network promotes deforestation in virgin areas
 - ? Training programs for unskilled workers and extension activities are not sufficiently developed and carried out
 - ? Research and development activities are not well established for offering innovative solutions to typically Brazilian problems, particularly in the Amazon. This situation needs to be urgently corrected.

Chapter 4

A Look at Chile

Forestry sector overview

The main characteristics of the Chilean forest sector at the end of the 1990's are presented in Table 4.1.

Table 4.1: The Chilean forestry sector and some social indicators in a nutshell

Forest resources and social indicators		Principal forest products (1997)	
Total land area	74 million ha	Roundwood 1997	23.2 million m ³
Forest area	15.7 million ha	Fuelwood and residues	3.6 million m ³
Natural forests	13.4 million ha	Industrial roundwood	19.6 million m ³
Plantation forests	2.3 million ha	Sawnwood	4.7 million m ³
Protected forest area	3.9 million ha	Wood-based panels	1.1 million m ³
Participation of forest sector in GDP	2.75%	Pulp	2.1 million t
Forest labor (direct employment)	0.13 million	Paper and paperboards	0.7 million t
Population	15 million	Wood chips for export	6.0 million m ³
		Total exports of wood-based products	USD 1.8 billion

Source: Jaakko Pöyry

Forest clusters in Chile

In Chile, two forest clusters can be identified based on different types of forest and industry development:

1. Regions V-X contain a forest cluster based on plantation forests. The cluster is clearly centered in Region VIII.
2. Regions VII-X also contain a forest cluster based on natural forests.

Factors and policies affecting competitiveness of the forest clusters

The role of SMEs versus larger industries

Chile's two forest clusters (natural and plantation) are both dominated by SMEs catering to the domestic market with a few larger industries capturing the export market. The SMEs are becoming more specialized to remain competitive and to increase their productivity but they have little government support and the country's banking system makes access to working capital or credit difficult. In addition, there is little cooperation or integration between the SMEs and larger industries and between SMEs and the small- and medium-sized plantation owners who supply them with raw wood. For these and other reasons, Chile's SMEs are diminishing in number and those that continue to function need to have more inter-industry relations with the larger forest industries (who currently prefer competition cooperation).

Comparative analysis of forest clusters in Chile

The situation of forest clusters in Chile is similar to those in Brazil in many aspects. Both have clusters based on forest plantations (which are in a strong position with their large, export-oriented, and globally competitive enterprises), and a cluster based on natural forests, which needs more attention. The possible changes to improve the competitiveness of the forest clusters in Chile have been given in Annex 4. The more important considerations are summarized below:

The forest plantation cluster has large, export-oriented, and globally competitive forest enterprises. Both clusters predominantly consist of SMEs. Cooperation in inter-industry relations needs to be enhanced, e.g., through industry and trade associations.

Both clusters have mainly privately owned forest resources, with the state owning virtually no forest plantations and only one-third of the natural forests. Forest plantations are large and geographically concentrated, but expansion is hampered by the high prices of accessible land and by tenure disputes. These disputes should be settled to attract investments, especially in Regions IX and X.

Infrastructure development (e.g., ports, roads, and railroads) needs to be accelerated. In addition, educational and research institutions need to be supported, especially to produce technician-level human resources and to reduce reliance on foreign technological solutions.

Forest products are being geared for export markets; the domestic markets are small although there has been a sharp increase in domestic consumption of key products, e.g., paper, sawnwood and wood-based panels. The clusters need to increase their production of high value-added products. Their companies should be encouraged to work for product certification.

A domestic manufacturing capacity exists for machinery and parts (and chemicals) used in wood harvesting and sawmilling, but the technology needs to be improved.

To encourage the development of the clusters, the government should 1) develop a consistent and balanced policy that defines a path for future development and investment, and 2) strengthen its institutions by streamlining its systems and procedures.

Chilean forest industries are investing in neighboring countries and their trade associations are taking an active part in regional activities, but trade agreements are not yet fully functioning.

Strengths, Weaknesses, Opportunities, and Threats in Chile

The diamond analysis of Chile's forestry sector reveals a number of strengths, weaknesses, opportunities, and threats to the country's ability to compete in global markets with its forest products. Listed below is a summary of these factors for consideration.

Strengths

- ? Some already established modern forest industries that work on an efficient basis and consequently are competitive in global markets
- ? A rapidly-expanding free trade economic system, and stable political situation
- ? Large and geographically concentrated resources of fast growing forest plantations,

Opportunities

- ? The geographical concentration of forest industries provides a favorable ground for establishing more advanced linkages between different actors in the forest cluster.
- ? Excellent unused chances for using the natural forests to establish forest industries and provide environmental services

mainly of *Radiata* pine, which are able to produce an ample range of forest products.

- ? Increasing future availability of softwoods and hardwoods from intensively managed plantation forests
- ? Abundance of skilled forest professionals
- ? Industries have been compelled to be efficient and competitive in the world markets for forest products due to the small domestic market.

Weaknesses

- ? Weak integration of forest industries, especially between large companies and SMEs. Weak cooperative relationships between forest enterprises.
- ? High prices and diminishing availability of accessible lands for new plantations
- ? Lack of a clear, long-term forest policy, which integrates the interests of all stakeholders and focuses on a more balanced use of forest resources
- ? Missing concerted initiatives between government programs and private company actions. Government institutions should be more efficient and creative in the formulation and application of forest programs. Bureaucratic control should not be their main objective.
- ? The role of natural forests as a source of products, services and progress in rural areas has been neglected. They are not sustainably managed and environmental services are not duly priced.
- ? Insufficient production of high value-added forest products. Most are exported as raw material to be processed in other countries.

- ? A clear opportunity for more efficient forest planning and integration of forest activities with rural development and anti-poverty campaigns. Better planning could further increase productivity of forestry and industrial operations.
- ? Increasing availability of wood raw material for significant expansion of industrial capacity
- ? Good prospects for expanding manufacture of higher value-added products (as furniture, pulp, MDF and OSB boards, and more finished sawnwood products)
- ? Good opportunities for increasing integration (vertical and especially horizontal) among larger companies and also between these and SMEs

Threats

- ? Lack of economically accessible lands for expanding the area of plantation forests
- ? Land tenure conflicts, especially the unresolved land ownership disputes of indigenous communities, constitute a clear threat for establishing new industries and attracting investments in the Central-south part of Chile (especially in Regions IX & X).
- ? Insufficient road network and port facilities constitute a clear bottleneck for further expansion of forestry and forest industries.
- ? There is a lack of personnel at the technical level, and an excess at the academic level. Training programs for unskilled workers and extension activities are not sufficiently developed.
- ? In forestry research and development, Chile has relied on solutions from overseas, which may not be optimal for Chilean conditions.
- ? Distorted (monopsonic) wood markets hinder the integration of small and medium plantation owners (wood suppliers) with SMEs (industry) for mutual economic growth.
- ? The banking system does not support SMEs and medium-small landowners, making access to credit difficult.

Chapter 5

An Analysis of Colombia

Forestry sector overview

The main characteristics of the Colombian forestry sector towards the late 1990s are presented in Table 5.1.

Table 5.1 The Colombian forestry sector and some social indicators in a nutshell

Forest resources and social indicators		Principal forest products (1997)	
Total land area	113.9 million ha	Roundwood 1997	20 million m ³
Natural forests	52.8 million ha	Fuelwood and residues	17 million m ³
Plantation forests	0.1 million ha	Industrial roundwood	3 million m ³
Protected forest area	9 million ha	Sawnwood	1.1 million m ³
Participation of forest sector in GDP	2%	Wood-based panels	0.2 million m ³
Population	39 million	Pulp	0.1 million t
		Paper and paperboards	0.7 million t

Source: Jaakko Pöyry

Identifying the forest cluster

The Colombian forest industries are fragmented and relatively weak. A national forest cluster cannot be identified, but the government has defined, through the Productive Chains Program (PROAGRO), three priority regions for productive forest development. These regions were selected based on a number of relevant factors: their location relative to external and domestic markets; the availability of areas of high productive potential; the technical knowledge of desired tree species; the level of industry development in the region; and the interest in the region for establishing forest plantations according to the demands of forest incentives.

Based on the above criteria and on an agreement with the private sector, priority was given to the following nuclei, in order of importance:

1. Antiquia-Caldas Mountains
2. Atlantic Coastal Region
3. Orinoquía Nucleus

Factors and policies affecting competitiveness of the forest clusters

The role of SMEs versus larger industries

Colombia has the potential to develop an integrated forest industry based on the cluster model but at present it has neither a strong forest product export industry nor a booming domestic market. There is little integration between the larger companies and the smaller SMEs and little government support for either. The current political conflicts in the country make it difficult to develop a globally competitive

forest cluster, though there is room to expand the domestic market for forest products to begin the process.

Comparative analysis of Colombia's forest clusters

Annex 5 summarizes the factors and policies affecting the comparative advantage of the forestry sector of Colombia, as well as indicates the possible changes needed to improve competitiveness. Some of the more important highlights follow.

Some large pulp and paper companies and wood-based panel industries have the potential to be the focal actors around which a forest cluster may form. However, there is a fragile relationship among these industries, and between them and the SMEs.

A positive factor for Colombia is its large tropical forest area, which has valuable species and an outstanding richness in biodiversity.

Relatively low-priced land and labor are available for expanding forest plantations. While the present area is not large, know-how is available for growing both native and exotic species.

Infrastructure development, especially roads and ports, need to be accelerated.

The lack of academic professionals and skilled technicians needs to be corrected. Public support is needed to strengthen forestry education and vocational training.

The forest industry has small domestic markets and is not competitive in the global market. Products and markets need to be diversified.

Investments in new industrial machinery are needed, together with training operators to replace obsolete machinery.

Last, but most importantly, the country must strive to attain a stable political environment in order to attract and mobilize investments for the development of the forestry sector. Forest and forest industries could also be used as a vehicle to attain social peace in unstable areas.

Strengths, Weaknesses, Opportunities, and Threats in Colombia

The diamond analysis of Colombia's forestry sector reveals a number of strengths, weaknesses, opportunities, and threats to the country's ability to compete in global markets with its forest products. Listed below is a summary of these factors for consideration.

Strengths

- ? A large forest area (51 million ha), mostly in tropical forests, with valuable species
- ? An outstanding richness of biodiversity and good prospects for a better use of environmental services provided by natural forests
- ? Ample availability of relatively low-priced land for forest plantations, especially degraded pastures
- ? Good knowledge about management of fast-growing tree species (native and exotics) and

Opportunities

- ? The new forest policy (NFDPP) addresses most of the problems listed above
- ? Good opportunities for increasing integration (vertical and especially horizontal) among larger companies and also between them and SMEs
- ? Improved management of natural forests has already been experimented on by local private companies

- ample land availability for expanding plantation forests.
- ? Good possibilities for developing dynamic linkages between forestry and agriculture
- ? Favorable possibilities for enlarging the domestic market for forest products
- ? Well-defined land tenure policy for indigenous groups
- ? Good experiences to link forest activities with the rather dynamic agricultural sector
- ? The forest policy of 2000 integrates the interests of all stakeholders and focuses on a more balanced use of forest resources.

Weaknesses

- ? A difficult socio-political environment for attracting new investments in forestry and forest industries
- ? The unstable political situation is a hindrance to international business activities.
- ? Weak government forest institutions and stagnated forest enterprises
- ? Missing initiatives between government programs and private company actions
- ? Weak integration of forest industries, especially between large companies and SMEs; fragile cooperative relationships between forest institutions
- ? Lack of vertical and horizontal integration between forest enterprises is common. This fact should be overcome and cooperation between forest companies and SMEs should be promoted.
- ? Insufficient infrastructure (especially road and port facilities) is a clear bottleneck for further expansion of the forest sector.
- ? Obsolescence of machinery and equipment of forest industries
- ? Training programs for unskilled workers and extension activities are insufficient

- ? Forest certification systems should be initiated to secure environmentally sustainable forestry and wood utilization practices.
- ? When socio-political hindrances are overcome, there are good prospects for expanding the domestic markets for forest products and promoting investments and a better integration of Colombian forest products in international markets.

Threats

- ? Deforestation (1.6% per year), which affects all types of forests and biodiversity, has not been controlled.
- ? Long-term forest policy and plans at the national and regional level that should include the interests of all stakeholders are not being formulated.
- ? Stumpage prices of natural forest species are too low. Therefore, there is no incentive for sustainable management of natural forests, which causes the conversion of natural forests to other uses.
- ? Socio-political conflicts are adversely affecting forest investments in new forest programs and progressive forest initiatives.
- ? Insufficient development of research, education, training and extension in forestry and forest industries

Chapter 6

The Potential in Mexico

Forestry sector overview

Table 6.1 shows the Mexican forestry sector in a nutshell. The sector is based mainly on socially (community) owned and managed natural forests. The less-than-optimal management in the past, the low organizational level of the forest owners, and the difficult terrain in most forested areas have limited this area's forest production. Practically all of the existing forest industries date from the time of the protective economic policies before 1987, and they have had a hard time adjusting to the open market situation of the 1990s. Even after the 1994 devaluation, the forest sector trade balance has been grossly negative, mainly in the pulp and paper industries.

