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ENCOURAGING INDUSTRIAL FOREST PLANTATIONS IN THE TROPICS

Report of a global study

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ITTO

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

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REPORT OF A GLOBAL STUDY

ITTO TECHNICAL SERIES #33

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

Encouraging Industrial Forest Plantations in the Tropics
Report of a Global Study
ITTO Technical Series No 33

by STCP Engenharia de Projetos Ltda

The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its 60 members represent about 80% of the world's tropical forests and 90% of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyses and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing industries at both community and industrial scales. All projects are funded by voluntary contributions, mostly from consumer member countries. Since it became operational in 1987, ITTO has funded close to 1000 projects, pre-projects and activities valued at nearly US$350 million. The major donors are the governments of Japan, Switzerland and the United States.

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FOREWORD

In 2004 the International Tropical Timber Council, the governing body of the International Tropical Timber Organization (ITTO), decided, among other things, to conduct a study on encouraging private-sector investment in industrial forest plantation in the tropics. STCP Engenharia de Projetos Ltda, a Brazil-based consultancy firm, was duly appointed to conduct the study. This report is the result.

The purpose of the study was to analyse and report on the key factors that determine the success or failure of commercial plantations in selected ITTO producer and consumer countries. This is important: tropical countries have many natural advantages in the production of wood from plantations, and a robust plantation-based wood industry can make a substantial contribution to economic development and rural employment. Some tropical countries have taken great strides in developing their plantation estates and are now reaping the benefits of the vibrant wood-processing industries that have sprung up to make use of these new resources. Others, however, have lagged behind. This report explores the factors behind successful plantation development, and the steps that tropical countries can take to pursue plantation development in a sustainable and economically efficient way.

Since the report was commissioned, the world has undergone a major financial crisis, the depths of which are only now starting to be understood. The reducion in demand, prices and flow of capital into tropical countries has already affected investments in forest plantations and is likely to have a major impact on the development of the sector for some time. It is still unclear when and how the global economy will rebound from this extraordinary recession. Moreover, the outcomes of negotiations on post-2012 arrangements on climate change, which could also have important implications for plantation development, are also unknown. Nevertheless, I believe that this report will greatly assist countries in ensuring they are fully prepared to encourage investment in plantation forests when economic conditions permit.

Emmanuel Ze Meka
Executive Director
ITTO

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This report is the result of the work commissioned by ITTO from STCP Engenharia de Projetos Ltda (Brazil). The work was directed by Dr Ivan Tomaselli and coordinated by Dr Marcelo Wiecheteck, and involved the following STCP consultants: Jefferson Garcia, Adriano Custodio Olsemann, Bernard Delespinasse, Rafael Dias, Marisa Baida, Gisele Batista, Marco Tuoto, Roberto Bonse, Sofia Hirakuri and Julio Paupitz.

The assessment of field information in selected countries in Latin America and the Caribbean, Asia-Pacific and Africa involved two external consultants: Mr Don Wijerwardana (New Zealand) and Mr Alhassan Attah (Ghana). Their efforts were very important for improving the accuracy of information in those countries.

Mr. Alf Leslie (Australia), working as senior advisor to the project, made an important contribution in several phases of implementation, including in the review of a draft version of the document. Markku Simula (Finland) provided peer review and substantive editing.

Several members of the ITTO Secretariat greatly contributed to and facilitated the implementation of the study. Their support, particularly that of Dr Manoel Sobral Filho and Mr Emmanuel Ze Meka, is gratefully acknowledged.

The efforts of governments, several national and international organizations, and the private sector, in contributing relevant information to the study is also acknowledged.

ACRONYMS

ABAFT	Bahia Planted Forest Producers Association (Brazil)
ABIMCI	Brazilian Mechanical Wood Industry Association
ABIMÓVEL	Brazilian Furniture Industry Association
ABIPA	Brazilian Wood Panel Industry Association
ABRAF	Brazilian Forest Plantation Producers' Association
ACR	Santa Catarina Forest Company Association (Brazil)
AfDB	African Development Bank
AIMA	Ecuadorian Wood Working Industry Association
AMS	Minas Gerais Silviculture Association (Brazil)
ANICC	National Veneer and Plywood Industry Association
ANFA	National Particleboard Manufacturers Association
APRE	Paraná Forest Company Association (Brazil)
APROPACA	Venezuelan Pulp, Paper and Board Producers Association
AREFLORESTA	Mato Grosso Reforestation Association (Brazil)
ASIFLOR	Steel Producers' Forest Development Association (Brazil)
ASOINBOSQUE	Forest Industry Association (Venezuela)
ASOPLANT	Venezuela Forest Plantation Association
ASOTECA	Ecuadorian Teak and Tropical Word Producers
BB	Bank of Brazil
BNDES	National Economic and Social Development Bank (Brazil)
BRACELPA	Brazilian Pulp and Paper Association
CIRAD	French Agricultural Research Center for International Development
CODEVASF	Development Company of the San Francisco and Parnaíba Valleys (Brazil)
CONAFOR	National Forest Policy Consultative Council (Peru)
CONAMA	National Environment Council (Brazil)
CORMADERA	Development Corporation for the Forest and Wood Working Sector of Ecuador
CORPEI	Export and Investment Promotion Corporation (Ecuador)
DI	Direct investment
EFCA	Central American Forest Strategy
EFWI	Economic Freedom of the World Index
FAO	Food and Agriculture Organization of the United Nations
FDPP	Forest Development Program of Piauí (Brazil)
FGHY	Fast-Growing High-Yielding initiative (China)
FISET	Sectoral Investment Fund (Brazil)
FONDAFA	Agriculture, Forest and Fishing Development Fund (Venezuela)
FRA	FAO's *Forest Resources Assessment*
FRG	Guyana Regional Fund (Venezuela)
GDP	Gross domestic product
ha	hectare
INRENA	National Institute for Natural Resources (Peru)
JKPP	Participatory Mapping Network (Indonesia)

Kgoe	Kilograms of oil equivalent
KPSHK	Community Forest System Development Group (Indonesia)
IAIF	Forestry Investment Attractiveness Index (*Indice de Atracción de Inversión Forestal*)
IBAMA	Brazilian Environment and Natural Resources Institute
IIFM	Indian Institute of Forest Management
ITTO	International Tropical Timber Organization
m^3	cubic meter
MAF	Ministry of Agriculture and Forestry (New Zealand)
MAI	Mean annual increment
MARN	Ministry of the Environment and Natural Resources (Venezuela)
MAT	Ministry of Agriculture and Land (Venezuela)
MTC	Malaysian Timber Council
MTIB	Malaysian Timber Industry Board
NAP	National Afforestation Program (India)
NRP	National Reforestation Plan (Peru)
NGO	Non-governmental organization
OECD	Organization for Economic Cooperation and Development
OSINFOR	Forest Resources and Wildlife Fauna Supervision Office (Peru)
PFE	Permanent forest estate
PIA	Promotion of Investment Act (Malaysia)
PLANAP	Plan of Action for the Integrated Development of the Parnaíba Valley (Brazil)
PNFR	National Forestation and Reforestation Plan (Ecuador)
PRC	People's Republic of China
PREP	Private Reforestation Extension Project (Thailand)
PROMECIF	Process to Improve the Business Climate for Forest Investment (Brazil)
PRONAF Florestal	National Agricultural Family Strengthening Program (Brazil)
PROPFLORA	Commercial Plantation and Forest Rehabilitation Program (PROPFLORA)
RMB	Renminbi (Chinese currency)
SBS	Brazilian Silviculture Society
SEMAM/PR	Environment Secretary of the President of the Republic (Brazil)
SFM Tropics	ITTO's *Status of Tropical Forest Management in the Tropics 2005*
SFA	State Forest Administration
SFM	Sustainable forest management
SODEFOR	Society for Forest Development (Côte d'Ivoire)
SOFO	FAO's *State of the World's Forests*
US$	United States dollar
WAHLI	Indonesian Forum of Environmental NGOs

CONTENTS

Tables

Figures

Boxes

EXECUTIVE SUMMARY

This document is the report of a study on encouraging private-sector investment in industrial forest plantations in the tropics. It assesses the success of forest plantations, taking into account ecological, economic and social aspects and their overall contribution to sustainable development in accordance with the ITTO *Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests* and ITTO action plans. While the study focuses on forest plantations for timber production, it also takes into account secondary products such as firewood and wood pulp that might contribute to the economic success of plantations. The report highlights lessons learned in selected countries through their experiences with commercial forest plantation development. Potential strategies to assist ITTO producer countries in the development of commercial plantations are also presented.

The study covers tropical timber species as defined in the International Tropical Timber Agreement (1994):

> non-conifer tropical wood for industrial uses, which grows or is produced in the countries situated between the Tropic of Cancer and Tropic of Capricorn.

Adjustments were made to this definition so that countries with territories in tropical and non-tropical zones were properly included in or excluded from the list. A brief analysis of forest plantations in non-tropical countries was also carried out because of their implications for global timber trade.

The study was based largely on secondary information, but also included primary data collected in a questionnaire survey and through visits by the study team to eleven ITTO producer member countries in the three tropical regions (Africa, Asia and the Pacific, and Latin America and the Caribbean).

Overview

Forest plantations in tropical countries

Area and location

In 2005 the forest plantation area in tropical countries was 67.5 million hectares (Table A), covering 1.4% of the total land area of those countries.

The Asia-Pacific region comprises 37 countries. With 54 million hectares it has by far the largest tropical forest plantation estate (more than 80% of the tropical total). Of this, India has 33 million hectares, which is 60% of the regional total. Indonesia and Thailand also have large areas of plantations; combined, these three countries account for 90% of the regional total.

Tropical Africa, which comprises 47 countries, has a total of 4.6 million hectares of forest plantation. With 0.7 million hectares, Nigeria has the largest share of this, followed by Sudan with 0.64 million hectares and Madagascar with 0.35 million hectares.

The tropical Latin America and Caribbean region's 8.8 million hectares (13% of the total tropical forest plantation estate) are distributed among 39 countries. The largest areas are in Brazil (5.6 million hectares, 65% of the regional total), Venezuela (10%) and Peru (7%).

Trends and perspectives

The total tropical forest plantation area more than doubled in the period 1995–2005; Table B shows that the average annual growth rate in area was 8.6%. The highest rate was in the Asia-Pacific region (9.4% per year), and the slowest was in Latin America and the Caribbean (4.3% per year). The total area of forest

Table A Forest plantation area in tropical regions, 2005

Tropical region	Land area ('000 ha)	Plantation area ('000 ha)	% of land area
Asia-Pacific	1,104,000	54,073	4.9
Africa	1,652,000	4,620	0.28
Latin America and the Caribbean	2,250,000	8,805	0.39
TOTAL	5,006,000	67,498	1.35

Source: FAO (2006a), adapted by STCP.

Table B Forest plantation area change, 1995–2005, three tropical regions

Tropical region	Total plantation area ('000 ha)		% change, 1995–2005	% annual change
	1995	2005		
Asia and the Pacific	23,995	54,073	125.4	9.4
Africa	2,158	4,620	114.1	8.8
Latin America and the Caribbean	6,046	8,803	45.6	4.3
TOTAL	32,199	67,496	109.6	8.6

Source: FAO (2006a), adapted by STCP.

plantations in Asia-Pacific increased from 24 million hectares in 1995 to 54 million hectares in 2005. In large part this was due to the rapid expansion of forest plantations in India, from 14.6 million hectares in 1995 to 32.6 million hectares in 2005. Several other countries of the region, notably Indonesia, Thailand and Malaysia, also significantly increased their forest plantation areas during the period.