Table 6.1: The Mexican Forest Sector in a nutshell (1998)

Forest resources and economic indicators		Principal forest products (1998)	
Total land area	197.3million ha	Roundwood 1998	24.0 million m ³
Natural forests, dense and open	57.1 million ha	Industrial roundwood	8.3 million m ³
Plantation forests	35,000 ha	Sawnwood	3.5 million m ³
Protected forest area	10.4 million ha	Wood-based panels	1.0 million m ³
Participation of forest sector in GDP	1 %	Wood pulp	0.5 million t
Forest labor		Paper and paperboards	3.7 million t
- direct employment	0.7 million		
- indirect employment	2 million		
Population (2000)	97.4 million	Total exports of wood-based products	USD 0.3 billion
		Total imports of wood-based products	USD 1.4 billion

Source: Jaakko Pöyry

Although environmental conservation has been high on the political agenda since the 1980s, so far conclusive consensus has not been reached between the productive and protective functions of the forest, thus affecting long-term sector planning. However, progress was made during the 1994-2000 presidential term in laying the legal and technical foundation for a more intensive management of natural forests, establishing and managing commercial and environmental plantations, and for improving environmental management of forest resources in line with the Agenda 21 recommendations and agreements signed by Mexico. The forest sector Strategic Plan of 2001-2005 outlines an investment plan for the development of Mexico's forests until 2025. The small and medium-sized industries based on natural forests in Mexico are, and can be even more than now, an engine for rural development, providing jobs and income to the forest-based communities that tend to belong to the economically most marginalized people in the rural areas of the country. The incipient industrial plantations are intended to provide raw material mainly to the large pulp and paper industries.

Defining the forest cluster

The national forest cluster is presently rather weak and suffering from an insufficient wood supply and, in general, from out-of-date production machinery. The times of a cheap and abundant wood supply from harvesting natural forests (normally the first stage of cluster development) passed in the 1980s or earlier, without the necessary investments having been placed in reforestation and management of the remaining resources.

While the national cluster may be weak, the principal forest states have a good potential to develop state-level forest clusters. Two main types of forest may be identified:

1. the temperate mountainous forest, where economic activity is based on pine (principally in Chihuahua, and also in Durango, Michoacan and Oaxaca), and
2. the tropical lowland forest, such as is found in Tabasco and the Yucatan.
3. The overall national decentralization policy, the promotion of specific wood supply areas in national forestry programs, and the state forestry funds as stipulated in the forestry law, may all contribute to cluster-based development in these areas.

Factors and policies affecting competitiveness of the forest clusters

The role of SMEs versus larger industries

Since Mexico's land tenure pattern is dominated by community-owned resources, it is not surprising that the country's forestry sector has a preponderance of SMEs. However, some of these SMEs are vertically integrated and are capable of producing for both the domestic and export markets. Unfortunately, there is little cooperation or coordination among the SMEs and between these and the few larger pulp and paper companies. In addition, many SMEs are using cheap, illegally cut wood from natural forests to remain competitive and also have difficulty in securing capital and credit due to complicated administrative processes.

Comparative analysis of Colombia's potential forest clusters

Annex 6 summarizes the factors and policies affecting the comparative advantage of the forest cluster, while also indicating the possible changes needed to improve competitiveness. Following are some of the highlights of that analysis.

The industrial component of the forest cluster consists mainly of SMEs. There are only a few large companies, mainly in pulp and paper; their expansion is limited by raw material availability. Some of the SMEs are progressive, vertically integrated, and capable of producing for both the export market and the demanding home markets. However, cooperation among SMEs is lacking and should be encouraged and supported.

An important feature of the forest cluster is the extent of natural forest under social (community) control (about 80%), which supplies practically all of the industrial wood. Many SMEs also use illegally cut wood to remain competitive. There is much potential in using natural forests for environmental services (e.g., ecotourism, biodiversity products, water production, etc.) which should be promoted and supported. There is a specific program (PRODEFOR) for managing natural forests, including industrial development.

Forest plantations are small and do not play a significant role in supplying wood. However, there are large areas of productive land available for forest plantation development. This activity should be supported to increase wood supply, the lack of which is limiting the expansion of large industries. Using plantation

wood for bulk products would allow the production of high value-added products from the natural forest. There is a specific national program for plantation development and another one (PRONARE) for environmental and other types of plantations.

Infrastructure (transport and communication) is generally good; the lack of forest roads is generally felt only in new areas.

Higher and technical-level education in forestry, including a training center, is available. There is an adequate supply of forestry professionals. There is also a network of research stations. However, technical assistance (extension and training) has not reached the marginal social sector, resulting in poor forest management. This is being corrected through PRODEFOR.

Mexico has a good location relative to its main export markets. Domestic demand for forest products is high and increasing. Since Mexico is a net importer of forest products, satisfying domestic markets is a priority.

Machinery and technology in the forest industry is mostly old and obsolete. Domestic manufacture is limited to simple machinery. Technology transfer of modern machinery, e.g., through foreign assistance and investors, should be promoted.

Government support for forestry and the forest industry under PRODEFOR and PRODEPLAN should continue, as well as the broader actions proposed by the Forest Sector Strategic Plan 2001-2025. The federal forest service itself needs to be re-assessed, e.g., in relation to its control, regulatory, and development functions.

Strengths, Weaknesses, Opportunities, and Threats in Mexico

The diamond analysis of Mexico's forestry sector reveals a number of strengths, weaknesses, opportunities, and threats to the country's ability to compete in global markets with its forest products. Listed below is a summary of these factors for consideration.

Strengths	Opportunities
? There are progressive, vertically integrated, positive-thinking, and competitive medium-sized private and social enterprises, capable of producing for export and for demanding home markets.	? Managed for industrial purposes, natural forests provide opportunities to produce high value-added products (furniture, moldings, handicrafts), while gradually phasing out the use of natural forest wood for bulk products (which can come from plantations).
? Most of the legislative and regulatory framework for environmental and forest management is in place, favoring decentralization at the state and municipal levels.	? Managed for environmental purposes, natural forests provide opportunities for ecotourism, biodiversity products and services and water production for urban and industrial development, for irrigation-based agriculture, and for hydro-energy generation, particularly in the dry North and in the Valley of Mexico.
? Substantial public incentives are available for forestry and forest industry development under established programs for natural forests (PRODEFOR) and plantations (PRODEPLAN)	? The secondary forests offer special opportunities as protective forests in watershed management, as well as for commercial purposes, both for wood
? Improvement in forest tenure legislation, permitting long-term leasing contracts between the private sector and social sector (ejidos/communities)	
? A well-developed transportation and	

communications infrastructure, always undergoing continuous improvement

- ? Abundant labor force, which is being trained under government-sponsored programs
- ? Large and expanding domestic market potential for forest products, with an increasing number of medium-to-high income urban populations
- ? A good geographic export market position for high value-added forest industries (e.g. furniture) within NAFTA, and improving its position with the European Union based on the recent Free Trade Agreement
- ? Government has prepared a Forest Sector Strategic Plan to 2025 that includes and identifies priority investments both in forest management and utilization and improvements in the provision of environmental services.

Weaknesses

- ? There are still uncertain legal aspects regarding long-term land leasing and forest management contracts between the private commercial and social sectors.
- ? No definite political agreement has been reached regarding the division of land into conservation and production areas at the national, state or local levels.
- ? Due to historical failures in forest management, there is still a low organizational level to forest-owning communities. Raw material supply is a severe constraint, particularly to pulp and particle-board industries while deforestation continues.
- ? Cheap, illegally cut raw material is used by many SMEs to compensate for poor competitiveness in the open market situation.
- ? Unstable organizational and hierarchical positions in the government forest service; weak control of illegal cutting, resulting in an increase in forest degradation.
- ? Financing of SMEs requires a complicated administrative process, and most small firms do not have or cannot obtain the required guarantees for loans.

products and NTFP, and for carbon sequestration.

- ? At least 6 million hectares of land in tropical areas are potentially available for fast-growing industrial plantations, and another 4 million hectares in temperate areas for both industrial and conservation plantations, including carbon sequestration.
- ? Opportunities exist to increase rural productivity, especially in hillside farming, through agro-forestry, and in animal husbandry through silvopastoral systems based on planted trees.
- ? Within the present legislation, there is an opportunity to develop state forestry funds, which are already in progress in various states (with Chihuahua being at the most advanced stage).

Threats

- ? No political consensus at the federal and lower levels on the allocation of production and protection areas in closed forests
- ? Populist forestry policies continue
- ? Lack of confidence in the private sector regarding public policies in land-use agreements and sector financing, affecting investments in forestry and industry
- ? State governments (the main policy makers in the new decentralized system) are not interested in sustainable management of their natural resources.
- ? Wood trade, product marketing and financing of working capital of the industry is handled in many areas by middlemen, and may involve illegal forest practices; low prices to forest owners diminishes interest in forest management, leading to forest degradation.
- ? Technical assistance, especially extension and training, is not reaching the marginal social sector forest owners, resulting in poor management of their forests and related resources.
- ? Corruption that allows for the degradation of forests and biodiversity cannot be curbed, thus negatively affecting the long-term supply of wood, biodiversity products and environmental services.
- ? Deficiencies in the existing financing systems of SMEs are not corrected.

Chapter 7

Conclusions and Recommendations

Lessons learned and general recommendations

Since the 1990s most Latin American countries have been formulating their forestry and environmental policies based on the UNCED principles, and many, if not all, have adjusted their legislation and policies to meet those principles. At the same time, these countries have opened their markets and liberalized their trade policies.

Notable among the selected countries is the case of Mexico, which updated its forest policy and legislation in the 1990s and prepared a Forest Development Strategy in 2001. Brazil and Colombia also completed national forestry plans in 2000 and, though these plans tend to be based on the traditional sector approach rather than the cluster model, the Colombian plan already encompasses many of the concepts of a forest cluster. Both Chile and Argentina are still developing national forestry plans and have the opportunity to consider the Nordic cluster model in their planning.

Although there is always a risk in trying to adopt one country's successful development strategy to another country's particular conditions, quite often a development model can be and is adaptable to the differing conditions. Such is the case with the cluster forestry framework provided by the Nordic countries as a potential development model for Latin America.

The positive results achieved in the Nordic countries, where a cluster strategy has been applied in the forestry sector, has demonstrated that increasing productivity and continuous innovations are crucial to secure a national competitive advantage.

According to the experience both in the Nordic countries and in Latin America, key elements for progressive development and competitiveness are 1) sound macroeconomic policies for business development, 2) competitive pricing of forest products and services in both domestic and world markets, 3) close collaboration with suppliers of required specialized inputs, 4) a functioning network of related supportive industries, and 5) an environment of cooperation between the actors in the cluster.

Among the region's short term needs for supporting investments that facilitate low cost production and competitive pricing of the products and services (both in domestic and international markets), is the need to improve roads and port facilities in the case countries of the study. In the area of research and development, all five countries need more relevant research facilities for their forestry sector. Areas of priority investment in this area would be to finance existing public research institutions and to develop research strategies and programs that are adapted to each country's conditions and the needs of its different stakeholders.

Another area that needs investment is education and training. There is a general lack of skilled administrative and managerial professionals, as well as technicians, in all five countries' forestry sectors. Support and financing for both academic education and vocational training is urgently needed. Additional studies may be needed to analyze staffing and training needs to meet individual cluster requirements. All five countries have significant areas of land in natural forests that urgently need sustainable management; research is required to study appropriate technologies. In cases where the necessary technologies exist,

investments are needed in sustainable forest management and conservation systems, both on private and public lands, as well as promoting forest certification.

The pulp and paper industry in the region varies from country to country. While Brazil has a well-developed P&P industry, Colombia's sector is deficient in training and has obsolete technologies. Mexico, Chile and Argentina's industries need updating and modernization, especially in paper grades, and support is needed for the local SMEs in this sector. In the mechanical wood industry in the region, support is needed for SMEs operating in natural forests, especially in helping them to diversify their products as well as improve their competitiveness. More horizontal integration is also needed in this sector. In the case of Mexico, investments in developing industrial forest plantations are needed to eventually replace part of the supply from natural forests

Conclusions and recommendations for the selected countries

Argentina is currently experiencing some political and financial difficulties that are hindering its progress in developing a comprehensive national forestry plan. In the long term Argentina has the potential to be a major player in forestry in the region. It especially needs to develop a policy for managing its natural forests that would elevate forestry to the same level of importance as agriculture and ranching. Another area of urgent concern for the government is to implement new policies that would eliminate the tax evasions and other illegalities that some SMEs resort to in order to increase their profitability at the expense of more honest companies. In addition, financing for SMEs is currently available but often considered too expensive, and there is a need to revise the loan conditions for SMEs, which are also considered too stringent.

Brazil launched its National Forest Program in October 2000, which contemplates providing environmental services and better wood availability in future years. Brazil is known as the leader in Latin America for plantation development and it will continue to be prominent by means of continuous investments and through on-going research and development programs. Current open market policies in the country favor continued foreign investment in forestry. Brazil's forest sector is dominated by SMEs and the more progressive, innovative ones will likely survive by consolidating their position in local market niches. Brazil's two main forest clusters – the Amazon region and the South-southeast region – together offer a remarkable potential for forestry development. However, that potential faces several obstacles to its realization due to such factors as unresolved land tenure issues, uncontrolled deforestation and widespread corruption. Brazil also needs investments in improving its infrastructure (mainly ports and roads) as well as in communications and training to order to create any forest clusters.

Chile's main forest cluster is based on plantations and is oriented toward export markets. The cluster is controlled by a few internationally competitive companies who also control wood markets and prices. To counter this situation, the government has created incentives that favor small landowners. Although the number of Chilean SMEs is small, they show a strong ability to succeed. At the same time, large Chilean companies are beginning to expand their business to other countries where land is cheap and where they don't have to contend as much with local indigenous tenure disputes or the high prices and decreasing availability of land found in Chile. As with its neighbors, Chile needs investments in improving its roads and port facilities and in education and vocational training in its forestry sector. It also needs less foreign technological solutions and more research and development.

Colombia differs from the other case countries in that it does not have a competitive forest cluster and its forestry sector is much weaker. Although Colombia urgently needs investments in roads, ports, education and training, its current national state of conflict impedes both foreign and domestic investments. Although Colombia completed a national forestry plan in 2000, it is not in a position yet to fully develop its large tropical forest area that has a rich biodiversity and very valuable wood species. Nevertheless, its

environmental policies and laws are based on UNCED principles and its new forestry plan already encompasses many concepts necessary to developing a forest cluster. In addition, there are government incentives in place that would support industrial plantations. However, the country needs to strive to attain a stable political environment before a competitive forest cluster can be developed.

Mexico is unique among the case countries because of its membership in NAFTA and its proximity to North American markets and competition. It also has mostly communally owned land whose legal restrictions affect forest plantation development. Although there are some large areas of productive land for plantations, they are only beginning to be developed as a result of the Strategic Plan for Mexican Forestry 2001-2025. Mexico's main concern at the moment is how to manage its natural forests and this issue is addressed in its new forest policy, which, like its neighbors, is based on the UNCED principles. There are some large forest industries in Mexico, but their trade associations offer little to their membership, and cooperation between these industries and the government needs improvement. In the more impoverished rural areas of the country, forest SMEs constitute a good vehicle for sustainable development. As elsewhere in Latin America, any internationally competitive large industry in Mexico will have to be based mostly on plantations rather than on natural forests.

As noted above, the five countries analyzed in this study differ significantly from each other. In the short term, Chile and Brazil will be in the best position to expand their forest production, mostly due to established, but still young, forest plantations as well as to their relatively stable macroeconomic development. Argentina has one of the best forest development potentials in the region, but it is unfortunately struggling with a political and financial crisis at the writing of this document. This will probably delay any medium- or long-term investments in its forestry sector. In Colombia, the past robust activity in forestry produced good results but the current limiting factor is the civil violence and state of war in the country. In Mexico, the emphasis on continuing to resolve the land tenure situation, plus the existence of a new Strategic Plan for Mexican Forestry, may provide the possibility of increasing investments in forestry. There is a great potential in all five countries to develop forest clusters along the Nordic model and thus benefit from a competitive position in global markets while still maintaining a sustainable base of production.

References

- Bercovich, N. 1998. 'Evolución y situación actual del complejo forestal en Argentina.' Santiago de Chile: U.N. Commission for Economic Development of Latin America and the Caribbean (ECLAC/CEPAL).
- CONIF, 2000. "Plan Nacional de Desarrollo Forestal de Colombia." Colombia: Ministerio del Medioambiente, Ministerio de Comercio Exterior, Ministerio de Desarrollo Económico, Departamento Nacional de Planeación, Ministerio de Agricultura y Desarrollo Rural. Bogotá.
- Domínguez Villalobos, L. 1998. 'Ruptura y remiendos de la cadena forestal Mexicana.' Santiago de Chile: Comisión Económica para América Latina,.
- FAO, 1999. "The State of the World Forests, 1999." Rome: Food and Agriculture Organization of the United Nations (www.fao.org).
- _____, 2000. "FAOSTAT, Forestry data." Rome: Food and Agriculture Organization of the United Nations (www.fao.org).
- Hazley, C.J. 2000. *Forest-based and related industries of the European Union industrial districts, clusters and agglomerations*. ETLA (The Research Institute of Finnish Economy), Series 160, Helsinki.
- Jaakko Pöyry, 2000. "Jaakko Pöyry forest products databank." Jaakko Pöyry Group, Helsinki.
- Jacobs, D. and A. De Man, 1996. "Clusters, industrial policies, and firm strategy: a menu approach." In: Hazley, C.J. 2000. *Forest-based and related industries of the European Union-industrial districts, clusters and agglomerations*. ETLA (The Research Institute of Finnish Economy), Series 160, Helsinki.
- Keipi, K., ed. 1999. "Forest resource policy in Latin America." Washington D.C: Inter-American Development Bank.
- Mendonça, M. 1998. 'Estudio sobre el cluster forestal en Brasil.' Santiago de Chile: U.N. Commission for Economic Development of Latin America and the Caribbean (ECLAC/CEPAL).
- MMA, 2000. "Programa nacional de florestas." Brasilia: Ministry of Environment, Secretariat of Biodiversity and Forest, National Forestry Program Bureau.
- Motta Bello, M. T. and Cándelo Cárdenas, R. 1998. "El complejo forestal Colombiano." Santiago de Chile: U.N. Commission for Economic Development of Latin America and the Caribbean (ECLAC/CEPAL).
- OECD, 1999. "OECD economic surveys 1999: Mexico." Paris: Organization for Economic Co-operation and Development.
- Palo, M. and G. Mery, eds. 1996. "Sustainable forestry challenges for developing countries." The Netherlands: Kluwer Academic Publishers.

- Palo, M. and J. Uusivuori, eds. 1999. "World forests, societies and environment." The Netherlands: Kluwer Academic Publishers.
- Plan Estratégico Forestal para Mexico, 2001. Secretaría de Medio Ambiente y Recursos Naturales. Mexico City. Mimeo
- Porter, M.E. 1990. "The competitive advantage of nations." In: Hazley, C.J. 2000. *Forest-based and related industries of the European Union-industrial districts, clusters and agglomerations*. ETLA (The Research Institute of Finnish Economy), Series 160, Helsinki.
- SAGPyA, 1998. "Argentine forestry Guide." 2d ed. Buenos Aires: Secretariat of Agriculture, Livestock, Fisheries and Food.
- _____, 1999. "Argentina: oportunidades de inversion en bosques cultivados." Buenos Aires: Secretariat of Agriculture, Livestock, Fisheries and Food.
- SEMARNAP, 2000. "Avances del programa forestal 1995-2000." Mexico D.F: Secretariat of Environment, Natural Resources, and Fisheries, Under-Secretariat of Natural Resources, General Forest Bureau.
- _____, 2000. "Producción forestal e incentivos para el bosque natural y plantaciones naturales. Resultados 1995-2000." Mexico D.F.: Secretariat of Environment, Natural Resources, and Fisheries; Under-Secretariat of Natural Resources, General Forest Bureau.
- Stumpo, G. 1998. "El conjunto forestal Chileno (borrador)." Santiago de Chile: U.N. Commission for Economic Development of Latin America and the Caribbean (ECLAC/CEPAL).

Annex 1

Elements for Latin American Forestry Sector Development

Natural forests and related policies

Area

The forest cover in Latin America and the Caribbean totals $\frac{1}{4}$ of the world's forests and $\frac{1}{2}$ of the total tropical forests. More than one-third of the total land area of Latin America is classified as forest. The total natural and semi-natural forest cover in Latin America totals 961 million hectares, whereas other wooded land areas account for 292 million hectares (estimation year 1990).

Latin America and the Caribbean have a total of 230 million hectares of national protected areas (Keipi, 1999). The national protected areas correspond to 11 % of the region's total land area, an exceptionally high proportion of the whole.

Deforestation and forest degradation

The deforestation in Latin America is equivalent to the world average: 7.5 million hectares or 0.8 % are lost annually. Central America and Mexico have the highest rate (1.63 %), followed by South America (0.73 %) and the Caribbean (0.26 %).

The main causes of deforestation in Latin America are the conversion of forest to agricultural land and colonization following commercial purposes. Population growth and poverty also cause conversion of natural forest to subsistence and permanent farming land. In Latin America, deforestation for commercial uses has been more common than in other regions. The forest industries do not necessarily cause direct deforestation, but often contribute to it by opening up virgin areas, which are later invaded by colonists. In the absence of sustainable forest management and sufficient control, forests are also degraded in quality, a process that forest industries also contribute to. In some cases, the iron and steel industry's demand for charcoal also causes significant deforestation (e.g., in Brazil and Argentina).

Tenure

The patterns of land tenure vary considerably throughout Latin America. In tropical South American countries with the largest forest areas, most of the forests are State owned. In the southern cone countries, 75 % of the forest land in Argentina is privately owned and in Chile, 70 % of the natural forest area is private. Effective ownership is weakly established in most Latin American countries, causing considerable difficulties for sustainable forest management.

Growing stock and forest growth

Latin America has a growing stock of 109 billion m³, of which 98 % is composed of hardwood species. The net annual increment in Latin American forests is on the order of 67 million m³ for softwood species and 556 million m³ for hardwood species. The growing stock of hardwoods in Latin America corresponds to 42.1% of the world total and, of that, softwoods comprise 1.6%.

Land use policies

The traditional land uses in the developing countries are a mix of indigenous subsistence-oriented practices and colonial ones, which in most cases are based on the production of commercial or cash crops for export. In Latin America, the Spanish and Portuguese colonists had little, if any, long-term economic interest in forest resources. Access to any land was quite free, combined with easily obtainable usufruct rights, which later could be turned into a formal title. Yet, in most Latin American countries, the Crown gave titles quite selectively, and most often to already influential families. Public or government forestland in Latin America was seldom, if ever, demarcated, which to this day still continues to create problems in land tenure stabilization.

Globally, the newest forest policies (especially the post-UNCED ones), are trying to change these traditions by promoting participatory forest management and utilization in communal and even in public/government forests, including a better distribution of forest benefits. In addition to traditional wood products from forest industries, new forest services and biodiversity, along with Non-Timber Forest Products (NTFP), are now being considered in forest management. The actual processes of policy formulation and planning are becoming increasingly participatory, and decentralization is increasing the possibilities for local level involvement and plan execution.

Natural forest management

Natural forest management is still in its infancy in Latin America. Although management methods are improving with research, especially in coniferous and mixed forests, much innovation is needed to develop a financially sustainable management of mixed tropical hardwood forests. Currently, forest management still has to compete with subsidized agriculture and ranching. Developing new management plans must be participatory if they are to be successful and sustainable. It is particularly important to include the cooperation of farmers and cattle owners from the agricultural frontiers who have invested several generations in farming and ranching on the land. In the long run, forest grazing should be stopped or controlled on technical and environmental grounds if forests are to be managed properly. Fire is the most imminent risk associated with grazing the forest .

Among the many challenges to developing natural forest management plans are ways to simplify those plans to eliminate legal and administrative procedures that may facilitate corruption. Another challenge is to generally speed-up the approval process of management plans. Special attention should be paid to those plans made by small private forest owners and rural communities, who normally do not have the resources to pay for preparing comprehensive management plans. The role of middlemen, who are well established in many LAC countries, should also be studied since their activities may increase illegal practices in wood supply to the forest industry and reduce the net benefit to forest owners, thus being a disincentive to forest management.

Secondary forests

Secondary forests are not receiving as much attention as they merit. Their role could be enhanced considerably as producers of industrial and household wood, and as providers of environmental services, including carbon sinks. They can be used as an environment for growing valuable species (mahogany, cedar) and, at the same time, they can produce fast-growing commercial pioneer species. Apart from protection from fire and grazing, they do not need special efforts for their establishment.

Plantation policies

Area

Latin America has 12 million hectares of forest plantations, or 5 % of the world's total. Fifty-two percent of the forest plantations in Latin America are composed of fast-growing softwood species, 46 % of fast-growing hardwood species and the rest of other species. There is a remarkable potential for establishing forest plantations in the region. The total estimated area in the region (including existing plantations and the area potentially available for plantations) may reach 60 million hectares, sufficient for producing 800 to 1000 million m³/yr. of industrial or other wood. Plantations could be established on naturally treeless or abandoned already-deforested land and could, among their socio-economic benefits, generate significant amounts of employment. For example, the Colombian NFDP estimates that establishing plantations generates five times more labor than traditional cattle raising.

Growth and yield

Latin America has the best growing industrial plantations in the world. Brazil has the highest annual growth (about 40 m³/ha/yr.) for broadleaved species (mainly *Eucalyptus*), followed by Argentina (35 m³/ha/yr.). The average growth in Chile for broadleaved species is below 25 m³/ha/yr.. Coniferous species grow fastest in Argentina, with an average of 30 m³/ha/yr.; in Chile coniferous species have an annual growth of 20 m³/ha/a on average.