Tropical forest plantations practically doubled in the African region over the period – albeit from a much smaller base than in Asia-Pacific – from 2.2 million hectares in 1995 to 4.6 million hectares in 2005. The highest growth was in Nigeria, Côte D'Ivoire and Sudan.

The forest plantation area expanded by about 2.8 million hectares over the period in tropical Latin America and the Caribbean, from 6.0 million to 8.8 million hectares.

Forest plantations in non-tropical countries

Area and location

Forest plantations in non-tropical (i.e. temperate and boreal) countries cover about 120 million hectares (Table C). Of the four regions, non-tropical Asia-Pacific has the largest forest plantation area, with over 50% of the total, followed by Europe (27%) and non-tropical America (17%).

China has the largest planted forest area (45.1 million hectares), which is 38% of the total non-tropical plantation estate. Combined, four countries – China, Russia, the United States and Japan – account for 75% of the total.

Trends and perspectives

Until recently, commercial forest planting in non-tropical countries has been growing; in most developed countries, however, other environmental and economic priorities have resulted in reduced investments in industrial forest plantations. In Japan, Korea and Australia, for example, the area of new plantation established in each five-year block between 1971 and 2000 declined (in Japan's case from 275,000 hectares in 1971–75 to 44,000 hectares in 1996–2000). On the other hand, the rate of new plantation establishment increased over the period in New Zealand and Chile as those countries sought to develop and expand their timber exports.

Table C Forest plantation area in the non-tropical regions, 2005

Region	Land area ('000 ha)	Plantation area ('000 ha)	% of land area
Non-tropical Asia-Pacific	2,830,000	64,622	2.3
Europe	2,260,000	32,015	1.4
Non-tropical America	2,239,000	19,803	0.9
Non-tropical Africa	728,000	3,423	0.5
TOTAL	8,057,000	119,863	1.5

Source: FAO (2006a), adapted by STCP.

In several non-tropical countries, especially in the northern hemisphere, forest plantation productivity is relatively low and land is expensive. This has encouraged investors to turn to other regions where returns might be higher. In the last decade, the move of investors to temperate countries in the southern hemisphere has accelerated, but some of those countries are now beginning to place strict conditions on the expansion of large-scale forest plantations.

Commercial forest plantations

Overview of ITTO producer (tropical) countries

The rapid expansion of forest plantations in Asia-Pacific, particularly in India, Indonesia, Malaysia and Thailand, seems to be associated largely with a favorable investment climate and strong demand for wood products in the region. Brazil has also had a good investment climate; private investment in industrial forest plantations there increased significantly in the last decade. In many other countries, however, particularly in Africa, the investment climate has been poor and only limited investments in forest plantations have been made.

Tropical forest plantations are composed of a relatively small number of species. *Eucalyptus* is the most widely planted genus because of its adaptability to different soil and climate conditions, high productivity and the strong demand for eucalypt wood. There is a total of 8.5 million hectares of eucalypt plantation in tropical countries (24% of the total).

Other important tree species used for industrial plantations in tropical countries are: pines (*Pinus* spp) (18%), used for solid wood and pulp production; rubber (*Hevea brasiliensis*) (18%), used for latex and solid wood; teak (*Tectona grandis*) (17%); and acacias (*Acacia* spp) (9%). Various other broadleaved species make up 14% of the tree species planted for industrial purposes.

Asia-Pacific region

The forest sector in the tropical countries of the Asia-Pacific region has a high dependency on government forest policies, development strategies and sectoral plans and programs. In most countries significant progress has been made in reforming and updating forest policies and legislation to meet national demands driven by fast economic growth, market liberalization and other factors. Many types of forest plantation incentives have been applied.

Forest plantations have emerged in the region as a means of addressing deforestation and reducing the gap between wood supply and demand, and in recognition of their potential multiple economic, social and environmental benefits. Nevertheless, governments and development agencies have often been criticized for the mixed results achieved through their plantation policies.

The region's industrial forest plantation estate is mainly composed of eucalypts, rubberwood, teak and acacias. *Eucalyptus* is the most widely planted genus, followed by rubberwood and pine.

Productivity is variable: under certain conditions, high-yielding, genetically improved rubberwood and eucalypts have produced mean annual increments (MAIs) of 20 m^3/ha/year. Pine plantations can also achieve relatively high MAIs (eg average of 12 m^3/ha/year in Thailand and 10 m^3/ha/year in Indonesia). Other species such as teak, acacias and lesser-cultivated broadleaved species generally achieve MAIs in the range 4–6 m^3/ha/year. In Thailand, acacias produce an average MAI of 8 m^3/ha/year.

Africa

The public sector has a strong influence on economic development in African countries, including in forest plantations. Although the role of the state is declining in all aspects of the economy, it is still significant in the forest sector.

Given the resources at their disposal, most forest institutions in sub-Saharan African countries have excessive responsibilities, which result in heavy workloads but diminishing budgets. The general trend of changes to government policies related to forestry and forest plantations suggest that the influence of the public sector in forest plantation development is likely to decline. On the other hand, change is occurring only slowly and the emergent private sector is still very small and insufficiently capitalized.

The establishment of industrial plantations and social forestry programs through the active participation of rural populations appear to be feasible alternatives. Such initiatives can support economic growth and social development. Efficient implementation, however, will require improvements in institutional frameworks and legislation, shifting responsibility from government to the private sector and allowing local communities and civil society a much greater role.

Productive forest plantations in Africa are composed mostly of eucalypts and pines (1.0 million and 0.7 million hectares, respectively). Other popular species are teak, rubberwood and other hardwood species.

Forest productivity can be high: a eucalypt plantation in the Republic of the Congo, for example, achieved MAIs of 19 m³/year/ha. Plantations of *Gmelina arborea* in Nigeria and teak in Côte d'Ivoire have reported MAIs of 15 m³/year/ha and 11 m³/year/ha, respectively. African hardwoods such as framiré (*Terminalia ivorensis)* are thought to have lower productivities (less than 10 m³/year/ha).

Latin America and the Caribbean

In the past few years the forest sector in Latin America and the Caribbean has increased its production and trade of plantation-based products.

The increased environmental regulation of natural resources, the enlargement of protected areas, and protection policies have all affected wood production in natural forests. The impact on wood supply has been to increase transaction costs and reduce the competitiveness of natural forest timber. On the other hand, increased plantation-based production and consumption have begun to substitute for wood produced in natural forests.

Administrative and institutional reforms in the 1990s have had a significant effect on the region's forest sector. Many countries combined institutions dealing with forests and other renewable natural resources under a single administrative system for protected areas and forests. These systems have the purpose of improving coordination, reducing costs and avoiding the duplication of functions.

During the 1980s and 1990s the forest industry in the region underwent significant structural adjustment and consolidation, although the process varied greatly between countries and industrial segments. The production increase that occurred in the region for most forest products was a result of higher exports rather than increased domestic consumption.

The most commonly planted tree species in the region are eucalypts and pines, accounting for 44% and 47%, respectively, of the planted area.

The Latin America and Caribbean region has the highest forest plantation productivities in the tropics – up to 90 m³/ha/year (under controlled conditions). The average MAI is 22 m³/ha for eucalypts (although high-yielding clone plantations are achieving MAIs of 30–35 m³/ha/year), 18 m³/ha/year for acacias, 13 m³/ha/year for pines, and 9 m³/ha/year for teak.

Overall prospects for the tropics

The tropical forest plantation estate is expected to continue to expand. Higher forest productivity in the tropics, lower investment and production costs, and the comparative availability of land (although land availability will also be a constraint – see below), among other factors, will tend to divert investments in forest plantations from non-tropical to tropical countries.

The investment climate and increasing demand for wood will be the main factors influencing the rate of plantation investment. To a certain extent this will favor the Asia-Pacific region, where the investment climate is generally good and the demand for wood is increasing rapidly.

In Latin America and the Caribbean, the area of industrial forest plantations will also increase but at a slower pace. In Africa, the industrial forest plantation area is not expected to increase significantly in the next few years, unless the investment climate there improves significantly.

Innovative financing mechanisms, such as the Kyoto Protocol's Clean Development Mechanism (CDM) and payments for environmental services, will be important in promoting plantations as part of community development.

Plantations will continue to be based on only a few species selected for their comparative advantages (ie productivity, availability of technology, industrial demand, and other aspects). In view of recent developments, eucalypts are expected to increase their share in the medium term.

Land availability and environmental pressures will act to limit forest plantation development, especially in the Asia-Pacific region. The sector will increasingly emphasize productivity gains, thereby reducing the sector's demand for land and increasing the competitiveness of tropical forest plantations in Asia.

The expansion of plantations, and gains in forest productivity, will help reduce pressure on natural forests; this is already the focus of the forest policies adopted by several countries. On the other hand, the increase in timber supply from plantations (and a possible over-supply) could also create problems for the sector. Private investment in natural forest management will tend to decline and other financing sources will be needed in the future to improve the management of natural tropical forests.

ITTO consumer (non-tropical) countries

Forest plantations in ITTO consumer member countries play a significant role in global wood production. Although, the area of planted forests is impressive, the area of productive plantation for commercial use is much smaller; only a portion of China's total plantation estate, for example, is reported as productive.

Case studies

The consultant selected three case studies to highlight successful experiences in industrial tropical forest plantations. Case study 1 examined teak plantations in selected countries, case study 2 dealt with an emerging forest plantation program in northeastern Brazil, and case study 3 reviewed the production and trade of rubberwood products.

The Brazilian case study received attention for the pioneer character of the program, which involves the integration of industrial forest plantations into a major regional development effort to promote social and economic development in one of Brazil's poorest regions. Lessons learned from the study include:

- the program demonstrates the value of the proactive involvement of government in promoting public policies through industrial forest plantations; and
- The program is being conducted under a process that can be assessed by other interested parties under similar conditions.

The foci of the other two case studies, teak and rubberwood, are two major commercial tree species that show the potential value of forest plantations in the tropics. Teak and rubberwood plantations, particularly in the Asia-Pacific region, have the capacity to supply a large portion of the market demand for timber, especially in the furniture industry, thereby substituting for hardwoods from natural forests. Both species have attracted the attention of investors in many tropical countries: teak plantations now cover an area of 5.7 million hectares worldwide and rubberwood plantations cover 6.2 million hectares. Prospects are good for both species, due at least in part to:

- public policies that provide incentives for plantation investment, mainly in Asia-Pacific;
- growing private investment in those species;
- the likelihood of increased restrictions on the harvesting of natural forests;
- increasing market demand for teak; and
- the preference of a number of forest-based industries for plantation timber.

Opportunities for industrial forest plantations

Main factors affecting investment in industrial forest plantations

The Inter-American Development Bank recently carried out a study on the attractiveness of forest investments in Latin America and the Caribbean. It developed what it called the Forest Investment Attractiveness Index to measure the climate for investments in sustainable forest businesses, taking into account supra-, inter- and intra-sectoral factors.

A preliminary assessment indicated that the investment climate for establishing industrial forest plantations is much more favorable in the tropical Asia-Pacific region than in the Latin America and Caribbean region. Tropical Africa has a generally weak climate for forest investment. Supra-sectoral factors are essential for understanding differences among the three regions in their business climates.

Overcoming the limitations imposed by some supra-sectoral factors, particularly those related to political stability and governmental transparency, would be a major step for most African countries. Addressing inter-sectoral factors such as the development of adequate economic and social infrastructure, judicial processes and land tenure is also important, particularly in tropical Africa and Latin America and the Caribbean.

Constraints to industrial forest plantation development

Industrial forest plantation development faces a number of constraints; these vary among ITTO producer countries but there are also many commonalities. Differences relate mainly to the importance of forest plantations to national economies, the size of the forest resource, the involvement and strength of the private sector, and the support received from international organizations.

The major constraints for industrial forest plantation development in tropical countries identified by the consultants are:

1) **lack of information on the current status of commercial tropical plantations**: the general lack of reliable information on a number of forest-related issues contributes to a lack of transparency and reduces the likelihood of favorable investment decisions;

2) **land tenure**: land tenure and, in particular, the absence of well-defined property rights have been key obstacles to attracting investment in industrial forest plantations in ITTO producer countries. The resolution of conflicts over land tenure rights and improved law enforcement are prerequisites for achieving industrial forest plantation development;

3) **lack of capacity**: low capacity in the technical and organizational management of forest plantations and a lack of dialogue between the public and private sectors hinders efficient and effective plantation development;

4) **insufficient research and development**: despite significant recent achievements in the establishment of forest plantations in the tropics there is still much to be done in basic and applied research to ensure that plantations are sustainable, productive and cost-effective;

5) **lack of financing mechanisms**: few tropical countries encourage forest plantations through subsidies or beneficial financing schemes. Public funds are still limited and private financing is just emerging; and

6) **competition for land**: worldwide, the public scrutiny of land ownership and land use has become increasingly intense. Industrial forest plantations compete for land with agriculture and cattle-raising in most tropical countries, especially those with large populations. The strong competition for land affects land prices and constitutes a barrier to forest business.

Opportunities

The study identified a number of likely developments in the commercial forest plantation sector at the regional and, to some extent, country levels.

- The industrial forest plantation area will increase rapidly in the next few years as a way of ensuring there is an adequate wood supply for the global forest industry. Plantation rates will be high in some Asia-Pacific countries, notably China, India, Indonesia and Malaysia, where government incentives (subsidies, grants, tax concessions, differential fees, cost-sharing arrangements, and others) are available. In Latin America and the Caribbean the area of industrial forest plantations will also increase, but at a slower pace.
- There is a prevailing perception that the supply of timber from natural forests will gradually decrease and production costs will grow. This will contribute to the expansion of the forest plantation estate in all three tropical regions.
- In most tropical countries the CDM and other mechanisms for payments for environmental services are likely to play an increasing role in plantation development. Access to these financing sources for forest plantations is very limited at the moment but could be enhanced.
- In many poor tropical countries, particularly in Africa, forest plantation programs will increasingly be linked to poverty alleviation, community development and the recovery of degraded land. These programs are likely to grow, contributing to an increase in plantation area, but the rate of expansion will depend on the support provided by international organizations and the financing made available.
- In Latin America and the Caribbean and some Asia-Pacific countries, the lack of large contiguous land areas and environmental restrictions on land use will mean that the expansion of industrial plantation area will occur mainly on small and medium-sized properties. The forest outgrower programs promoted by the pulp-and-paper industry are likely to intensify and will help consolidate forestry activities on small rural properties. These partnership programs are important in Latin American countries, notably Brazil, and will also increase in the Asia-Pacific region.
- The private sector will continue to be the main investor in forest plantations worldwide, particularly in Asia-Pacific and Latin America and the Caribbean.
- Domestic direct investment is the main source of financing for industrial forest plantations, with foreign direct investments making only a minor contribution. Timber investment management organizations have emerged recently, mainly in the Latin America and Caribbean and Asia-Pacific regions, and are helping to finance industrial plantations.

- In most non-tropical countries, in both the northern and southern hemispheres, plantation productivity is lower than in tropical countries and land is almost always more costly. This encourages investors to seek locations where returns might be higher.

ITTO strategies for promoting industrial forest plantation development

In general, this study validates ITTO plantation-related goals and reinforces the importance of related actions set out in the ITTO Yokohama Action Plan (2002–2006).

The factors restricting industrial forest plantation development associated with Goal 1 of ITTO's Yokohama Action Plan ('Support activities to secure the tropical timber resource base') include: a lack of attractiveness to businesses resulting from a poor investment climate; the low price of illegal products; a lack of innovative incentives mechanisms and the complexity, in some countries, of existing legislation; and land-use restrictions.

On the other hand, the factors restricting industrial forest plantation development associated with Goal 2 of the Yokohama Action Plan ('Promoting sustainable management of tropical forest resources') can be summarized as: the cost and complexity of forest certification; the lack of information on forest plantations (especially sustainable production capacity for policy definition and investors); the dissociation of community forest plantations from forest product markets; in some regions the loss of planted forest areas due to, among other things, fire; and a lack of adequate knowledge on silviculture and forest management.

A favorable investment climate is fundamental to the expansion of forest plantations, which is dependent on a combination of supra-, inter- and intra-sectoral factors. ITTO should concentrate its efforts mainly on addressing intra-sectoral factors (see below).

Strategic country-level actions supported by ITTO

- ITTO should assist governments to:

  Development/improvement of forest policies and legislation

  1) Create enabling policies and enhance political commitment to forest plantation development; undertake land-use planning; combat illegal logging and illegal timber trade; create adequate incentive mechanisms and a conducive investment climate; secure property rights for forest landowners and producers; and promote institutional development, considering that:
     - in countries with a competitive advantage in industrial plantations, forest policies and national strategies should include industrial plantations as a major area of intervention, targeting both the meeting of domestic needs and the development of export-oriented production. This would require strategic planning supported by analytical studies as well as adequate mechanisms in land allocation and tenure, training and extension, research and development and financing incentives
     - in less competitive countries, institutional capabilities will need to be upgraded to integrate forest plantations within the national planning system. This will require analytical studies to clarify the role of forest plantations, including their contributions to economic growth, poverty alleviation, and environment conservation.
  2) Reduce transaction costs by simplifying the administrative procedures for the establishment of plantation projects and the harvesting of plantation timber (eg by revising forest laws, establishing clearing-house mechanisms, and other actions).
  3) Develop innovative incentives and financing mechanisms for forest plantations, including those under the CDM, other carbon financing initiatives, and avoided deforestation. Options include payments for other environmental services and special forest plantation trust funds and securities.
  4) Revise the legal framework related to land and natural resource use by identifying bottlenecks that prevent the adequate implementation of forest plantation programs. Legal reforms would also help to remove restrictive aspects of current laws and the judiciary system linked to the risks faced by long-term investments.

  Definition and allocation of land for forest plantations

  5) Identify priority zones for forest plantations (land and resource macro-zoning).

6) Support forest plantation programs by enhancing national capacities for land-use planning and the allocation of forest plantation areas in accordance with best practice.

Capacity-building

7) Promote and support research and development through concerted action among national governmental and private-sector institutions.

8) Develop ways of communicating relevant information and findings from research on plantation forests to stakeholders, including through specialist publications.

9) Build up human resource capacity through programs for improving plantation-related skills (professional, technical and vocational).

10) Improve the national services – such as extension, advisory and technical assistance – needed for the establishment and expansion of industrial forest plantations.

- ITTO should assist organizations of smallholders and communities to:

11) Facilitate interactions between government, the private sector and NGOs through capacity-building in negotiation and conflict-resolution skills.

12) Disseminate information about the importance of forest plantations and their impacts on the conservation of natural forests.

13) Support the organization of smallholders and communities interested in plantation development.

14) Build the capacity of stakeholders to participate in plantation development by convening workshops and providing specialized training courses.

- ITTO should assist the private sector to:

15) Support the adoption, by private-sector organizations, of proper planning, including in regard to financial aspects and risk assessment, taking into account the importance of land-use planning, tenure rights and national guidelines and regulations for forest utilization.

16) Disseminate to private-sector organizations up-to-date information on the application of relevant international standards and best practices codes.

17) Disseminate information related to the role of forest plantations in climate change mitigation, soil and water conservation, and biodiversity conservation, and their direct contributions to economic and social development.

18) Facilitate cooperation between the corporate sector, communities and smallholders through appropriate types of partnerships and outgrower schemes.

19) Through national and international fora, facilitate the active exchange of technical and scientific information related to forest plantations.

20) Support innovative technologies that improve environmental performance (eg reduced-impact logging).

Strategic actions to be implemented by ITTO

ITTO should:

Information base on timber plantations

21) Improve existing ITTO forest databases by including adequate information on industrial plantations. This will involve providing support to producer member countries to develop their systems. ITTO should also disseminate information through its Market Information Service and other ITTO communication vehicles.

22) Collect the information (eg through national and regional forest inventories, etc) on forest plantation resources – such as planted area, tree species, distribution and sustainable production capacity – necessary for decision-making to promote forest planting and timber utilization.

23) Share information, knowledge and technology through cooperation with countries and other organizations (eg disseminate technical information on plantation forests, including forest planting methods and management, based on the lessons learned from successful and unsuccessful plantation experiences).

24) Communicate information at the national and international levels through national workshops, seminars and other events, and publications using various media (printed and electronic).

International and regional forums and seminars

25) Organize international and regional forums to exchange experiences in financing mechanisms and the development of strategies for forest plantations in the tropics, taking into account recent developments in the United Nations Framework Convention on Climatic Change, the CDM, etc. ITTO should provide specific forums for small and medium-sized investors related to potential forest development ventures, especially in emerging and developing economies where access to financial resources is often restricted to large corporations.

Policy development to improve the investment climate for forest plantations

26) Support the implementation of national programs to improve the business climate for sustainable forest investment.

27) Develop national strategies to improve the attractiveness of plantation investment (domestic/foreign).

28) Promote regional initiatives for engaging national institutions and professional, public and civil-society organizations in the identification of forest development projects that can be presented to investment institutions and international development cooperation and aid agencies. This could be done, for example, by coordinating the provision of assistance with regional entities such as *Corporación Andina de Fomento*, multilateral and regional development financing organizations, and others.

Human resource development and institutional strengthening

29) Support the development of human resources in topics such as:
- the management of genetic material
- nursery measures
- species-specific silviculture
- appropriate harvesting technologies
- fire management
- pest and disease control.

30) Promote the transfer of technology among national research institutions by facilitating dialogue and funding fellowships for specific training and the investigation of technical issues such as species selection, seed supply, nursery operations, plantation establishment and management, and other aspects.

31) Develop guidelines for the participatory formulation of plantation projects to be used by stakeholders in producer member countries in order to facilitate access to resources and technical assistance.

Guidance on the establishment and sustainable management of planted tropical forests

32) Review the *ITTO Guidelines for the establishment and sustainable management of planted tropical forests*.