Tenure

In Latin America, most of the plantation forests and the land on which they grow belong to the private sector. Of the five countries studied here, land tenure patterns vary somewhat. In Brazil, most of the plantation forest owners are private companies and owners of vast extensions of land. In Chile, 71 % of the plantations correspond to two percent of the forest owners, and the rest to small- and medium-sized owners. Argentina's tenure pattern shows that all commercial forest plantations belong to the private sector. In Mexico, social land tenure has been a constant obstacle for the development of large-scale forest plantations because of legal and organizational constraints.

Tax incentives rather than direct subsidies have been the most common form of government support to plantations on private land. Fiscal incentives for forest plantations in Brazil have been phased out, and the Brazilian forest industry claims that the tax rates are now too high when compared with international rates. In Chile the plantation incentives are now directed toward small landowners. In Mexico the incentive program for forest plantations is not likely to be available to the larger companies as it is intended for co-operative and private landowners. While there is a lot of justified criticism against the use of public funds to promote plantations (low success rate, poor management, etc.), on balance it can be said that the most developed forest industry clusters of Latin America are based on publicly supported industrial plantations, which, overwhelmingly, have been established on marginally productive, degraded grazed or farmed land and, in some cases, on originally non-forested land. In general, forest policies are becoming more comprehensive, more flexible, and more participatory in their approach. What is needed is a constructive dialogue between stakeholders to resolve the most critical issues of land use, tenure, and the economic, environmental and social aspects of forestry.

Plantation management

In industrial wood production on plantations, Brazil and Chile lead the region in cutting-edge technologies; other countries are following the same tendencies. Many new plantations have suffered

setbacks from bad species selection, scattered locations, deficient or non-existent management, and in some cases, from fires, pests and diseases, whereby the net accessible areas and projected production have been lower than the official statistics would indicate. A major pitfall has been the politically motivated plantation campaigns, often for environmental protection, where direct economic returns are not the primary objective. In these situations, technical and management aspects of the plantations, and even land tenure, have been overlooked, resulting in low actual success rates and a waste of scarce financial resources.

There are some areas of special interest in establishing new forest plantations; these include the adaptability of native species to plantation forestry and agroforestry (including silvopastoral practices). Agroforestry has shown considerable promise in documented cases (e.g., in Honduras), by improving soils, decreasing hydric deficit and considerably increasing crop yield, while at the same time producing domestic wood and valuable timber (e.g., mahogany, cedar). Agroforestry is particularly important in the type of hill farming practiced on tens of million of hectares in Latin American countries. The value of shade trees or plantations to cattle in pastures is not well understood, nor is the potential of fodder trees. This area of research will require working closely with cattle owners to change their attitudes and practices.

Forest functions

The use of forest products and services occurs within the limits of an ecosystem's productive capacity and the economically viable uses extracted by stakeholders. The three principal types of forest use are environmental, economic, and social.

Environmental forestry

The environmental functions of an intact forest ecosystem are well known but undervalued. Natural forests protect watersheds and soils, provide clean air and water, conserve biodiversity, encourage recreation and ecotourism, and provide carbon storage and sequestration, among other services. Considering these functions when formulating new forest policies and legislation might make traditional industrial forestry more profitable and sustainable. Especially after UNCED, these new policies and legislation have widened the scope of forest management to include environmental functions of forests as part of whole ecosystems and providers of environmental services.

There are already ongoing test programs with plantation forests for environmental purposes in Latin America (e.g., Costa Rica, Guatemala). Green certification would also increase the commercial value of forests and natural forest products. A major challenge for environmental economics is to develop pricing mechanisms for such services.

Industrial forestry and certification

Traditionally, industrial forestry implied management for industrial wood, but recently forests have been dedicated to the extraction of NTFPs. However, in many cases, organizational difficulties and poor management threaten the NTFP extraction projects, and quite generally, low profitability is still the main reason for the limited success of extractive reserves.

Certification of forest products is an instrument that could make an important contribution to the sustainable management of natural resources, although the existing standards might not be sufficient for promoting sustainability. Some Latin American countries have been developing strategies for certification programs that would identify the origin of raw materials used by the forest industry. For example, Brazil's certification guidelines include conservation of biodiversity, sustainability of natural resources, protection of the soil, water and air, environmental protection combined with social and economic development, and

compliance with national legislation (Simula, 1999 in Keipi, 1999). Similar trends occur in Argentina and Chile.

According to the Forest Stewardship Council, to date there are 21.5 million hectares of certified forests worldwide; in Latin America there are 2 million hectares. In the LAC region, a formidable obstacle to forest certification is unstable land tenure and continuing uncontrolled colonization. Sustainable forest management is impossible if forest ownership or tenure is not secured.

Agroforestry

Agroforestry means the use of trees or shrubs as an integral part of agricultural and grazing systems. Trees and shrubs may provide fodder and shade for animals, wood products and food for the people, protection against soil erosion, and can regulate the evaporation of moisture from the soil. Agroforestry is particularly beneficial in hill farming, and silvopastoral systems should be applied to some subtropical and tropical pastures – although at the moment, this is very poorly understood in Latin America.

Economic Forestry – Profitability

There are two basic economic questions regarding plantation forest resources: (1) can the sustained production from natural forests be justified on an economic basis, and (2) is plantation forestry competitive with other land uses? The answer to the first question had, in many cases, been negative: conventional products give a low return on forestry investments, and current political and traditional attitudes promote deforestation and forest degradation, enhancing short-term gains. There have been, until now, few governments in Latin America willing and strong enough to stop the current deforestation. Nevertheless, the more expensive reforestation of deforested areas has been receiving government support, and continues to do so.

In almost all countries, deforestation and reforestation take place at the same time, with the two processes being supported by the governments. Part of the reason for this is that intensively managed industrial plantations are really closer to intensive agriculture than forestry and can be competitive with other land uses (Keipi, 1999). The traditional deforesters continue to deforest because their economics are based on immediate, not long-term, benefit and they do not take into account the long-term environmental impacts of deforestation. Individual case studies to the contrary have traditionally not sufficiently convinced decision makers to reverse this trend on a larger scale.

Social forestry – Participation

With recent policies promoting people's participation and decentralization, the role of local people in natural resource management is gradually increasing. The government-led authoritarian, top-down approach to decision-making, planning, implementation and control is gradually being replaced by a participatory, bottom-up approach. Before this can take place however, stakeholders need training in participatory methods, including government officials and politicians.

For cluster development to be successful, it is imperative that all stakeholders participate; otherwise the concept does not work. Principal participants should include national and local governments, NGOs, International Financing Organizations, research and development institutions, extensionists, the private sector (including large industries and SMEs), and the social sector, including indigenous and other communities.

Annex 2. Diamond Analysis of Competitiveness in Argentina, Brazil, Chile, Colombia and Mexico

A. ARGENTINA

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	<ul style="list-style-type: none"> ? An internationalization process is underway, leading to dominance of large competitive industries and restructuring of SMEs ? Some of the newer projects are vertically integrated. 	<ul style="list-style-type: none"> ? Numerous firms, mostly SMEs, which are mostly not competitive internationally ? Lack of coordination along the stages of the production chain ? Few relationships among industry players; industry associations weak 	<ul style="list-style-type: none"> ? Improve information flow among firms involved in different stages of the production chain ? Establish a stronger and more uniform, positive position of industry towards government
2. Factor conditions <ul style="list-style-type: none"> a. Basic factors <ul style="list-style-type: none"> i. Location and climate ii. Natural forests iii. Forest plantations iv. Energy resources v. Demography 	<ul style="list-style-type: none"> ? Wide climatic variety, suitable soils and no pest problems allow establishment of different species ? Vast expanse of suitable land for plantations (20 million ha) ? Excellent conditions for recreation and ecotourism in several regions ? No significant land tenure problems; private sector owns 71% of natural forests and practically all plantations ? Government incentives for plantation development ? Available energy (hydropower) in places where forestry is important ? Large well-educated population with purchasing power 	<ul style="list-style-type: none"> ? Long distances between production and market centers ? Outdated and inefficient legislation for natural forests ? Low genetic quality of presently available timber as raw material ? Anticipated short-term shortage of plantation wood ? High energy prices 	<ul style="list-style-type: none"> ? Reform policy and legal framework covering sustainable management of natural forests and interaction with grazing, agriculture, and commercial forestry ? Develop sustainable natural forest management systems ? Direct industrial plantation investments to economically feasible locations

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
<ul style="list-style-type: none"> - Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities 	<ul style="list-style-type: none"> ? Road network adequate for cluster development ? Communication and other infrastructure sectors in the process of development ? Available academic forestry education ? One research institution with national coverage (INTA) 	<ul style="list-style-type: none"> ? High tolls on important roads ? Planning and development of infrastructure does not always consider needs of industries ? Deficient in technical skills training ? Poor public support of education and research ? Weak interaction between industries and research institutions 	<ul style="list-style-type: none"> ? Improve infrastructure where forestry is important (Northeastern part) ? Increase public support of technical and vocational education and research ? Promote international exchange programs in education and training ? Encourage joint research programs between industries and research institutions ? Encourage market research and development on regional (Mercosur) basis
<p>3. Demand conditions</p> <ul style="list-style-type: none"> a. Domestic demand b. Export demand 	<ul style="list-style-type: none"> ? Good domestic demand for paper ? Net exporter of pulp but net importer of paper ? Incipient exports of moldings and other secondary wood products ? Increasing demand for ecotourism and recreation 	<ul style="list-style-type: none"> ? Low demand for construction wood products due to poor quality and lack of a standard system of classification ? Virtually no sawnwood exports; furniture geared for domestic market 	<ul style="list-style-type: none"> ? Establish standard system of product classification as a starting point to respond to domestic demand and later to increase exports
<p>4. Related and supporting industries</p>	<ul style="list-style-type: none"> ? Foreign firms and progressive SMEs invested in new sawmills, panel mills, and advanced technology ? Base chemicals mostly produced in the country ? Some in-country production of machinery for mechanical forest industry 	<ul style="list-style-type: none"> ? Machinery used is generally obsolete and unsophisticated except for a few new ones. ? Machinery of export-oriented firms is imported. ? Quality of domestic machinery not sufficient for export products 	<ul style="list-style-type: none"> ? Promote further investments to upgrade machinery and technology ? Resort to transfer of technology rather than domestic development to speed up upgrading of machinery to competitive levels

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
5. Government	<ul style="list-style-type: none"> ? Liberal legislation for foreign investments in plantations and industry ? Past economic stability led to an increased willingness to invest in the industry. 	<ul style="list-style-type: none"> ? Financing of SME industries is complicated and inadequate ? Liberalization has caused problems for all industries, but especially to SMEs. 	<ul style="list-style-type: none"> ? Improve financing and technical assistance to SMEs ? Continue to liberalize the market, but try to mitigate the adverse impact on SMEs ? Increase public research and training support of sustainable forest management, infrastructure development where appropriate, strengthen education and extension (particularly technical education), and promotion of forest products in both domestic and export markets
6. Chance		<ul style="list-style-type: none"> ? Affected by the financial crisis in Argentina and the oscillating economies in neighboring countries 	
7. International business activities	<ul style="list-style-type: none"> ? Foreign firms increasing investments in plantation development and the industry ? Country is a signatory of most global agreements ? Mercosur is the most significant trade agreement and is starting to have a positive impact ? Improvement of commercial links with EU 	<ul style="list-style-type: none"> ? No significant acquisitions by Argentina's forest industry companies abroad 	

B. BRAZIL

Cluster: Southeast and Southern cluster of forest enterprises based on forest plantations

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	<ul style="list-style-type: none"> ? Export-oriented and globally competitive large pulp and paper and integrated forest enterprises ? Geographical concentration provides opportunities for interaction among firms. ? Pulp and paper companies are diversifying to sawnwood and panel manufacture. ? Strong managerial expertise and rich technological resources exist in large forest enterprises. 	<ul style="list-style-type: none"> ? Numerous SMEs, but have weak links with large enterprises and no horizontal integration ? Competition rather than cooperation is prevalent among firms. 	<ul style="list-style-type: none"> ? Enhance cooperation and intra- and inter-industry relations, e.g., through trade associations and federations
2. Factor conditions <ul style="list-style-type: none"> a. Basic factors <ul style="list-style-type: none"> i. Location and climate ii. Natural forests iii. Forest plantations iv. Energy resources v. Demography 	<ul style="list-style-type: none"> ? Highly productive land for forest plantation development ? Large and geographically concentrated fast-growing forest plantations ? Private ownership of forest plantations, but mainly by large enterprises 	<ul style="list-style-type: none"> ? Inequitable land tenure structure 	<ul style="list-style-type: none"> ? Obtain higher government priority for forestry; the new National Forestry Plan indicates a positive approach
<ul style="list-style-type: none"> - Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities 	<ul style="list-style-type: none"> ? Well-developed road network, ports, and logistic services ? Available higher education in forestry, including programs in pulp and paper and mechanical wood industry ? Abundance of skilled forest professionals and workers ? Available expertise in research and development, especially in forest plantation development 	<ul style="list-style-type: none"> ? Poorly developed formal education for high-level technicians ? Training for forest and forest industry workers is weak. ? Dependence on foreign technological solutions, especially in the forest industry ? Top-level expertise still partially imported 	<ul style="list-style-type: none"> ? Strengthen technician and vocational training in forestry and forest industries ? Increase public and private investments in research and development, to solve problems specific to Brazilian conditions ? Pool public and private resources into large neutral research facilities