Other strategic actions

Although, in general, ITTO actions do not target government decisions directly associated with extra-sectoral factors (ie supra- and inter-sectoral factors), given ITTO's intergovernmental nature there are a number of actions it can take to address them. ITTO should:

Macroeconomic policies (supra-sectoral)

33) *International trade*: Continue to undertake actions related to market constraints, including on tariff and non-tariff trade barriers and policies that address illegal logging and trade.

34) *Government transparency*: Contribute to international efforts that might, in the long run, result in the adoption of improved planning practices and a higher degree of participation by civil society. A lack of transparency can have a detrimental effect on the development of the forest plantation sector.

35) *Fiscal benefits in the economic environments of tropical countries*: Support analytical work to assist governments in adjusting their fiscal policies, such as by improving taxation efficiency in the forest sector.

Other related economic sectors (inter-sectoral)

36) Carry out analytical studies on the economic instruments applied in agriculture to clarify their impact on the rehabilitation of marginal lands through forest plantations, and on land values.

37) Review experiences in other sectors related to technical education and training and financing mechanisms and determine their applicability to forest plantation development.

1 INTRODUCTION

At its 35th and 36th sessions, held in November 2003 in Yokohama, Japan, and July 2004 in Interlaken, Switzerland, respectively, the International Tropical Timber Council, the governing body of the International Tropical Timber Organization (ITTO), decided to implement the following two strategic policy activities:

1) encourage private-sector investment in industrial forest plantation in the tropics; and
2) conduct a market study on tropical forest plantation timber products.

To take advantage of potential synergies between the two activities and to maximize their cost-effectiveness, ITTO's Executive Director invited submissions for their joint implementation, although separate reports were to be prepared.

In September 2005, STCP Engenharia de Projetos Ltda submitted a proposal to the ITTO Secretariat for a global study on tropical forest plantations. After evaluating all submitted proposals, in January 2006 ITTO informed STCP that it had been selected to undertake the work. Following the preparation and discussion of a study work plan with ITTO in February 2006, STCP took the necessary steps to implement the work plan.

Study objective

The purpose of the study was to analyse and report on the key factors that determine the success or failure of commercial plantations in selected ITTO producer and consumer countries. Aspects to be examined included government policies, institutional factors, land tenure systems, the economics of production and returns on investment, community benefits and community involvement, ecological aspects, and technical issues. The specific objectives of the study are given in Chapter 2.

Outputs

This report presents the results of the study on encouraging private-sector investment in industrial forest plantations in the tropics. It assesses the success of forest plantations, taking into account ecological, economic and social aspects and their overall contribution to sustainable development. While the study focuses on forest plantations for timber production, it also takes into account secondary products such as firewood and wood pulp that might contribute to economic success. The report highlights lessons learned in selected countries through their experiences with commercial forest plantation development. Potential strategies to assist ITTO producer countries in the development of commercial plantations are also presented.

Chapter 2 sets out the methodological approach taken in the study, as well as its scope (ie the characterization of products and species), geographical coverage, and assumptions. Chapter 3 presents an overview of commercial forest plantations, including the most current statistics on tropical forest plantation area and distribution in Asia and the Pacific, Africa, and Latin America and the Caribbean. Trends a nd perspectives associated with the development of commercial forest plantations in those regions are also discussed.

Chapter 4 reviews the status of commercial forest plantations (both private-sector and community-based) in four selected ITTO producer countries per region and three consumer countries.

Chapter 5 presents three case studies on commercial tropical plantations:

1) *successful plantations*, focusing on teak plantations in the tropics (mainly in Africa and Asia-Pacific);
2) *emerging plantation programs*, detailing the structure and objectives of the recently implemented Forest Development Program of Piauí State (Brazil), which is promoting eucalypt plantations for commercial and protection purposes; and
3) *the successful marketing of tropical plantation timber*, focusing on rubber plantations and the commercialization of rubberwood, primarily in the Asia-Pacific region.

Chapter 6 presents an analysis of the key factors that have influenced the success or failure of commercial plantations in selected ITTO producer and consumer

countries. A perspective is provided on the certification of plantation timber, and the constraints to commercial plantation development in ITTO producer countries are analysed.

Taking into account the ITTO *Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests* and the ITTO Yokohama Action Plan, the document recommends, in Chapter 7, the strategies that ITTO could adopt to assist producer countries to promote private-sector investment in sustainable commercial plantation development.

Annexes to the document include the complete list of contacted institutions and persons and the model questionnaires used for data collection.

2 METHODOLOGY

Based on the terms of reference set out by ITTO and taking into consideration the time and resources available, this study was based largely on secondary information, supplemented by primary data collected through field visits to selected countries and through a questionnaire-based survey completed by various stakeholders in the regions of interest.

Secondary sources included existing technical reports and publications, the web pages of a large number of institutions linked to the forestry sectors of tropical countries, STCP's own database and knowledge base, and official data from governments, international organizations and others.

An initial assessment of data sources indicated that while information on forest plantations in the tropics and on markets for tropical plantation timber products was generally available, the quality of the information was highly variable and often poor.

The three major sources of secondary information on forest plantations used in this study were: i) *Status of Tropical Forest Management 2005* (ITTO 2006a, referred to here as *SFM Tropics*); ii) *State of the World's Forests* (referred to hereafter as SOFO, FAO 2006a); and iii) the FAO Forest Resources Assessment (referred to hereafter as FRA), most recently for 2005 (FAO 2006b).

SFM Tropics presents an overview of the status of forest management in the tropics, including analysis, conclusions and recommendations as well as profiles of ITTO producer member countries organized by region (Asia and the Pacific, Africa, and Latin America and the Caribbean). Among other things it canvasses planted forests, institutional arrangements, forest certification, and timber production and trade, in each country. FRA and SOFO also constitute a relatively good source of global information on forests; they were used extensively in this study for identifying and consolidating statistics on forest plantation area and distribution.

To mitigate the risks associated with the use of poor and often inconsistent secondary information, STCP:

- assigned a work team with considerable experience in and knowledge of forest plantation issues worldwide to carry out field surveys in selected countries (see 'geographic coverage' below) and to consult with local authorities and private-sector and other local experts, especially in countries and regions with less-consistent information. The final decision on the countries to be visited was made after consultation with the ITTO Secretariat and as set out in the work plan. A total of eleven countries were visited (Table 2.1); and
- developed and applied a questionnaire, which was completed by selected stakeholders covering most tropical countries.

STCP also made use of peer review in order to ensure the quality of the final report. A preliminary report of the study was presented to the International Tropical Timber Council's Committee on Reforestation and Forest Management and suggestions by delegates were taken into account.

More detail on the actions taken to reduce risks and improve data quality for this study are presented below.

Table 2.1 List of ITTO producer countries visited during the study

Asia and the Pacific	Africa	Latin America and the Caribbean
Indonesia	Republic of Congo	Brazil
Malaysia	Gabon	Ecuador
Thailand	Ghana	Peru
	Nigeria	Venezuela

Specific objectives

The specific objectives of the study were to:

- **provide information on commercial plantations** in ITTO tropical member countries using existing sources such as ITTO and FAO as well as written contributions from ITTO member countries;
- **review the status of commercial plantations** in selected ITTO producer countries and in two consumer countries, including private-sector plantations and those involving community participation;

- **analyze the key factors in the success or failure of commercial plantations** in selected ITTO producer and consumer countries, including government policies, institutional factors, land tenure systems, the economics of production and returns on investment, community benefits and involvement, ecological aspects and technical issues, as well as lessons that could be learned from other countries with successful commercial plantations;
- **analyze common constraints to commercial plantation development** in ITTO producer countries; and
- **recommend strategies that ITTO could adopt to assist producer countries** in promoting private-sector investment in commercial plantation development that supports sustainable forestry development.

In its analysis of key factors involved in the success or failure of commercial tropical timber plantations in selected ITTO producer and consumer countries, STCP took advantage of its experience gained in implementing the 2005 study on the forest-sector investment climate and the development of the Investment Index for the Forest Sector for the Inter-American Development Bank.

Scope of work

Characterization of products and species

This study covers tropical timber species as defined in the International Tropical Timber Agreement, 1994:

> non-conifer tropical wood for industrial uses, which grows or is produced in the countries situated between the Tropic of Cancer and Tropic of Capricorn. The term covers logs, sawnwood, veneer sheets and plywood (UNCTAD 1994).

STCP found it necessary, however, to broaden the scope of this definition so as to ensure comprehensive coverage of the factors influencing the dynamics of tropical forest plantations. Since a number of countries have both tropical and non-tropical zones, STCP decided to include the entire territories of all countries that were mostly located within the tropics. These were: Bangladesh, Botswana, Brazil, India, Paraguay, Madagascar, Mali, Mauritania, Mexico, Mozambique, Myanmar, Namibia and Saudi Arabia. Australia and China, which both have territory in the tropics, were classified as non-tropical because they are classified by ITTO as consumer rather than producer members. Table 2.2 shows the classification of tropical and non-tropical countries for the purpose of this study, and Figure 2.1 depicts this graphically.

An adjustment was made to the definition to include planted coniferous forests, which in some tropical countries (particularly Brazil, Colombia and Venezuela) are quite significant. Such an adjustment was important to account for market interactions between coniferous and broadleaved species, such as combined plywood (which uses both pine and broadleaved species as raw materials), tropical sawnwood pine timber (which can substitute sawnwood hardwood in some applications), and reconstituted wood panels (in which both softwoods and hardwoods are used as raw materials and the products are not usually differentiated in the market place).

Moreover, all tropical plantations were considered to be part of the estate if they were growing in the countries located between the Tropic of Cancer and Tropic of Capricorn, regardless of whether they were native to the tropics. In view of the importance of the pulp-and-paper sector in improving the competitiveness of plantations (particularly through the utilization of small-diameter logs), pulpwood was added to the products covered in the study.