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
3. Demand conditions a. Domestic demand b. Export demand	? Products geared for export markets ? Large domestic markets for forest products ? SMEs able to secure specific market niches allowing them to be competitive	? Several weaknesses in the domestic market chain and lack of clear standards of product quality	? Encourage companies to work for product certification
4. Related and supporting industries	? Several manufacturers of machinery and parts for soil preparation, silviculture, timber harvesting, and mechanical wood processing ? International companies have local distributors of pulp and paper machinery ? Domestic chemical industry exists ? Well-developed consulting services exist for forest and forest industries e.g., in management contracting, harvesting, transport, etc.	? Sophisticated machinery, automation processes, and robots still imported ? The quality of domestic machinery is not always at the international level.	? Encourage technological improvement, e.g., by supporting research and development in machinery and industrial processes to reach high international processes standards
5. Government	? Fiscal incentives provided in the 1980s promoted a sizable pool of large-scale forest plantations. ? The National Forest Program promotes new plantations	? Lack of a clear and coherent forest policy; the National Forest Program came only in 2000 ? Responsibility in program formulation and implementation decentralized to the states but resulted in contradictory forestry programs	? Crystallize government role in facilitating cluster development and creating forces for upgrading and innovation, e.g. by establishing rules and incentives, supporting research and development, etc.
6. Chance	? Liberalization policy in mid-1990s improved transparency and increased internal competition ? Innovation in forest plantation development, e.g., genetic manipulation, accelerated growth and improved wood quality.		
7. International business activities	? Liberalization policy attracted foreign investments.	? Brazilian companies have not yet expanded their investments abroad.	? Get more aggressively involved in EU, MERCOSUR, and other arenas to promote forest products exports

Cluster: Northern cluster of forest enterprises in Brazil, based on natural forests

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	? Traditional forest companies and numerous SMEs operate in the cluster.	? SMEs have weak links with large companies and poor horizontal integration.	? Enhance cooperation and intra- and inter-industry relations, e.g. through trade associations and federations
2. Factor conditions a. Basic factors i. Location and climate ii. Natural forests iii. Forest plantations iv. Energy resources v. Demography	? Large area of natural forests providing a vast reservoir of raw wood material and the potential for environmental services	? Remote location ? Corrupt practices in granting land rights ? Land claims and tenure disputes, conflicts between indigenous communities and landless peasants ? Inequitable land tenure structure promotes deforestation in new areas ? Forest management is neglected and deforestation commonly follows selective logging. ? Stumpage prices cannot be raised sufficiently to promote sustainable management. ? Incentives for agriculture and grazing often lead to deforestation. ? Global, national, and local interests between socio-economic development and biodiversity conservation have not been adequately reconciled.	? Reform policies to remove perverse incentives that promote deforestation ? Strengthen land tenure and agrarian reform in already deforested areas ? Plan forest development based on the cluster approach of integrating forestry with agriculture and ranching (agroforestry) ? Use natural forests for providing environmental services
– Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities	? Available higher education in forestry, but mainly in southern parts of the cluster ? Regional research facilities exist	? Poor road and communication networks ? Mostly obsolete mechanical wood industry equipment ? Training for unskilled workers and extension activities not sufficiently developed or carried out ? Research and development not well established	? Implement well-conceived and planned development of road and communications networks ? Promote re-tooling in the mechanical wood industry ? Strengthen technician and vocational training in forestry and forest industries ? Increase investments in both forest management and product development
3. Demand conditions a. Domestic demand b. Export demand	? Products geared for export markets ? Large domestic markets for forest products ? SMEs able to secure specific market niches,	? Unutilized potential for high value-added products ? Several weaknesses in the domestic	? Promote marketing of lesser known species ? Expand production of high value-added

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
	allowing them to be competitive	market chain and lack of clear standards of product quality ? Most of the Amazonian timber for furniture is processed in the South where the domestic demand is	products, e.g., furniture, MDF and OSB panels ? Encourage companies to work for product certification
4. Related and supporting industries	? Several manufacturers of machinery and parts for soil preparation, silviculture, timber harvesting, and mechanical wood processing ? Same services exist for forest and forest industries e.g., consulting, management contracting, harvesting, transport, etc.	? Mechanical wood industry unable to improve processing technology	? Encourage technological improvement, e.g. by supporting research and development in machinery and industrial processes
5. Government	? National Forestry Plan formulated in 2000	? There has been lack of a clear and coherent forest policy, especially in the 1990s. ? Responsibility in program formulation and implementation was decentralized to the states but resulted in contradictory forestry programs. ? Little change in past negative attitudes of political decision-makers towards environmental sustainability ? Bureaucratic orientation and inability to efficiently implement laws and programs of federal and state governments ? Poor transparency	? Crystallize the government's role in facilitating cluster development, e.g. by proper policy on land use, concessions, and protected areas; infrastructure development; participatory land-use planning; better coordination of forestry programs and interaction with companies and landowners; development of sustainable forest management models; strengthening industry associations; etc. ? Promote transparency in government operations
6. Chance	? Liberalization policy in mid-1990s improved transparency and increased competition	? The BSE epidemic in the EU cattle increased protein demand from other animal and non-animal sources; the production of export beef and soya may be causing further deforestation in the region	
7. International business activities	? Liberalization policy attracted foreign investments	? Brazilian companies have not yet expanded their investments abroad.	? Get more aggressively involved in EU, MERCOSUR, and other trade arenas to promote forest products exports

C. CHILE

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	<ul style="list-style-type: none"> ? Export-oriented and globally competitive large forest enterprises ? Strong managerial expertise and rich technological resources of large forest enterprises ? SMEs are becoming more specialized to maintain competitiveness, and are able to increase productivity 	<ul style="list-style-type: none"> ? Very few large companies dominate the sector. They are weak in horizontal coordination for export markets. ? SMEs are diminishing in number ? Large companies have monopsonistic characteristics in wood procurement of mills, driving down stumpage prices and discouraging use of native forests 	<ul style="list-style-type: none"> ? Enhance cooperation and intra- and inter-industry relations, e.g., through trade associations and federations
2. Factor conditions a. Basic factors i. Location and climate ii. Natural forests iii. Forest plantations iv. Energy resources v. Demography	<ul style="list-style-type: none"> ? Private ownership of most natural forests, with the State owning only one-third ? Large and geographically concentrated fast-growing forest plantations ? Private ownership of forest plantations, but mainly by large enterprises 	<ul style="list-style-type: none"> ? High prices of accessible land for new forest plantations ? Numerous disputes in land tenure and ownership ? Natural forests are of fairly high quality but they are not sustainably managed and are neglected as a source of forest products and services. 	<ul style="list-style-type: none"> ? Work for settlement of land disputes to attract investments, especially in Regions IX and X ? Pay more attention to natural forests to provide environmental services and forest products on a sustainable basis
- Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities	<ul style="list-style-type: none"> ? Higher education in forestry available ? Abundance of skilled forest professionals ? Expertise in research and development, but it is mainly imported rather than domestic 	<ul style="list-style-type: none"> ? Bottlenecks in infrastructure and logistics ? Long neglect in road network and port development ? Excessive production of university-level professionals, but scarcity in medium-level technicians ? Dependence on foreign technology ? Funding shortage and poor institutional coordination in research 	<ul style="list-style-type: none"> ? Accelerate infrastructure development, e.g., ports, roads, and railroads ? Support institutions (e.g., universities and technical schools), in developing education and training programs with emphasis on technical and vocational training in forestry and forest industries ? Support the development of concrete research and development programs to reduce reliance on foreign technological solutions ? Establish a national information system (e.g., for resource assessment)

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
3. Demand conditions a. Domestic demand b. Export demand	? Products geared for export markets ? Overall stable growth in domestic demand for forest products ? Recent sharp increase in domestic consumption of key products, e.g., paper, sawnwood, wood-based panels	? Small domestic markets for forest products	? Increase production of high-value added products rather than raw materials for foreign industries ? Plan and work for diversifying both products and markets to cushion against market and price fluctuations ? Encourage companies to work for product certification
4. Related and supporting industries	? Domestic manufacturers exist for machinery and parts for forest and harvesting operations and for sawmilling ? Domestic chemical industries exist ? Services exist for forest and forest industries e.g. consulting, management contracting, harvesting, transport, etc.	? Advanced industries (e.g., process automation), are not yet competitive ? Banking and financial system does not support SMEs, making access to capital difficult	? Encourage technological improvement, e.g., by supporting research and development in machinery and in industrial processes
5. Government	? Policies on forest plantations and forest industry development exist.	? Policy for natural forests does not exist ? Institutions weak and bureaucratic ? Lack of support for SMEs ? Government programs often contradictory, favoring selected stakeholders.	? Develop a consistent and balanced (including natural forests) long-term framework policy that defines the path for future development and investments ? Strengthen government institutions and streamline systems and procedures
6. Chance	? Change in the political system in the early 1990s	? Innovations and technological jumps have not yet played a significant role in improving competitiveness	? Increase resiliency against price shocks by means of various measures indicated above
7. International business activities	? Open economy attracted large international firms ? Chilean forest industry firms are investing in neighboring countries. ? Chile's trade associations take an active part in regional activities.	? Trade agreements and associations with other countries and parties not yet fully functioning	? Get more aggressively involved in trade associations in ASEAN, EU, MERCOSUR, and other trade arenas to promote forest products exports

D. COLOMBIA

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	? Some large pulp and paper and wood-based panel industries have the potential to form a forest cluster.	? Forest cluster not yet developed ? Weak integration in the forest industry, e.g., between large companies and SMEs; their relationship is fragile.	? Develop, together with the government, growth centers for forest industries, allowing the development of mini-clusters as a starting point for developing a national forest cluster
2. Factor conditions a. Basic factors i. Location and climate ii. Natural forests iii. Forest plantations iv. Energy resources v. Demography	? Ample land available for expanding forest plantations ? Relatively low price of land ? Large tropical forest area with valuable species ? Outstanding richness in biodiversity ? Relatively low cost of labor	? Uncontrolled deforestation for grazing and other purposes affecting all types of forests ? Low stumpage prices do not provide an incentive for sustainable management. ? Little experience in executing coherent and effective long-term forest policy and plans.	? Improve the management of natural forests, building on existing pilot activities ? Promote the conservation of biodiversity and the provision of environmental services ? Expand forestry activities integrated with rural development
- Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities	? Good knowledge of management of fast-growing tree species, both native and exotic ? Good possibilities for developing dynamic linkages between forestry and agriculture	? Poor infrastructure, especially road networks and ports ? Lack of academic professionals and skilled technicians ? Inadequate development in education, research, and extension in forestry and the forest industry	? Accelerate infrastructure development ? Strengthen forestry education and vocational training in forestry and forest industries ? Greater public and private investments in research and development
3. Demand conditions a. Domestic demand b. Export demand	? Room for expanding domestic demand for forest products	? Industries are not export-oriented and not competitive internationally ? Relatively small domestic markets	? Promote diversification of products and markets; develop local, national, and export markets
4. Related and supporting industries	? Existing capacity for production of simple equipment and parts for mechanical wood industries ? Available consulting services	? Obsolete machinery	? Invest in new industrial equipment, accompanied by training programs
5. Government, chance, and international business activities	? Possibility is strong for forestry and forest industry as a vehicle for rural development if political conflicts are solved ? The new National Forest Development Plan was launched in late 2000.	? Unstable political environment is a hindrance to attracting investments and to conducting business ? Weak government institutions ? Absence of government in conflict areas	? Streamline forest policy (e.g., by removing perverse incentives that promote deforestation), develop pilot sustainable forest management/programs; promote biodiversity conservation and protected areas ? Implement the NFDPP

E. MEXICO

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
1. Firm strategy, structure, and rivalry	? Available progressive and vertically-integrated SMEs capable of producing for export and for demanding home markets	? Except for a few large pulp and paper companies, numerous, often weak, SMEs and even microenterprises dominate ? Lack of cooperation among SMEs ? Expansion of large industries limited by raw material availability	? Encourage and support a federation of SMEs and an increased interaction among them
2. Factor conditions - Basic factors Location and climate Natural forests Forest plantations Energy resources Demography	? Improved land tenure position that allows long-term leasing contracts ? Perverse incentives that promoted deforestation are mostly eliminated ? Large tracts (80%) of natural forest is under community control and is supplying most of the industrial wood ? Large areas of productive land for developing forest plantations ? Abundant labor force with forest experience	? Cheap, illegally cut wood is used by many SMEs to remain competitive. ? Forest plantations play an insignificant role in wood supply ? Sustainable management and utilization of community forests has been complicated ? Long-term contracts for forest management and plantations still have legal problems	? Promote forest plantation development to increase the supply of plantation wood in the manufacture of pulp and paper and bulk products such as sawnwood and reconstituted boards ? Promote the use of natural forests for environmental services such as ecotourism, biodiversity products, and water production and catchment area management
- Advanced factors Communications Infrastructure Sophisticated skills Higher education Research facilities	? Well-developed and still improving transportation and communication infrastructure ? Increasing productivity in agroforestry ? Abundance of skilled forest professionals ? Technical-level and higher education in forestry available, including a training center (CECADES/SEMARNAP) ? Network of research stations; advances in studies of non-timber products and ecological services.	? Lack of forest roads ? Technical assistance (e.g., extension and training), is not reaching the marginal social forest sector, resulting in poor forest management. ? Geographical distribution of research facilities is not optimal ? Research in forest industries is not sufficient	? Assess training needs and prepare a corresponding program ? Increase cooperation between the state and the private sectors and communities in technological development and research, biodiversity and environmental services, specialized training, extension, and financing
3. Demand conditions a. Domestic demand b. Export demand	? Good geographical location and access to NAFTA market ? Large and expanding domestic market, Mexico being a net importer of forest products	? Product quality has hampered demand in the past	? Produce high value-added products from natural forests, gradually using plantation wood for bulk products like reconstituted wood ? Promote certification

Determinants of competitiveness based on the diamond model	Description of factors and policies affecting competitiveness		Possible changes to improve competitiveness
	Positive	Negative	
4. Related and supporting industries	<ul style="list-style-type: none"> ? Available domestic manufacturers of simple machinery and parts for logging and sawmilling ? Existing domestic chemical industries ? Available services for consulting, especially for community and environmental forestry 	<ul style="list-style-type: none"> ? Machinery and technology used in wood harvesting, the mechanical wood industry, and the pulp and paper industry is mostly old and obsolete. ? Consulting services requiring modern technology (e.g., pulp and paper) need to be imported 	<ul style="list-style-type: none"> ? Encourage technology transfer in high quality machinery through foreign assistance and investment
5. Government	<ul style="list-style-type: none"> ? Apparent priority for the sector, expressed in the Forest Sector Strategic Plan through 2025 ? Substantial incentives for forestry and forest industry development under PRODEFOR and PRODEPLAN ? Legislative framework mostly in place favoring decentralization ? Present forestry law dates to 1992; substantially revised in 1997 ? Government in the process of reducing bureaucracy to promote investments ? Opportunity to develop state forestry funds along the cluster concept 	<ul style="list-style-type: none"> ? As yet unstable organizational and hierarchical position in the forest service; staff redundancy measures have weakened control of illegal logging ? Lack of public financing of forest management programs ? No political agreement on priority allocation of production and conservation forests ? There is still a lack of confidence in government/industry relation; industry participation in policy development is lacking ? Financing of SMEs requires a complicated administrative process 	<ul style="list-style-type: none"> ? Institute organizational reform in the federal forest service ? Improve transparency in government operations ? Improve government/industry relations ? Educate and promote sustainable management by decision-makers in the states during the decentralization process
6. Chance		<ul style="list-style-type: none"> ? Innovations or technological jumps have not yet played a significant role in improving competitiveness 	
7. International business activities	<ul style="list-style-type: none"> ? Foreign, mostly American, firms are investing in some companies, e.g., Kimberly-Clark, Weyerhaeuser, Smurfit ? Mexico has negotiated 9 free trade agreements (e.g., NAFTA, EU), and is a signatory of most international agreements on the environment ? Expansion by Mexican firms to USA, Colombia, and Central America 	<ul style="list-style-type: none"> ? Industry wants an extension of the current protection policy before NAFTA is totally implemented ? SMEs have not joined forces to participate actively in international business activities 	<ul style="list-style-type: none"> ? Make use of trade agreements (e.g., EU) to facilitate technology transfer through imports of modern machinery and through exports of forest products (furniture and other mechanical products) ? Invest in nature-based tourism and in biodiversity-related sustainable businesses

Annex 3

Review of Nordic Forest Cluster

Example: Finland

Historical Background

Table 1: Forestry sector of Finland in a nutshell

Resource data:		Forest products (1999):	
Total area, km ²	338.815	- Industrial wood, mill.m ³	59
Population (2000)	5.100.000	- Sawnwood, 1000 m ³	12.770
Forestry land, 1000 ha	26. 255	- Firewood, mill.m ³	4.64
Natural forest, 1000 ha	22. 943	- Panels and boards, 1000 m ³	1.611
Plantation forest, 1000 ha	210	- Pulp, 1000 tons	11.579
Protected areas, 1000 ha	2. 440	- Paper and board, 1000 tons	12.947

Source: Jaakko Pöyry

The Finnish forest cluster has evolved from tar production over 500 years ago to the current era of sophisticated printing papers. The Finnish forests were extremely degraded in all accessible areas by 1850, and there were regions with shortage of fuelwood and construction timber. In the main tar production areas, forests still have signs of degradation caused by this industry. A prerequisite for the forest cluster development has been stabilization of land ownership and land use, particularly agriculture and grazing (Figure 1).

Raising forestry to a level of competing land uses in the 1850s was an important political decision, and not without opposition. Forest protection from fire, shifting cultivation and illegal cutting were the main objectives of the initial forest policies and laws, and these were largely achieved by the 1920s and 1930s, whereas forest grazing continued in some areas until the 1960s.

An important milestone was the 1928 private forestry act, which promoted forest sustainability by prohibiting such cutting practices that endangered the natural regeneration of the forest, and created the national and district forestry boards for private forestry. A gradual improvement of forest management required trained professionals (starting from the 1870s), results from forest research (started in the late 1800s) and national forest inventories (from the early 1920s), organization of forest owners and forest extension campaigns (on voluntary basis from the early 1900s and formalized by the 1928 act), incentives (from the 1920s) but were also dependent on the development of user industries and these in turn on demand for different forest products. For example, creaming off (negative selection) of the best trees was the most economic cutting method when there was no pulp industry or transport distances were long, and birch (*Betula sp.*), now a highly valued pulpwood species, was considered an unwanted tree in coniferous stands until the 1970s and destroyed mechanically and chemically over large areas. On the other hand, a large reserve of small-sized wood was gradually made available to industry by replacing fuel wood with other fuels, and the gradual removal of cattle from the forest made possible better regeneration and improvement of timber quality.

Figure 1: Relationship between agriculture and forest cluster development in Finland

Relationship between agriculture and forest cluster development in Finland					
Years					
2000	Towards more organic agriculture ****	Combined industrial and environmental management *****	Almost total integration of raw material	Developed national forest cluster, globalization	Environmentally acceptable forest industry
	Intensive, non-organic, no grazing in forests	Intensive industrial management	Increasing integration of raw material	Integration, consolidation of national cluster	Cleaning of forest industry
1950	Permanent/semi-organic, grazing in forests diminishing ***	Management with less intensive techniques ****	Sawlogs, plywood and pulpwood from thinnings, tops and sawmill residues; Rising wood prices	Increasing integration of pulp, paper and mechanical industries	No environmental control of industry
1900	Migratory/permanent,** Grazing in forests common	Creaming-off, without management **	Sawlogs, fuelwood	Incipient pulp & paper industry	Forest fires diminishing
1850	Land tenure organized *		NTPF important	Incipient local sawmilling clusters	
	Agriculture	Forestry	Wood market	Industry	Environment
	*Agrarian reforms in the 1920s ** 5 ha/person under agriculture and grazing. *** Fertilizer factory 1920 **** 0.5ha/person under agriculture and permanent pastures	*1st forestry college **1st forestry law *** Law on private forestry (1928) **** Ban on creaming-off (1948) *****Forestry law 1996, Certification 2000			

Forest industry companies used to buy forest from private owners at very cheap prices, until the government prohibited this trade by law in 1914. Unlike Sweden, Finland did not have mining companies with large forest areas, and with this prohibition, forest remained mainly as part of private farms. With increased education and organization of private forest owners and rising wood prices, transparent timber trade methods and a national level price negotiation system (now abolished) between forest owners and industry were gradually established. To strengthen their position, the private forest owners started to first export roundwood, and later established their own industry, now the third largest forest industry group in Finland.

The intensity of forest management reached the peak in the 1970s and 80s. Heavy soil treatment methods, use of pesticides and fertilizers, large clearfellings and fear of loss of biodiversity roused strong criticism, and in the 1990s, environmental aspects in forest management have become increasingly important. The new private forestry act from 1996 (following the UNCED principles) includes the obligation to biodiversity conservation in forest management plans and all forest operations.

The development of forest industry clusters first started with the establishment of sawmills in suitable locations providing power (hydropower at rivers) and transport conditions (water transportation). The growth centers, after reaching enough critical mass, started to attract related industries and services, which in their part supported favorable conditions of further growth, which continued during the first half of the 20th century. The early integration of the sawmill and pulp industry gradually decreased the number of sawmills in the rural areas with the adverse effects on the rural employment.

In the second half of the 20th century the industry and the government made a concerted effort to upgrade the product range, particularly the value-added of the paper grades produced. This involved close cooperation with above all the machinery industry, but also with all the other related and supporting industries. As a result, Finland now has a complete forest cluster. The country is highly competitive in the

core products, i.e. paper, paperboard and sawnwood. In addition to this it is an important global producer in many related and supporting industries such as timber harvesting machinery, pulp and paper making machinery, paper chemicals and forest industry consulting.

The development of exports of secondary and converted forest products, such as furniture, wooden construction elements, printed products, etc. has been modest in Finland, but there is now a strong effort to develop new, standardized wood products that can be produced in large volumes, for the European markets.

Some of the important milestones in the evolution of the Finnish forest cluster can be summarized as follows:

Table 2: The evolution of the Finnish forest cluster

1500 - 1950	1950 - 1980	1980 =>
Imports of technology, exports of goods	Exports of technology, new products to new markets	Globalization of forest industry, exports of know-how and technology
1500 -> Tar burning 1550 -> Sawnwood production and exports 1860: First groundwood pulp and paper mill 1880-> Roundwood exports 1880 - 90: Innovations in paper making 1905: First paper machine (US license) 1949: First paper machine for export (UK license)	Paper firms' export sales associations 1970 -> Roundwood imports 1970 - 1980: End of paper machine licenses, modifications to existing technology 1975-> Systematic upgrading to higher value-added paper grades 1975-> Related chemical industry 1980- Technological innovation in paper making machinery	Global producer of machinery and process automation Global producer of printing and writing paper and plywood Global producer of consulting services Industry consolidation on national and international level Finnish firms major global players

Forest management

Uniform silvicultural systems dominate Finnish forest management, although there has been a small upsurge for systems resembling single tree selection (high grading) during the last decade. Uniform stands are established through planting, and natural regeneration using seed trees. Other regeneration methods include seed trees, shelter wood or direct seeding. The rule is that clear felled areas must be regenerated using acceptable and reasonably site adapted techniques. Rotations are typically around 100 years, ranging from 80 years in south to around 130 years in north Finland (roughly five times longer than in most Latin America fast growing plantation).

The forest laws have been strict and well respected throughout the times. A factor making enforcement easier than in other countries is the general lack of economically attractive alternative land uses for forestland. Forests also play an important role in the cultural heritage making obvious misuse of the resource unacceptable to the public.

The milestone political decisions were based on a firm resolve to improve the forestry situation by bringing forestry to a level with other land uses. A democratic, participatory approach at local level even in the most conflictive areas is likely to have a much better response than the traditional punitive, controlling approach, especially if it is combined with economic benefits accruing to the stakeholders in a transparent way. Sustainable forestry and forest industry demand that forest tenure be stable and there is no encroachment, and this was understood early in Finland and the other Nordic countries.

Key conditions and policies that shaped the forest cluster

The success of the Nordic (Finnish in this context) forest cluster stems fundamentally from the timely utilization of the historical window of opportunity in the post-World War II world. It was based on proximity of growing export markets providing steady demand for forest industry products, the available and accessible forest resource base which was managed in a sustainable way towards progressively growing production targets, the relatively free access to new production technology, innovations and know-how (important part of which were initially imported and adjusted) and availability of adequate risk capital to be tied to large investments with a long maturity.

Furthermore, the government policies were supportive to the growth of the core industry and its spin-offs as well as the related input and service providers to form a genuine cluster over time. Forest industry was high on the national economic development agenda, the economic policies were even deliberately adjusted to keep the sector competitive (for example, currency exchange rate and liberal export trade policies). Education, training and extension, and research and development throughout the cluster stakeholders were publicly supported. The key was to create an enabling environment and establish a permanent negotiation process between the representative organizations of the cluster stakeholders. This was particularly true for Finland, which was more dependable on forest sector exports than Sweden that already had a broader industrial base and was earlier on the way to becoming a service-oriented post-industrial society.