Geographic coverage

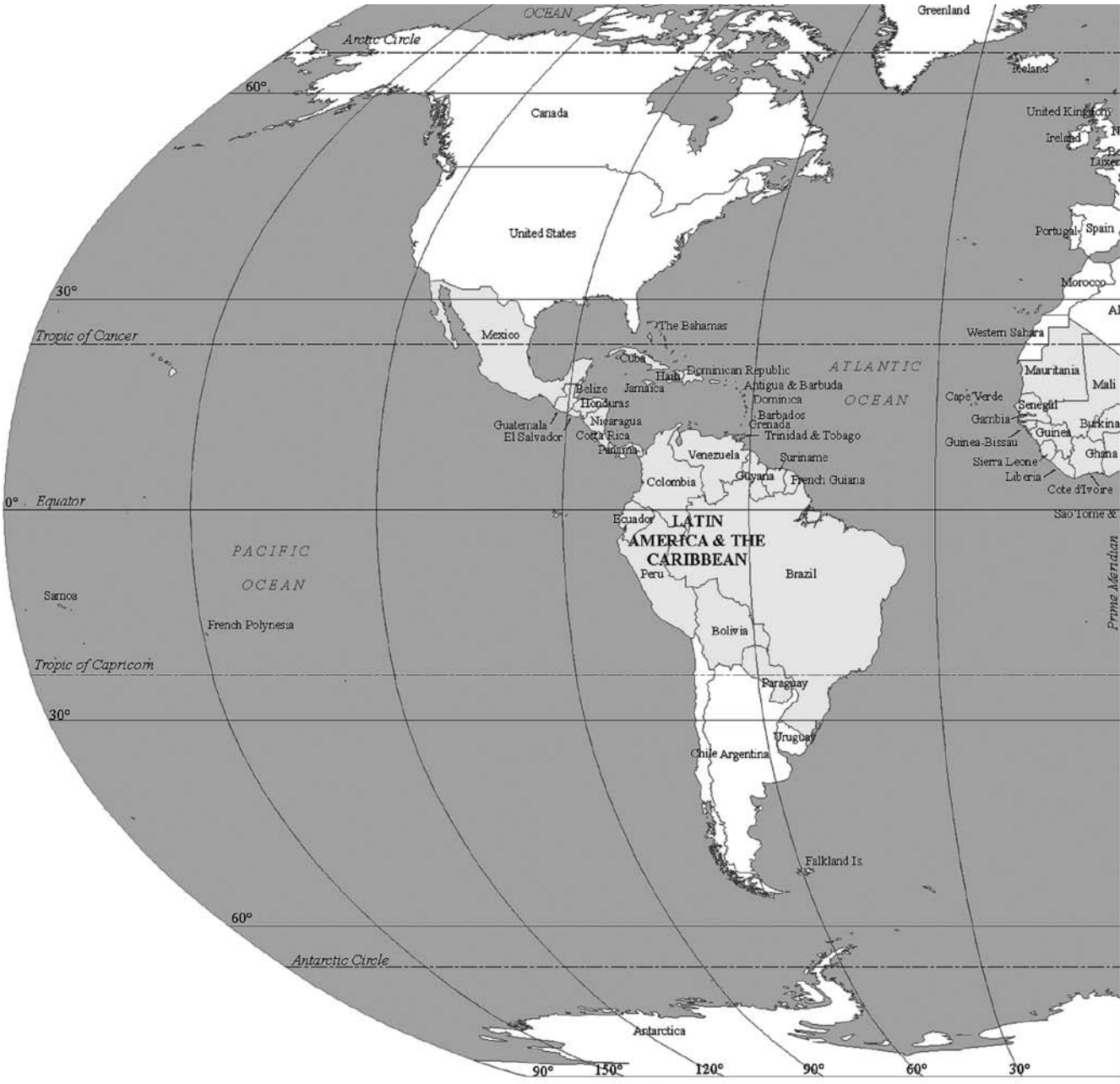
The study considers all tropical countries, although its focus is on ITTO producer members. Forest plantations and timber markets in non-tropical regions also affect the trade in tropical timber. The study therefore includes a global overview of plantation forests and industrial developments outside the tropics.

Table 2.2 Countries defined as tropical for the purposes of the study

ASIA AND THE PACIFIC			
Bangladesh	*Philippines*	Cook Islands	Northern Mariana Islands
Brunei Darussalam	Saudi Arabia	*Fiji*	Palau
Cambodia	Singapore	French Polynesia	*Papua New Guinea*
India	Sri Lanka	Guam	Samoa
Indonesia	*Thailand*	Kiribati	Solomon Islands
Lao People's Dem. Rep.	East Timor	Marshall Islands	Tonga
Malaysia	United Arab Emirates	Micronesia	*Vanuatu*
Maldives	Viet Nam	Nauru	
Myanmar	Yemen	New Caledonia	
Oman	American Samoa	Niue	
AFRICA			
Angola	*Dem. Rep. Of the Congo*	Madagascar	San Tome and Principe
Benin	Djibouti	Malawi	Senegal
Botswana	Equatorial Guinea	Mali	Seychelles
Burkina Faso	Eritrea	Mauritania	Sierra Leone
Burundi	Ethiopia	Mauritius	Somalia
Cameroon	Gabon	Mozambique	Sudan
Cape Verde	Gambia	Namibia	*Togo*
Central African Republic	Ghana	Niger	Uganda
Chad	Guinea	*Nigeria*	United Republic of Tanzania
Comoros	Guinea-Bissau	Reunion	Zambia
Congo – Brazzaville	Kenya	Rwanda	Zimbabwe
Côte d'Ivoire	*Liberia*	Saint Helena	
LATIN-AMERICA & CARIBBEAN			
Bolivia	Antigua and Barbuda	El Salvador	Netherlands Antilles
Brazil	Bahamas	Grenada	Nicaragua
Colombia	Barbados	Guadeloupe	*Panama*
Ecuador	Belize	*Guatemala*	Puerto Rico
French Guiana	British Virgin Islands	Haiti	Saint Kitts and Nevis
Guyana	Cayman Islands	*Honduras*	Saint Lucia
Paraguay	Costa Rica	Jamaica	Saint Vincent and Grenadines
Peru	Cuba	Martinique	*Trinidad Tobago*
Suriname	Dominica	*Mexico*	United States Virgin Islands
Venezuela	Dominican Republic	Montserrat	

Countries in italics are ITTO producer members.
Source: ITTO, adapted by STCP.

Figure 2.1 Distribution of tropical and non-tropical countries for the purpose of the study



Robinson Projection

[1] Adapted by STCP
Source: STCP database


Sweden
Norway
Finland
Estonia
Latvia
Lithuania
Poland
Belarus
Germany
Slovakia
Ukraine
Austria
Hungary
Croatia
Romania
Serbia
Italy
Montenegro
Bulgaria
Greece
Malta
Tunisia
Russia
Kazakhstan
Mongolia
Uzbekistan
Kyrgyzstan
Tajikistan
Georgia
Azerbaijan
Armenia
Turkey
Turkmenistan
Syria
Cyprus
Israel
Iraq
Iran
Afghanistan
Jordan
China
North Korea
South Korea
Japan
Pakistan
Nepal
India
Bangladesh
Myanmar
Laos
Thailand
Cambodia
Vietnam
Philippines
Libya
Egypt
Saudi Arabia
Qatar
Oman
Niger
Chad
Sudan
Eritrea
Yemen
Djibouti
Somalia
Ethiopia
Nigeria
CAR
Cameroon
Togo
E. Guinea
Gabon
Congo
Rwanda
Burundi
Congo, DRC
Tanzania
Uganda
Kenya
AFRICA
Gambia
Angola
Zambia
Malawi
Mozambique
Zimbabwe
Namibia
Botswana
Lesotho
Swaziland
South Africa
Comoros
Madagascar
Mauritius
Reunion
Seychelles
Sri Lanka
Maldives
ASIA - PACIFIC
Brunei
Malaysia
Singapore
Indonesia
Indonesia
Timor Leste
Papua New Guinea
Australia
PACIFIC
OCEAN
INDIAN
OCEAN
Micronesia
Nauru
Solomon Is.
Vanuatu
Fiji
New Caledonia
New Zealand
60°
30°
0°
30°
60°
0°
30°
60°
90°
120°
150°
90°
Legend
Tropical Countries (ITTA/1994)[1]
Non-Tropical Countries

Methodology

In commissioning two studies together (see Chapter 1), ITTO expected that information collection and analysis for both would be conducted concurrently, with considerable benefits in terms of efficiency and cost-effectiveness.

Figure 2.2 presents a schematic view of the approach taken by STCP. It shows that the study was implemented in three phases: i) inception; ii) data/information collection, field survey and analysis; and iii) reporting.

Phase 1: Inception

The inception phase, which began in the third week of January 2006, included: 1) internal planning; 2) briefing and consultation with the ITTO Secretariat; and 3) the preparation of a detailed work plan (which served both studies). In mid-February 2006 STCP presented the draft work plan to the Secretariat and finalized the plan after taking feedback into account.

Phase 2: Data collection, field survey and analysis

In the second phase, efforts were concentrated on the collection and analysis of primary and secondary data. Data collection involved:

- the desktop review of secondary information;
- visits to selected countries and consultations with officials, experts and other stakeholders; and
- dispatch of questionnaires to stakeholders in a number of tropical countries.

The latter two are described in more detail below.

Field surveys

To carry out the field surveys, STCP personnel visited selected countries in the three tropical regions. Africa was divided into English-speaking and French-speaking countries.

Prior to the visits, a complete checklist of information and data to be gathered from stakeholders in each country was prepared. This ensured that similar procedures of data collection were applied in each country.

The ITTO Secretariat provided a list of ITTO official contact points to be consulted. In each country a number of relevant organizations were also identified prior to the visits.

The following actions were taken during the country field surveys:

- review of forest plantation and forest products data, at the country level, to update and improve information relevant to the study; and
- collection of information at the country level and, where possible, the exchange of views with stakeholders to facilitate the elaboration of three case studies covering:
  a. successful plantations
  b. emerging plantation programs
  c. successful marketing of tropical plantation timber.

During the field visits STCP personnel were able to contact a diversified group of stakeholders. Annex 1 provides a complete list of institutions and personnel contacted during field visits.

Questionnaires

An important complement and counter-check to the secondary information gathered during the study was the preparation and circulation of questionnaires to relevant stakeholders in over 50 tropical countries.

The draft questionnaires were validated by the STCP team, including those directly involved in the field surveys, and sent to selected stakeholders by email. Separate questionnaires were developed for the following stakeholder groups: private companies and investors; government agencies and public bodies; financing institutions; civil-society organizations; and certification bodies. Annex 2 presents samples of the questionnaires submitted to these groups.

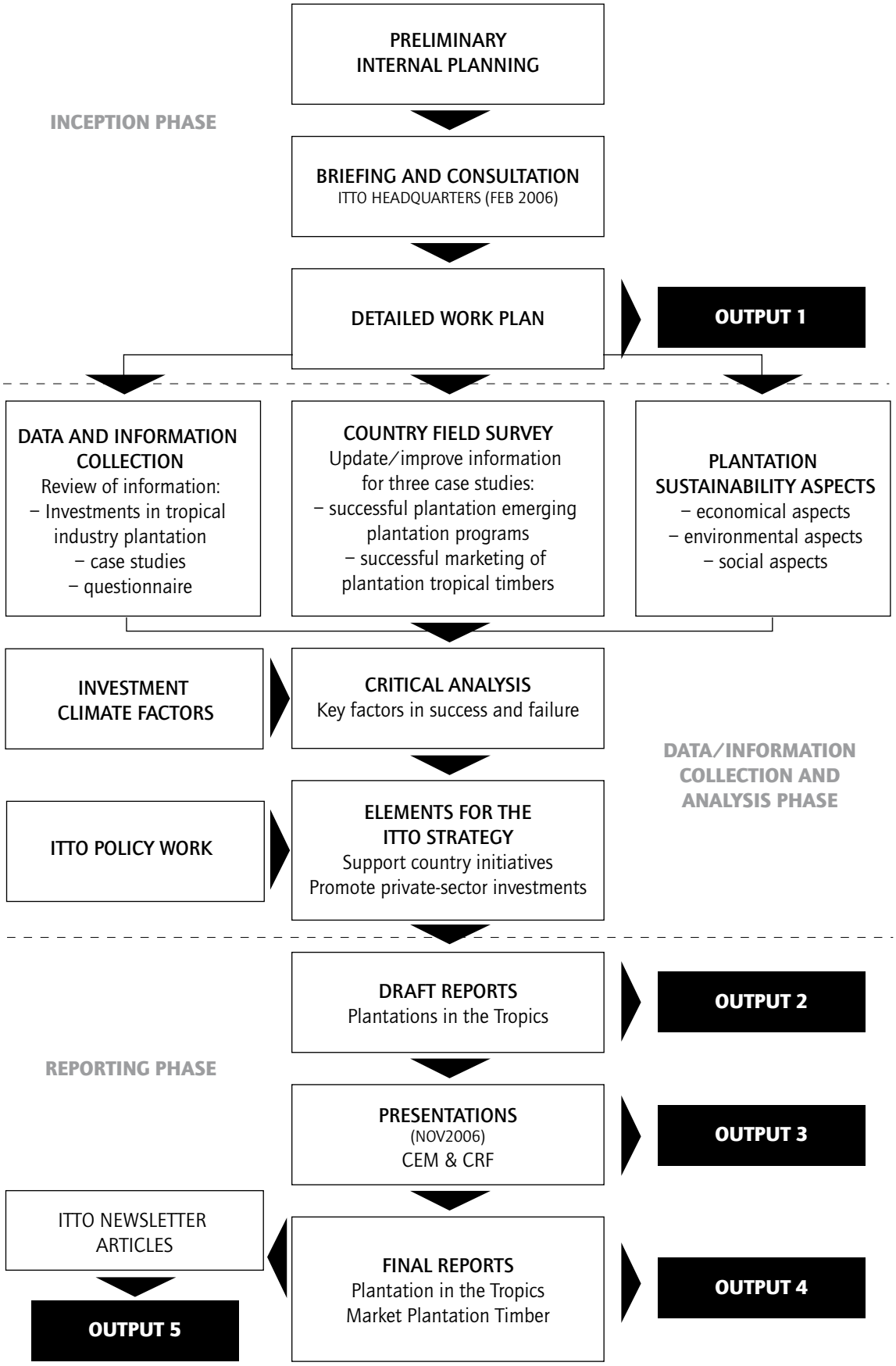
Over 900 stakeholders were contacted during the survey process, with sequential follow-ups for non-respondents.