Latin American countries do not represent a similar position to that of the Nordic countries in the past. With a possible exception of Chile, in no country does the forest industry form the primary export branch and be the main driver of the national economy. Also, the world market is today much more open and does not allow the kind of development that took place behind the import barrier, under strict investment allocation control of the central bank and a consensus policy of the government, financiers, industry and labor unions as in Finland and the other Nordic countries.

While the Finnish experience as such may not be replicable as an export commodity and success story (with a certain resemblance to the South Korean experience), important elements are certainly worth studying. First, determined national cluster building is a long-term effort and must thus be an explicit part of the national economic programming exercise. If there is an identified opportunity to a feasible degree of certainty and a cluster development program with all necessary ingredients is adopted, it must be regularly up-dated and adjusted, and key stakeholders must be committed to its implementation. Second, the cluster must be formed to employ the most prominent competitive advantages and must from the beginning be made to withstand global competition. Third, fair and equal treatment must be guaranteed for foreign capital investments and the best available technology to enter the country. Some Latin American countries can develop the cluster to rely mostly on the demand of the domestic market. However the benchmark of competitiveness must be based on the international market since the sector has to be able to compete with imported products.

Annex 4: Factors for Success in the Finish and Swedish Forest Clusters - Their Applicability to Latin America

Factors of Competitiveness based on the diamond model	Finnish Forest Cluster	Swedish Forest Cluster	Applicability to Latin America
1. Firm strategy, structure, and rivalry	<p>Strategy: Vertical and horizontal integration in Finland in the 1970s, mergers in Finland in the 1980s, international acquisitions to become global players in the 1990s; moving closer to the customers both in production, marketing and product development; in mechanical industries, the progressive family-owned sawmills have been able to survive, ranging in size from small to large (15000 to 250000 m³/a); high environmental standards, fairness in dealing with labor issues, obedience to law and a generally transparent behavior in business are common strategies.</p> <p>Structure: Now three large vertically and horizontally integrated international firms, about 60 family-owned medium and large sawmills, some 2000 small local sawmills</p> <p>Rivalry/cooperation: Until the 1980's, pulp and paper export associations, now dismantled; large industries strongly organized under national federation, politically influential.</p> <p>State involvement: Early introduction of fundamental forest laws, natural forest inventory on rolling basis of allowable cut, regional implementation and monitoring, extension services; all forest related laws reviewed in the 1990s. State input essential in establishing forest industries in Southern/Northern Finland, but now ownership reduced. State forest service now operates on commercial basis, essential supplies of wood particularly in northern</p>	<p>Strategy in Pulp&paper industry: Comprehensive restructuring during the 80s and early 90s (Billerud-Kopparfors-Stora, Iggesund-Holmen-MoDo); Nordic cross border mergers and acquisitions during late 90s (Stora-Enso, Södra-Norske Skog, MoDo-SCA-Metsä Serla). Increased production and further conversion, but less intensive than in Finland; forest plantations in Africa and Latin America during the 70s, Latin America during the 80s, and Latin America and Southeast Asia during the 90s. Acquisitions and mergers during the 80s and 90s in USA and Europe. Increased interest for industrial investments in Latin America and Asia during the 90s.</p> <p>Board and mechanical industry: Passive restructuring including production concentrations and closing down of non-profitable units. Strong competition from Central and Eastern European Countries (CEECs). Investments in sawmill industry, however, still with unstable economy.</p> <p>State involvement: Borders between state authority activities and state commercial business were successively established during the 70s and 80s. State forestry service restructured during the 80s to a state-owned limited company, merged with state forest industry during the 90s and privatized.(AssiDomän)</p> <p>Structure: P&P industry dominated by a</p>	<p>Strategy: Advanced firms in Chile, Brazil and Argentina are in a process of integrating mechanical and chemical industries (raw material) and some acquisitions by Chilean (mainly within MERCOSUR) and Mexican (one in U.S) firms have taken place; there are further possibilities to continue integration of sawmilling and pulp industries, and production of paper from the pulp sold now as market pulp; family-owned, competitive mechanical industry firms should be promoted, in Mexico also the social sector firms.</p> <p>Improvement of transparency is an issue for the whole society but the firms can contribute to it decisively through their own behavior because they are mostly the ones who pay the costs. Industry associations should help in this process. Good environmental management is becoming a competitive advantage especially in exports and also indicates the level of transparency.</p> <p>Structure: As in Nordic countries, pulp and paper industry could be restructured mostly based on competitiveness in the international market, although many small firms (mainly paper and board) occupying special niches in the local and national market are likely to survive far into future. In mechanical industries, the structural change should not be left to market forces alone, but especially SMEs should be suitably strengthened</p>

Factors of Competitiveness based on the diamond model	Finnish Forest Cluster	Swedish Forest Cluster	Applicability to Latin America
	Finland.	<p>few groups (StoraEnso, SCA, MoDo, Holmen, AssiDomän, Södra) vertically and horizontally integrated international groups. A few larger groups of sawmills (merging/acquisition trend) and still a large number of medium- to small sized sawmills, industry or family/private owned</p> <p>Rivalry/Cooperation Rivalry harder than in Finland between different groups and between private industry and forest owners organizations. Principally no official organized cooperation in production or trade.</p>	<p>especially in rural areas to improve employment, rural income and sustainable forest management.</p> <p>Rivalry/cooperation: This is an area where Nordic experience can be applied, although the cultural difference (Nordic – Lutheran; Latin American – Roman Catholic-Mediterranean) is an important factor for success.</p>
<p>2. Factor conditions</p> <p>a. Basic factors</p> <p>i. Location and climate</p> <p>ii. Natural forests</p> <p>iii. Forest plantations</p> <p>iv. Energy resources</p> <p>v. Demography</p>	<p>Well situated for main (West European) markets although somewhat distant; cold climate increases building and energy costs and ice sea transport costs in winter</p> <p>68 % of forest area private non-industrial, 8 % forest industry, 24 % government owned, stable ownership; sustainable wood availability stabilized at 65 mill m³/a, forest growth 75 mill m³/a</p> <p>Forest plantations integrated with natural forest, using native species but improved stock</p> <p>Wood used for bioenergy 16 mill m³/a, 20 % of total energy; forest industry 75 % based on bioenergy; forest industry used to justify energy investments;</p> <p>Population growth < 1 %/a, no pressure on forest, high basic education level, well developed forest-related culture. General</p>	<p>Mild climate, moderated by oceanic influences, slopes. Typical average annual precipitation ranges from 500 to 700 mm; on higher mountains heavy winter snow-cover is common in central and north Sweden.</p> <p>Total forest area about 27 million ha, about half privately owned, some 38 per cent company owned, and public forests 12 per cent. Annual logging is about 75 million m³ sob per year, and annual national increment in the range of 100 million m³ sob.</p> <p>When regenerating by planting, native species are almost always used, with improved seedling stock. Planting integrated into the natural forest, making even planted forests "semi-natural". Bio-energy plantations, afforested former agricultural land, and afforestation of drained out wetlands are traditional plantations.</p>	<p>Location in relation to main markets varies greatly; U.S. market close to Mexico, Colombia; for Brazil, Argentina, Chile, overseas markets are distant; home markets for some products are distant in Brazil (from Amazonia to the South) and Argentina (from Misiones to Buenos Aires); climate is favorable (from temperate to tropical) for natural forest and plantations in most countries.</p> <p>Natural forests mostly in public ownership except in Argentina, mostly in grave danger of colonization and in a weak legal position, including protected areas. Sustainable management practiced over negligible areas. The Nordic experience can be most readily applied to coniferous/mixed forest management in Mexico and Central America and possibly in temperate forests of Chile and Argentina.</p> <p>Industrial plantations practically all private,</p>

Factors of Competitiveness based on the diamond model	Finnish Forest Cluster	Swedish Forest Cluster	Applicability to Latin America
	<p>cultural background. Lutheran/protestant, with little influence from other cultures.</p>	<p>Electric power mainly produced in nuclear and hydropower plants (roughly 45 % each), from biofuel and fossil fuels in CHP-plants, and industrial back-pressure) Biofuels (mainly wood fuels) make up some 25-30 % of total fuel supply (excl. nuclear and hydropower) for industry. Oil (dominating), coal and natural gas make up the rest.</p> <p>Population. No pressure on forest. High basic education level. Influence from other cultures is slight, but has increased due to immigration during the last decade. Most of the population belongs to the protestant church</p>	<p>with a relatively strong legal protection comparable with Scandinavia. Nordic experience could benefit overall industrial planning and tree improvement programs for specific end uses.</p> <p>There is a vast unused potential in bioenergy in Latin America, including unused sawmill waste. Technology for power plants of different sizes based on bioenergy is highly developed in Nordic countries and could be applied in Latin America.</p>
<p>b. Advanced factors i. Communications infrastructure ii. Sophisticated skills iii. Higher education iv. Research facilities</p>	<p>All forest now accessible, forest industry and wood transport used to justify infrastructure development; port designs tailored for forest product handling; telecommunications coverage 100 % of the country.</p> <p>Skilled personnel available for all forest cluster requirements</p> <p>Graduate-level specialized engineering education exists for chemical and mechanical forest industries and for forestry, up to Ph.D. level</p> <p>Highly advanced research centers/departments for pulp and paper (1 owned jointly by the main p & p firms, 1 by state), plus the machinery manufacturers' own laboratories, plus 7 universities; several universities have wood technology laboratories, industrial</p>	<p>Non-accessible forest areas are mostly intended to be inaccessible in the future. Well-maintained road network covers the country. There are adequate port facilities for export of forest products and a good basic railway net. Telecommunications cover the entire country.</p> <p>Skilled personnel is available for all requirements.</p> <p>Graduate training is available for all sectors of Swedish forestry, as is post-graduate training up to Ph.D. level.</p> <p>Advanced research is done in a number of universities or by specialized institutes more or less financed and controlled by the industry (jointly owned), e.g. P&P research laboratory, mech. wood industry research</p>	<p>Nordic experience can be used to design integrated transport and port infrastructure systems for forest products.</p> <p>Latin American countries are deficient in planning forest cluster manpower requirements and training programs, in which Nordic countries have a long tradition.</p> <p>There is no graduate-level specialized education for engineers in forest industries in Latin America, and Nordic experience can be applied also here.</p> <p>There are research facilities for forestry and forest industries in Latin America, but their territorial coverage is not sufficient and mostly they are deficient in financing and resources. Nordic experience could be most useful in planning of national and regional</p>

Factors of Competitiveness based on the diamond model	Finnish Forest Cluster	Swedish Forest Cluster	Applicability to Latin America
	testing of wood products by firms/equipment manufacturers.	laboratory, and forestry research institute. Companies also carry out advanced research of their own. There are large permanent research areas for forestry, some established early last century.	research network, and in pulp and paper, wood harvesting and bioenergy technology research.
<p>3. Demand conditions</p> <p>a. Domestic demand</p> <p>b. Export demand</p>	<p>Domestic demand is about 10 % in pulp and paper products, 30 % in mechanical wood products. There is a strong promotion campaign of wood as construction material going on.</p> <p>Export demand determines the market and product development, but the domestic quality requirements in principal products are high enough for testing of export products. Drive to penetrate North American and Asian markets.</p>	<p>Wood pulp production about 10.5 Mt of which 32-33 % market pulp. Roughly 7.7 mill. ton used domestically and about 2.8 mill. ton exported. The domestic use of waste paper approaches 2 mill. ton. Production of paper and paperboard around 10 mill. ton of which over 8.5 mill. ton exported.</p> <p>Total production of sawn wood (over 98% conifers) reaches some 15-16 mill.m³ of which close to 11 mill.m³ exported. Wood strongly promoted as construction material. Export market diversification drive</p>	<p>Domestic demand determines the markets in Brazil, Argentina, Colombia and mostly in Mexico. Promotion campaigns are needed especially in mechanical wood products (particularly construction), of which Nordic countries have recent and actual experience, including product development.</p> <p>Export demand determines markets in Chile, in some products in Brazil and Mexico. Nordic experience could be applied especially to marketing of mechanical forest products</p>
4. Related and supporting industries	<p>Related industries: process automation for p & p and mechanical industries; GIS application in timber transport; electronic tree measurement and recording devices in forest inventories and electronic log volume measurement in harvesting machinery; consulting services; packaging and printing industries</p> <p>Supporting industries: Chemical industry; machinery/equipment industry for p & p, mechanical forest industries, harvesting machinery.</p>	Situation similar to that in Finland.	<p>Nordic experience best applicable to development of harvesting methods in Mexico and Argentina, process automation, engineering consulting services for pulp and paper especially in Mexico, Colombia, Argentina.</p> <p>Development of mechanical forest industry machinery, harvesting machinery in Mexico, Argentina.</p>

Factors of Competitiveness based on the diamond model	Finnish Forest Cluster	Swedish Forest Cluster	Applicability to Latin America
5. Government	Forest and forest industry recognized as the main export industry since the early 1900s; forest legislation based on sustainable forestry in place since the 1920s; long-term forestry development programs since the 1950s; because forest industry was the main export industry, devaluations were used to improve competitiveness until the 1980s; the latest forestry and environmental legislation of the 1990s formulated on the UNCED principles. Finnish government has actively participated in revision of the WB forest policy in 1999-2000.	See Environmental policies...Item "12 Other policy areas"	The principal tasks of the governments is to change the traditional attitudes of the politicians, landowners and other stakeholders regarding forestry, to give forestry as land use an equal value to agriculture and grazing, not only in policies but in practice; institute stable land ownership, stop perverse incentives, land grabbing and corruption which lead to uncontrolled, unnecessary deforestation and degradation of natural forest; apply realistic values to all uses and services of forest land, including grazing in forests; rehabilitate secondary forests, including enrichment plantations with valuable native species. Formulate and carry out long-term forestry policies and programs.
6. Chance	War reparations created heavy metal industry, resulting in p & p technology development; the market booms for forest products after WW II led to industry expansions from the 1950s onward.	Long history and tradition in base industries – mining, forest industry etc. After WW II strong technical and economic development in high- tech industries now integrated to the forest industry	
7. International business activities	In 1999, the Finnish forest industry firms held the 1 st , 2 nd , 4 th and 9 th positions in Western Europe, measured by turnover, and in global scale, the 3 rd and 7 th positions. The global expansion took place mainly in the 1990s.	Small domestic market requires strong focus on international marketing, and production units. International business outside Western Europe started early in the 70s (forest plantations) and switched towards industrial production and sales during the 80s and 90s. Increasing interest for Central and Eastern Europe during the 90s, sales offices followed by production.	Strengthen the industry first at home, expand then sub-regionally, and then regionally.

Annex 5: Environmental Policies in Finnish and Swedish - Their Applicability to LatinAmerica

Policy Area	Environmental Policies		Applicability to Latin America
	Finnish Forest Cluster	Swedish Forest Cluster	
1. Distribution of natural production forests, forest plantations, protected areas, and other forest areas	<p>? Natural production forest: 15.9 million ha (78% of total)</p> <p>? Plantation: 4.1 million ha (22%)</p> <p>? Protected forest areas: 2.4 million ha (10.4% of forest land)</p> <p>? Other forestry land: 3.3. million ha</p> <p>? The policy is to increase protected forest area by 0.4 million ha to 2.8 million ha (12% of forest area) and total protected area from 2.8 million ha to 3.6 million ha (11.8% of land area)</p>	<p>Total forest estate some 60 per cent of the country</p> <p>Like in Finland, almost all forests are "semi-natural". Protected productive forests, i.e. national parks, nature reserves and areas under the management of Swedish Environmental Protection Agency, cover some 0.8 million ha. Slightly more than 0.5 million ha have management restrictions that restrict industrial forestry, e.g. soil protection, grazing, military areas and urban forests.</p>	<p>The process of allocation of land to productive and protective uses is going on both in Nordic countries and in Latin America, with the difference that the stable land ownership in Nordic countries and the established role of forestry makes the process easier.</p>
2. Sustainability of natural production forests	<p>Area is affected by infrastructure building and urbanization, not by other uses; planting and seeding with native species are used in addition to natural regeneration, and natural seedlings are allowed in planted areas for environmental and genetic reasons. About 20 % of the area now semi-natural.</p>	<p>Occasional pressure for land from infrastructure and urbanization. Conversion of forests to agricultural land is not done. Native species dominate regeneration. Interest in natural regeneration methods is on the increase. Hardwood control is less intense than before, have gained increased acceptance. Strong strive to incorporate conservation into day-to-day management. Scarification has become less intensive than before.</p> <p>Hardwood forests, mostly beech and oak, in south Sweden are strongly protected. Logging is permitted in these forests provided that regeneration is done using the original species. No conversion of hardwood forests into softwood forests is permitted.</p>	<p>For sustainability, the production forests first have to be defined and this has not been done in any Latin American country. Agrarian reform, the most difficult political process in Latin America and basis of permanent land use, has not been carried out completely in any country; in Nordic countries it took 300 to 400 years. Both on private and public land, sustainability of natural forest is presently highly uncertain.</p>

Policy Area	Environmental Policies		Applicability to Latin America
	Finnish Forest Cluster	Swedish Forest Cluster	
3. Sustainability of forest plantations	Plantations are an integral part of the total regeneration system of the natural forest, and thus part of sustainable management; about 0.2 million ha have been established on redundant agricultural land and integrated into the production forest.	Clearly distinguishable plantations are well integrated into normal forest management. Plantations for energy purposes, mainly established on abandoned agricultural land, are sustainably managed but can easily be converted to other land uses.	Where there is industry using plantation-grown wood, sustainability of plantations is relatively secure (except fires), and in any case much better than that of natural forest. There should be a better planning and management of plantations in order to reduce failures by fire, pests and diseases.
4. Sustainability of protected and other forest areas	No major threat on boundaries, but increasing tourism and recreation may affect biodiversity.	Establishment of reserves and protected areas is subject to detailed negotiations with landowners. A trend among larger owners to voluntarily set aside areas for protection, e.g. more or less unlogged areas or areas with populations of rare plants or animals. There are areas where pressure from recreation and/or tourism may be higher than what is sustainable	A large part of the protected areas lacks administration and control, and encroachment and conversion to other uses is common. Part of the problems is the unsettled land tenure and the still prevailing traditional occupational rights.
5. Biodiversity conservation	Included in the new constitution as an obligation of every citizen and as an application in forestry and environmental legislation; about 3.5 % (1500) of all species (43000) estimated to be threatened, one third in forests; main threats fragmentation and change of habitat, especially diminishing area of old growth forests. There is a monitoring of application of biodiversity conservation in logged areas. Finnish forest certification scheme in line with PEFC dominant.	Adequate national legislation is already in force, Sweden's national strategy on Biological Diversity (1993) places equal weight and importance on environmental and economic considerations. Dialogue between environmental authorities and private sector essential. Forestry legislation is applicable to the conservation of biodiversity. Most companies (all major) have had their practices certified by FSC. There are moves by private forest owner's to have their practices certified by PEFC. Companies have active policies of their own on conservation of biodiversity.	The legislation in Nordic countries follows the UNCED recommendations, as does the legislation in Latin America, and the application has just started. The problems are related with general sustainability of forests, deficient controls of biodiversity legislation, and high demand of animal, fish, and plant species. Ex-situ conservation and production of commercial and protected species is one alternative.
6. Soil and water conservation	Heavy methods in soil preparation have been abandoned, fertilization reduced to a bare minimum, natural water courses are conserved and rehabilitated, and non-productive drained	Radical, i.e. brutal, scarification methods have been abandoned. Erosion is not a major problem. Fertilization is done on a very modest scale. Drainage of wetlands for	The Nordic experience shows a cycle of moving from natural regeneration methods to highly intensive ones with strong negative impact on soil and water, and back again to

Policy Area	Environmental Policies		Applicability to Latin America
	Finnish Forest Cluster	Swedish Forest Cluster	
	peat lands restored.	afforestation abandoned. Drainage for other purposes is subject to strict legislation. On the opposite wetlands are now to a small extent reestablished for environmental reasons.	more refined and gentle methods to conserve environment. This lesson in general could be applied in Latin America to avoid unnecessary damage to soils and water – low impact logging and forest management in natural forests and lighter soil preparation in plantation.
7. Forest fire management	Average burnt area 600 ha/a; not a risk factor; control under Ministry of Interior. Prescribed burning used to some extent.	Fire is not a risk factor in Swedish forest management. During exceptionally dry and hot spells there may be wild fires, but only rarely affecting more than a few hectares. Prescribed burning is used on a small scale as a site preparation method.	The fire risk and damage in Nordic countries almost disappeared with shifting cultivation, and this, together with increase of permanent pastures and abandonment of forest grazing, could be the case also in Latin America, although an intensive extension campaign to change public behavior is also needed.
8. Timber production technology	Harvesting mechanized up to 86 % (1999) using highly developed harvesting machinery, with less impact on soil and damage to remaining trees. The process from manual tools and animal traction via chainsaw and agricultural tractors to processors and forwarders took 45 years. Productivity and harvesting technology very similar in Finland and Sweden.	Mechanization of logging operations started in the 1950:s. Work productivity rose from 1.4 m ³ per man-day in 1950 to 14.5 m ³ in 1990. Clear fellings and thinnings have been completely mechanized. Cut-to-length methods are applied to almost 100 %. A single grip harvester is normally used for felling, delimiting and crosscutting, and a forwarder transports the timber to a roadside landing. As trees are cross cut inside the forest, landings need not be large. Some double grip harvesters are still in service, mostly doing clear felling. Some felling done by chainsaw, mostly private forest owners working on their own estate. Harvesting machinery has been developed to minimize damage to soil and residual stand.	The Nordic technology has been adapted to large plantations in Brazil and can be done wherever terrain and tree size permits also in natural coniferous forests, but it is unsuitable in mixed tropical forest. The development process is cost-driven and reduces employment.
9.Importance of non-timber forest products	Value of NTFP (berries, mushrooms, lichen, game, reindeer) in 1999 was close to USD 200 million or equivalent to 11 % of the stumpage	Non-industrial use of forestland is mostly hunting, mushroom collecting and berry picking. Mushrooms and berries are	In Nordic countries, there is a wide-spread historical tradition for use of NTFP, and Nordic experience could help to promote

Policy Area	Environmental Policies		Applicability to Latin America
	Finnish Forest Cluster	Swedish Forest Cluster	
	income of industrial roundwood. There is much unused market potential especially in berries and mushrooms.	underutilized and only locally picked at a commercial scale. Hunting is very common, and particularly moose hunting is important to the rural economy in some places.	some little used products and in particular, game management and hunting culture which is a widely neglected area in Latin America.
10. Pollution control in pulp and paper industries	Legislation and institution development were started in the early 1970s, and after initial resistance (blaming high costs), the industry started the necessary investments in environmental controls culminating in the late 1980s and early 1990s. As examples, in BOD and solid waste, the per ton pollution level is now about 1 % of the 1970 level; compared with 1988, the organic chlorine level is about 8 %; phosphorus 18 % and nitrogen, 40 %. The industry is aiming to reach ISO 14001 standard or the more demanding Environmental Management and Auditing Schemes (EMAS) promoted by European Union. A high environmental standard is now a competitive advantage.	The situation is similar to Finland. The environmental improvement work – legislative, institutional and technical – started during the 1960s and culminated during the late 80s and the 90s. Emissions have been reduced extensively. Examples: The COD emissions to water per ton of product are now (2000) about 3.5 %, compared to 1960. For AOX (chlorinated organics), the emissions to water per ton (2000) are 1.5 %, compared to 1970. For sulphur emissions to the atmosphere, the emissions per ton (2000) are 6 %, compared to 1980. Companies emphasize their environmental improvements in marketing. Certification according to ISO 14001 and/or EMAS was, in 2000, represented by 77 % of the total pulp production and 73 % of the total paper production, and this will be further increased during 2001.	For the Nordic firms, clean industry is a competitive advantage especially to exports, and large industries in Latin America have recognized this and comply with the international standards. The need to clean the old industries will accelerate structural change as it did in Scandinavia because environmental investments in obsolete mills are not viable. The present environmental legislation in most countries complies with international standards, and the large industries are quite law-abiding. Application of Nordic technological know-how at this stage could be directed to research institutions.
11. Pollution control in mechanical wood and other industries	These cause little pollution and are relatively easy to control; about 60 % of the sawmills use ISO 14001 or EMAS already. The use of toxic chemicals has been practically eliminated.	The situation is similar to Finland. The environmental problems are less serious, compared to the pulp and paper industry, but significant issues include handling and recovery of wastes, water and air emissions and chemicals use and handling. Many companies are today certified according to ISO 14001 or EMAS.	The Nordic industry can be used for medium-term environmental standards, particularly for export mills. ISO 14001 for the time being is difficult to reach for most mills, but ISO 9000 is possible.

Policy Area	Environmental Policies		Applicability to Latin America
	Finnish Forest Cluster	Swedish Forest Cluster	
12. Other policy areas	<p>Because traditionally, farmers were the main group of non-industrial forest owners, forestry has been and still is under Ministry of Agriculture and Forestry, and forest income has been important to farm economy.</p> <p>There has been a strong political backing to promote private forestry on a participatory basis through forest management associations, and there has been a specific legislation and organization for private forestry.</p> <p>Agricultural and forest producers belong to the same national federation and constitute a politically strong interest group.</p>	<p>Forestry and forest industry is the single most important sector of Sweden's trade balance. The sector presently is under the Ministry of Industry, Employment and Communications. Forest policy implementation and state forest administration is mainly the responsibility of the National Board of Forestry with subordinated regional offices. The National Board of Forestry works efficiently and in close cooperation to various interest organizations, for example private forest owners associations. Private agricultural and forest producers belong to the same national federation and constitute a politically strong interest group. The forest industry is organized in their own national federation.</p>	<p>Private forestry in Nordic countries is well developed, and could be one of the main areas of cooperation. It could enhance balanced land use on private farms, forest owners associations, and even participation of forest owners as shareholders of forest industries. Private forestry should have a specific legislation and organization, and forest management objectives and plans should be adjusted to private economy, as well as taxation.</p>