Analysis

Three aspects related to plantation sustainability were also considered in the study:

1) economic aspects;
2) environmental aspects; and
3) social/community-related aspects.

Figure 2.2 Study approach



The information collected from secondary sources and field surveys, as well as lessons learned from the case studies, were critically analysed in order to identify key factors in the success or failure of tropical plantations. To facilitate the identification of these factors, the approach developed by STCP for the InterAmerican Development Bank on the analysis of factors affecting investments in sustainable forest businesses was used.

The analysis also considered the need to define key elements of an ITTO strategy related to forest plantations in the tropics and the marketing of tropical plantation timber products. These were identified in two broad areas:

1) support for country initiatives on forest plantations; and

2) the promotion of private-sector investment.

In the process of defining elements for the ITTO strategy on plantations STCP took into consideration ITTO's objectives as specified in the ITTA, 1994, as well as relevant ITTO policy work. STCP based its recommendations on its findings and analysis as well as the inputs of stakeholders received during field visits.

Phase 3: Reporting

The last phase of the work was the preparation of the final draft report to be submitted to the ITTO Secretariat for its consideration. The report was revised by the consultant's senior project advisor prior to submission.

Two other products were prepared: a presentation for the 34th session of the Committee on Reforestation and Forest Management, held in November 2006 in Yokohama, Japan, and an article with a summary of the study findings to be published in the ITTO newsletter, the *Tropical Forest Update*.

Following comments received from the ITTO Secretariat and members of the Committee, the final version of the report was prepared and submitted to peer review prior to delivery to the ITTO Secretariat.

3 OVERVIEW OF FOREST PLANTATIONS

This chapter provides an overview of forest plantations worldwide, presenting country-level information on area and distribution and an assessment of major trends. It is based on secondary data and covers tropical countries (as defined in Chapter 2) and non-tropical countries separately.

The data available on world forest plantation area vary according to source. The main reasons for discrepancies between sources are related to: differences in the definition and classification of forest plantations; imprecise data reported for existing forest plantations; and different methods for measuring tree mortality and classifying forest regeneration.

In some cases, even data from the same institution are inconsistent. Table 3.1, for example, shows the differences found in contemporary estimates of total tropical forest plantation area in SOFO (FAO 2006a) and FRA 2005 (FAO 2006b).

The estimate derived from SOFO is almost double that derived from FRA. Several comments can be made on this discrepancy:

- in the Asia-Pacific region, the largest discrepancies are found in data on India, Indonesia, Thailand and Viet Nam. In all cases, SOFO reported a larger area compared to FRA (an additional 29.3 million hectares for India, 6.5 million hectares for Indonesia, 1.8 million hectares for Thailand, and 984,000 hectares for Viet Nam). These differences were mostly due to different definitions of semi-natural forest areas and forest plantations. The two reports also show significant differences in plantation area in Bangladesh (346,000 hectares), Laos (170,000 hectares) and the Philippines (133,000 hectares);
- in tropical Africa the FRA estimate is larger than that of SOFO. The largest discrepancy was for Sudan: FRA estimated 5.4 million hectares of forest plantation while SOFO reported only 641,000 hectares. In FRA, a large part of the area classified as forest plantation was semi-natural forest, which in SOFO was not considered to be forest plantation. Substantial differences were also found in the data for Nigeria (344,000 hectares), Ethiopia (275,000 hectares) and Côte d'Ivoire (153,000 hectares);
- compared to other regions, the difference observed between the two sources for Latin America and the Caribbean is rather small. Discrepancies are most significant for Mexico (791,000 hectares), Peru (640,000 hectares), Venezuela (863,000 hectares) and Costa Rica (178,000 hectares). FRA did not report on forest plantations for countries such as Peru, Venezuela and Costa Rica. Other major differences are found in the estimates for Cuba (222,000 hectares) and Colombia (187,000 hectares); and

FRA considered two types of forest plantations: (i) productive forests (forests and other wooded lands) with areas larger than 0.5 hectares and wider than 20 meters; and (ii) protective forests.[1] This separation is difficult to apply in practice and may be a source of error; it probably accounts for many of the discrepancies between the two reports. SOFO only presented the

1 FAO (2005) defined a 'productive plantation' as Forest/other wooded land of introduced species and in some cases native species, established through planting or seeding, mainly for production of wood or nonwood goods. It defined a 'protective plantation' as: Forest/other wooded land of native or introduced species, established through planting or seeding mainly for provision of services

Table 3.1 Total forest plantation area in the three tropical regions: estimates from two FAO publications

Region	Plantation area ('000 ha)		Difference (%)
	SOFO [1]	FRA [2]	
Asia and the Pacific	54,073	16,821	-68.9
Africa	4,620	9,522	+106.1
Latin America and the Caribbean	8,805	7,621	-13.4
TOTAL	**67,498**	**33,964**	**-49.7**

[1] *FAO (2006a).*
[2] *FAO (2006b).*

Table 3.2 Total global forest plantation area, by tropical and non-tropical region, 2005

Region	Land area ('000 ha)	Plantation area ('000 ha)	Plantation area as % of total land area% of total global plantation area (%)
Tropical	5,007,174	67,498	1.35
Non-tropical	8,056,726	119,863	1.49
TOTAL (World)	**13,063,900**	**187,361**	**1.43**

Source: FAO (2006a), adapted by STCP.

total area of forest plantations in each country without splitting into productive and protective.

For the purpose of this current study, the SOFO database was adopted as the basis for plantation area estimates. Thus, in 2005 there were an estimated 187 million hectares of forest plantation worldwide, of which the tropical regions accounted for 67.5 million hectares (36% of the global total) and non-tropical regions for 120 million hectares (64%) (Table 3.2).

Both the tropics and non-tropics have a similar percentage of their land areas under forest plantation. In non-tropical countries, a large part of the forest plantation estate is considered 'semi-natural'; in contrast, most forest plantations in tropical countries are clearly identifiable and classified as forest plantations.

Figure 3.1 shows a global picture of forest plantations, ranking the ten countries with the largest forest plantation areas. Of those ten, six (China, Russia, the United States, Japan, Ukraine and Iran) are in temperate or boreal zones. The remaining four (India, Indonesia, Brazil and Thailand) are tropical.

Forest plantations are clearly concentrated in a few countries. China, India and Russia combined, for example, have over 50% of the global plantation estate; the top ten countries account for around 80%.

Tropical countries

Forest plantation area and distribution

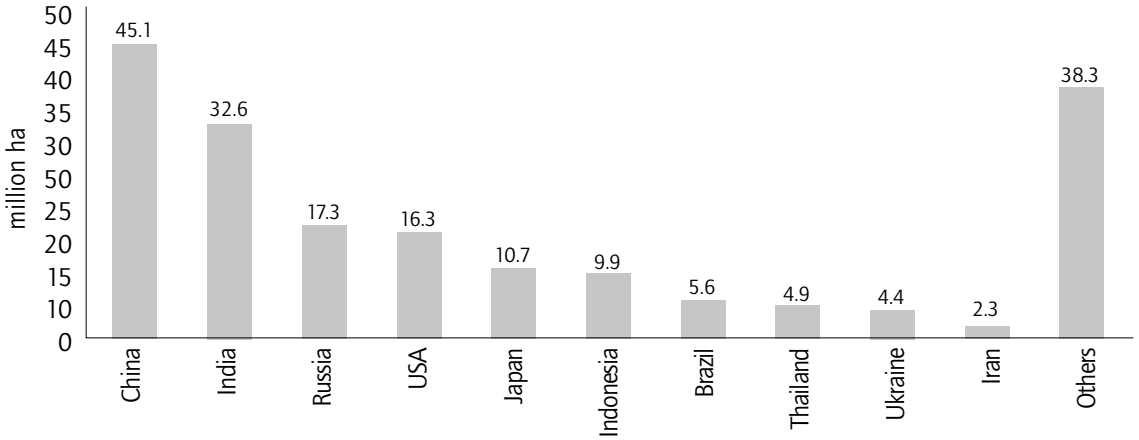
Regional total

Table 3.3 shows the total forest plantation area in each of the tropical regions as a percentage of the total land area. This percentage is very low in Africa and Latin America and the Caribbean but almost 5% in Asia and the Pacific.

Asia and the Pacific has by far the largest share of tropical forest plantations, with over 80% of the total, followed by Latin America and the Caribbean (13%) and Africa (7%) (Figure 3.2).

The large contribution of Asia and the Pacific to the total tropical plantation area is due mostly to a few

Figure 3.1 World's ten top-ranking forest plantation countries by area, 2005



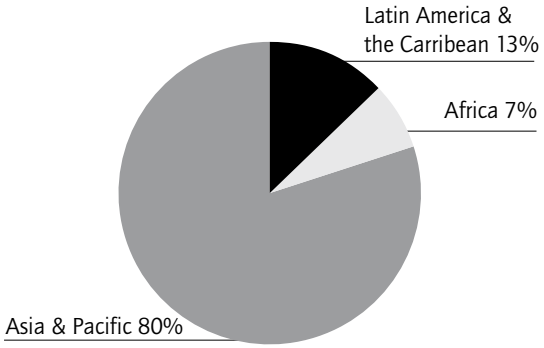
Source: FAO (2006a), adapted by STCP.

Table 3.3 Forest plantation area in the three tropical regions, 2005

Region	Total land area ('000 ha)	Plantation area ('000 ha)	% of total land area
Asia and the Pacific	1,104,000	54,073	4.9
Africa	1,652,000	4,620	0.28
Latin America & Caribbean	2,250,000	8,805	0.39
TOTAL	**5,006,000**	**67,498**	**1.35**

Source: FAO (2006a), adapted by STCP.

Figure 3.2 Share of total tropical forest plantation estate, by region, 2005



Source: FAO (2006a), adapted by STCP.

countries: combined, India, Indonesia, Thailand, Malaysia, Viet Nam, Myanmar and the Philippines have 52.5 million hectares (78% of the total tropical forest plantation estate). With nearly 33 million hectares, India has by far the largest tropical plantation area, almost half the total (Figure 3.3).

Brazil has the largest plantation estate in Latin America and the Caribbean, followed by Venezuela. In tropical Africa, Nigeria has the largest plantation area. All other tropical countries combined account for about 8 million hectares of forest plantations.

Regional analysis

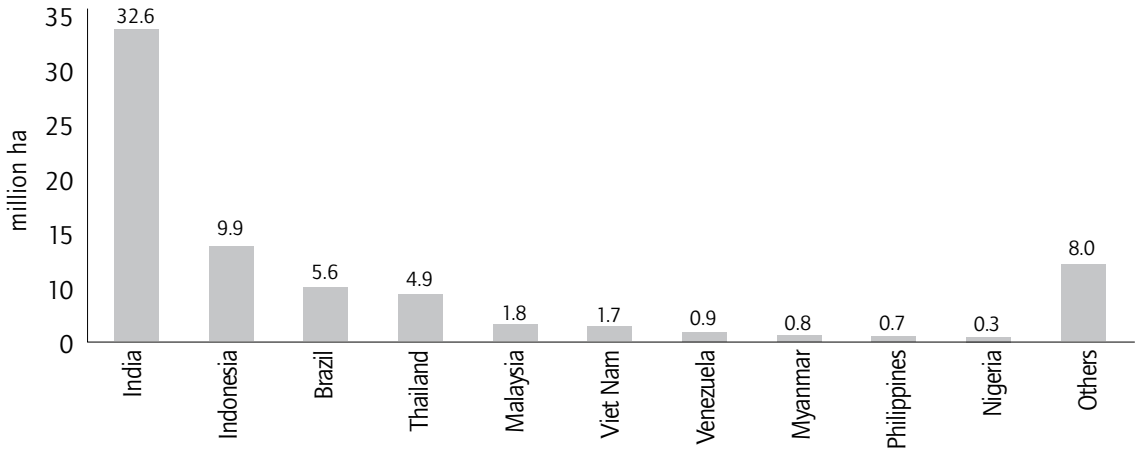
- *Asia-Pacific*

SOFO provides data on forest plantation area for 24 of the 37 countries that make up the tropical Asia and the Pacific region; those data are shown in Table 3.4. Nearly 5% (54 million hectares) of the region's land area is covered by forest plantations.

Forest plantations in the region are highly concentrated. India accounts for 60% of the regional total; the plantation areas of India, Indonesia and Thailand combined account for 90% (Figure 3.4).

India's large plantation area is a result of strong national policies, particularly the Twenty Points Program for Afforestation of the mid-1970s, as well as strong institutional support. Indonesia and Thailand

Figure 3.3 Main tropical countries with forest plantations, 2005



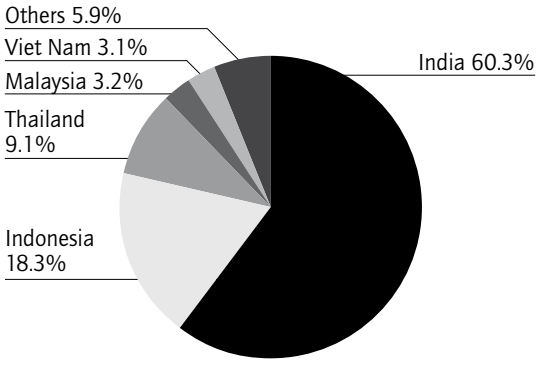
Source: FAO (2006a), adapted by STCP.

Table 3.4 Forest plantation area in tropical Asia and the Pacific, by country, 2005

Rank	Country	Land area ('000 ha)	Forest plantation area ('000 ha)	% of total regional plantation area
1	India	297,319	32,578	60.3
2	Indonesia	181,157	9,871	18.3
3	Thailand	51,089	4,920	9.1
4	Malaysia	32,855	1,750	3.2
5	Viet Nam	32,550	1,711	3.2
6	Myanmar	65,755	821	1.5
7	Philippines	29,817	753	1.4
8	Bangladesh	13,017	625	1.2
9	Sri Lanka	6,463	316	0.6
10	United Arab Emirates	8,360	314	0.6
11	Fiji	1,827	97	0.2
12	Cambodia	17,652	90	0.2
13	Papua New Guinea	45,239	90	0.2
14	Lao People's Dem. Rep.	23,080	54	0.1
15	Solomon Islands	2,856	50	0.1
16	New Caledonia	1,828	10	0.0
17	Samoa	282	5	0.0
18	French Polynesia	366	5	0.0
19	Saudi Arabia	214,969	4	0.0
20	Brunei Darussalam	527	3	0.0
21	Vanuatu	1,218	3	0.0
22	Cook Islands	23	1	0.0
23	Tonga	73	1	0.0
	Others (13)	54,722	0	–
	TOTAL	**1,104,290**	**54,073**	**100**

Source: FAO (2006a).

Figure 3.4 Country share of forest plantation area, tropical Asia and the Pacific, 2005



Source: FAO (2006a), adapted by STCP.

have developed their planted-forest sector with an orientation towards exports, primarily to China and Malaysia, and as a way of reducing pressure on natural forests. Both have applied active government policies and incentives to encourage private investment.

- *Africa*

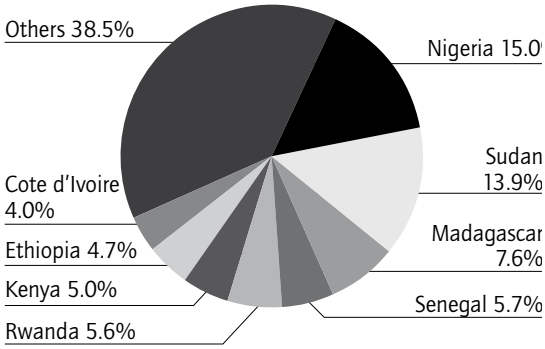
Tropical Africa comprises 47 countries; they cover a total land area of slightly more than 1.6 billion hectares, of which forest plantations cover only 0.3% (Table 3.5). Although the total planted area is small, 43 countries have established at least some forest plantations. Nigeria, Sudan and Madagascar combined have a total of 1.7 million hectares, which is 36% of the region's

Table 3.5 Forest plantation area in tropical Africa, by country, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	Nigeria	91,077	693	15.0
2	Sudan	237,600	641	13.9
3	Madagascar	58,154	350	7.6
4	Senegal	19,252	263	5.7
5	Rwanda	2,466	261	5.7
6	Kenya	56,915	232	5.0
7	Ethiopia	110,430	216	4.7
8	Côte d'Ivoire	31,800	184	4.0
9	Zimbabwe	38,685	141	3.1
10	Angola	124,670	141	3.1
11	United Republic of Tanzania	88,359	132	2.9
12	Liberia	11,137	119	2.6
13	Malawi	9,409	112	2.4
14	Benin	11,063	112	2.4
15	Dem. Rep. of the Congo	226,705	97	2.1
16	Cap Verde	403	85	1.8
17	Congo Brazzaville	34,150	83	1.8
18	Cameroon	46,540	80	1.7
19	Ghana	22,754	76	1.6
20	Zambia	74,339	75	1.6
21	Burundi	2,568	73	1.6
22	Niger	126,670	73	1.6
23	Burkina Faso	27,360	67	1.4
24	Mozambique	78,409	50	1.1
25	Uganda	19,964	43	0.9
26	Togo	5,439	38	0.8
27	Gabon	25,767	36	0.8
28	Guinea	24,572	25	0.5
29	Mauritania	102,522	25	0.5
30	Eritrea	11,759	22	0.5
31	Mali	122,019	15	0.3
32	Chad	125,920	14	0.3
33	Mauritius	202	13	0.3
34	Sierra Leone	7,162	6	0.1
35	Seychelles	45	5	0.1
36	Central African Republic	62,297	4	0.1
37	Reunion	250	3	0.1
38	Somalia	62,734	6	0.1
39	Saint Helena	31	2	0.1
40	Comoros	186	2	0.1
41	Gambia	1,000	2	0.1
42	Guinea-Bissau	3,612	2	0.1
43	Botswana	56,673	1	0.0
-	Other (4)	87,546	0	0.0
	TOTAL	**2,250,615**	**4,620**	**100**

Source: FAO (2006a).

Figure 3.5 Country share of forest plantation area, tropical Africa, 2005



Source: FAO (2006a), adapted by STCP.

total forest plantation area. Senegal and Rwanda have 6% of the total, followed by Kenya (5%), Ethiopia (5%) and Cote d'Ivoire (4%) (Figure 3.5).

- *Latin America and the Caribbean*

The tropical part of the Latin America and Caribbean region comprises 39 countries, which have a total land area of 2.2 billion hectares. The total tropical forest plantation area in the region is 8.8 million hectares (0.4% of the total land area, Table 3.6); according to SOFO (FAO 2006a), twelve countries in the region have no forest plantations.

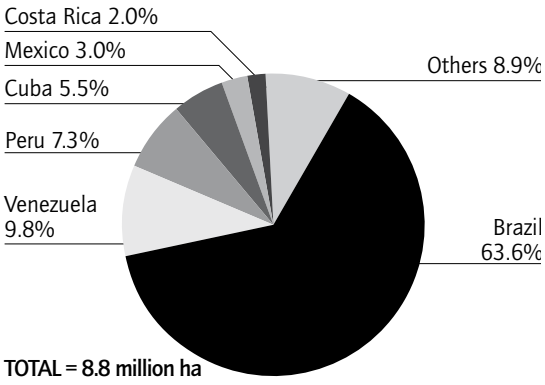
Brazil has the largest forest plantation area in the region (5.6 million hectares); in contrast, French

Table 3.6 Forest plantation area in tropical Latin America and the Caribbean, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	Brazil	845,651	5,597	63.6
2	Venezuela	88,206	863	9.8
3	Peru	128,000	640	7.3
4	Cuba	10,982	482	5.5
5	Mexico	190,869	267	3.0
6	Costa Rica	5,106	178	2.0
7	Ecuador	27,684	167	1.9
8	Colombia	103,871	141	1.6
9	Guatemala	10,843	133	1.5
10	Honduras	11,189	48	0.6
11	Nicaragua	12,140	46	0.5
12	Bolivia	108,438	46	0.5
13	Panama	7,443	40	0.5
14	Dominican Republic	4,838	30	0.3
15	Paraguay	39,730	27	0.3
16	Haiti	2,756	20	0.2
17	Trinidad Tobago	513	15	0.2
18	El Salvador	2,072	14	0.2
19	Suriname	15,600	13	0.2
20	Guyana	21,498	12	0.1
21	Jamaica	1,083	9	0.1
22	Guadeloupe	169	4	0.1
23	Puerto Rico	887	4	0.1
24	Belize	2,280	3	0.0
25	Martinique	107	2	0.0
26	Sainte Lucia	61	1	0.0
27	French Guiana	8,815	1	0.0
-	Others (12)	1,438	0	0.0
	TOTAL	**1,652,269**	**8,803**	**100**

Source: FAO (2006a).

Figure 3.6 Country share of forest plantation area, tropical Latin America and the Caribbean, 2005



Source: FAO (2006a), adapted by STCP.

Guyana and Santa Lucia both have about 1,000 hectares each.

Three countries (Brazil, Venezuela and Peru) account for over 80% of total forest plantations in the region; other countries with relatively important forest plantation areas are Cuba (5.5% of the region's forest plantations), Mexico (3%) and Costa Rica (2%) (Figure 3.6).

Analysis

Most tropical countries, especially those with large forest plantation areas, have developed their plantations to provide a future supply of timber. This reflects the general perception that, for various reasons, the timber supply from natural forests will gradually decline and production costs will increase.

On its own, a large area of plantation forest does not mean that countries will achieve their timber production targets; other variables include forest productivity and timber quality. In most countries, the replacement of timber from natural forest by timber from domestic plantations will depend on national policies, investments in technology, and the availability of financial resources (mainly direct investments).

The following analysis of trends in forest plantation area is based on a comparison of 1995 and 2005 data. Several sources of information were considered, particularly FAO studies on global trends and regional outlooks for the forest sector, published in 2005.

Tropical regions

The tropical forest plantation area more than doubled in 1995–2005. On average, the growth rate in the global area of tropical forest plantations was 8.6% per year (Table 3.7).

The fastest growth took place in the Asia-Pacific region, where plantation area increased by an average 9.4% per year over the decade. The slowest percentage growth was in Latin America and the Caribbean (4.3% per year).

Pandey (1997) estimated that around 4 million hectares of forest plantations were established in tropical and subtropical countries in 1995. Of this, about 1.7 million hectares were in countries located in tropical zones and 2.3 million hectares were in countries in subtropical zones. He also pointed out that not all planted areas were new forest plantations: a significant share was made up by the replanting of existing areas after harvesting operations.

The establishment of new plantations accelerated after 1995. In the Asia-Pacific region (particularly India and Indonesia) the annual rate of plantation expansion was, on average, around 3 million hectares in 1995–2005.

In Africa, the average annual growth rate as a percentage of the existing plantation estate was also

Table 3.7 Forest plantation area change, 1995–2005, three tropical regions

Tropical region	Total plantation area ('000 ha)		% change, 1995–2005	% annual change
	1995	2005		
Asia and the Pacific	23,995	54,073	125.4	9.4
Africa	2,158	4,620	114.1	8.8
Latin America and the Caribbean	6,046	8,803	45.6	4.3
TOTAL	**32,199**	**67,496**	**109.6**	**8.6**

Source: FAO (2006a), adapted by STCP.

substantial, although the area added was much smaller than in the Asia-Pacific region. In absolute terms, the forest plantation area increased in Africa by about 245,000 hectares per year over the period.

Of the three tropical regions, the slowest percentage annual growth was in Latin America and the Caribbean (4%), although the area planted per year (280,000 hectares) was higher than in Africa. Most of the increase was in Brazil, Venezuela, Peru and Mexico.

The overall forest plantation area in the tropics is expected to continue to grow, although probably more slowly than in 1995–2005. The availability of land, environmental restrictions, higher costs, lower returns on investment and other constraints are likely to lead to greater efforts to increase the productivity of already-existing plantations and to reduce the rate of growth in plantation area.

Other factors will also exert an influence. Harvesting restrictions in natural forests, government policies to promote forest plantations, and the investment climate, for example, are also likely to affect the expansion of forest plantations and lead to differences in the growth of forest plantation area between countries.

This prediction of a deceleration in the growth of forest plantation area applies particularly to plantations designed for timber production. In contrast, the trend for forest plantations with a focus on social and/or environmental benefits is still strongly towards expansion, especially in lower-income tropical countries. In such countries, forest plantation programs (basically reforestation) are often linked to poverty alleviation, community development and the rehabilitation of degraded land. These programs are expected to continue to grow, and will contribute to an increase in plantation area.

In most tropical countries, the expansion of socially or environmentally oriented forest plantation programs will depend on the availability of funds from the public sector and international cooperation, both of which are currently limited. The development of innovative financing mechanisms is therefore a key to their continued expansion. Among the options under discussion are avoided deforestation under the Clean Development Mechanism (CDM) and various schemes for the payment of environmental services. So far, access to these financing sources for forest plantations has been limited.

Regional and country analysis

- *Asia-Pacific*

In tropical Asia and the Pacific the total planted area expanded, on average, by 3 million hectares per year over the period 1995–2005. Most of the expansion took place in India, Indonesia and Thailand (Table 3.8). In India the area of plantation forests grew by 1.8 million hectares per year, thus adding 18 million hectares of new plantations over the ten years. Over the same period Indonesia added 3.7 million hectares to its already existing plantation forest estate, while Thailand added 4.3 million hectares. Forest plantations also increased significantly in Malaysia, by around 1.6 million hectares over the period.

The forest plantation area is expected to continue to grow in the Asia-Pacific region over the next few years, but at a slower pace. In densely populated countries such as India, Indonesia, Thailand and Viet Nam, a lack of available land will constrain plantation expansion, even if other preconditions for such an expansion are in place; plantations will tend to be out-competed by agriculture.

There are differences, however, between countries. In Malaysia, for example, a smaller population, an aggressive forest development policy and the availability of large areas of land are expected to enable the more rapid expansion of forest plantations.

- *Africa*

In tropical Africa the plantation area increased, on average, by 246,000 hectares per year over the period (Table 3.9). Two countries, Nigeria and Sudan, accounted for around 40% of the increase.

A poor investment climate, which reduced investment generally in the region, and a lack of government encouragement account for the limited expansion of forest plantations in the tropical African countries over the period. In some countries, for example, government policies associated with the conservation of water resources have limited forest plantation expansion. The public debate on the adverse effects of forest plantations on water has been longstanding in the region. In response, some countries, such as Sudan and Rwanda, have exercised a higher level of government control on the establishment of new forest plantations.

Over the next few years, restrictions imposed by governments on forest plantations in most countries in the region are expected to continue

Table 3.8 Average annual growth in plantation area in selected Asia-Pacific countries, 1995–2005

Country	Plantation area ('000 ha)		Average annual change ('000 ha)
	1995	2005	
India	14,620	32,578	1,796
Indonesia	6,125	9,871	375
Thailand	529	4,920	439
Malaysia	100	1,750	165
Viet Nam	1,470	1,711	24
Myanmar	276	821	55
Others (31)	875	2,422	155
TOTAL	**23,995**	**54,073**	**3,009**

Source: FAO (2006a), adapted by STCP.

Table 3.9 Average annual growth in plantation area in selected tropical African countries, 1995–2005

Country	Plantation area('000 ha)		Average annual change ('000 ha/year)
	1995	2005	
Nigeria	151	693	54
Sudan	203	641	44
Madagascar	217	350	13
Senegal	112	263	15
Rwanda	88	261	17
Others (42)	1,387	2,412	103
TOTAL	**2,158**	**4,620**	**246**

Source: FAO (2006a), adapted by STCP.

and the investment climate is unlikely to change significantly. Faced with enormous social problems, most governments in Africa put investment in forest plantations at the lower end of their lists of priorities. Direct investments in forests (domestic and foreign) are not expected to increase significantly over the next few years, either, so there is little hope for a significant change in the rate of forest plantation expansion for timber in the near-to-mid term.

The outlook is different for forest plantations for protection. In recent decades, many forest plantation programs have been directed towards combating desertification (e.g. dune fixation and watershed conservation). In this case, funds are most often derived from government programs and particularly international cooperation. The future expansion of forest plantations for protection will be linked to the availability of financing from these sources.

- *Latin America and the Caribbean*

Forest plantations increased in the tropical countries of Latin America and the Caribbean over the 1995–2005 period, but at a lower rate (4.3% per year) than in the other two regions. On average, the forest plantation area in the region expanded by 279,000 hectares per year (Table 3.10).

Brazil has the largest forest plantation area in the region; over the period it planted, on average, an additional 70,000 hectares per year. This was equivalent to 1% annual growth in its plantation estate, which was slow compared with other countries in the region, including Venezuela and Peru, which have the two next-largest plantation estates. Nevertheless, increases in forest productivity, mostly of fast-growing species, have been dramatic in Brazil, resulting in significant increases in sustainable production capacity. This has

Table 3.10 Average annual growth in plantation area in selected countries in tropical Latin America and the Caribbean, 1995–2005

Country	Plantation area ('000 ha)		Average annual change ('000 ha)
	1995	2005	
Brazil	4,900	5,597	70
Venezuela	253	863	61
Peru	184	640	46
Cuba	245	482	24
Mexico	109	267	16
Others (32)	335	954	62
TOTAL	**6,026**	**8,803**	**278**

Source: FAO (2006a), adapted by STCP.

already helped to reduce the cost of timber production and increased the competitiveness of plantation timber products in international markets. Further productivity gains are projected for the next few years.

In the past, forest plantations were strongly promoted by governments in several tropical countries. Fiscal incentives and other types of subsidies, especially in the 1970s and 1980s, supported the expansion of plantations in Brazil, Costa Rica and Venezuela.

With the reduction or elimination of direct government subsidies, the rate of establishment of forest plantations declined significantly; currently most of the expansion of industrial plantations is based on private investment (both domestic and foreign). Nevertheless, initial investments in plantations made in the past by the public sector were important catalysts in supporting industrial development and strengthening the sectoral economy, especially in Brazil.

Many countries in the region, especially Ecuador, Peru and Brazil, have recently developed new policies to promote forest plantations with the aim of expanding their forest industries as part of national strategies to increase exports, create jobs and reduce poverty. Despite the generally positive climate encouraging forest plantation investments in the region, concerns related to the environmental and social impacts of plantations are growing and could limit the rate of expansion in the future. In many countries in the region, the development of programs to promote plantations on small and medium-sized properties and through the involvement of communities are gaining importance.

For many years, countries in Central America have discussed the Central American Forest Strategy (EFCA) proposal for forest plantations, with a goal of establishing 5–8 million hectares of plantations in Central America by 2025; its implementation, however, has been delayed. The target is ambitious considering the relatively small land area in the sub-region. Were the strategy to be implemented, if only in part, the role of forest plantations in Central America would change significantly.

Non-tropical countries

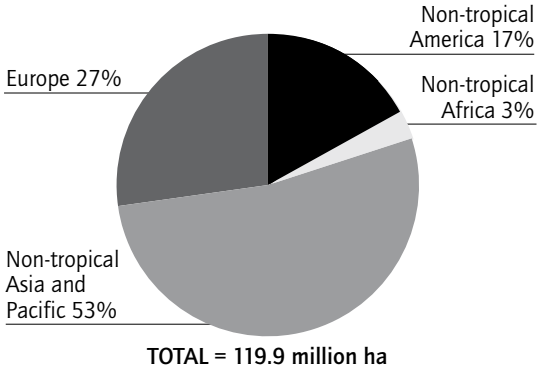
Forest plantation area and distribution

Non-tropical (temperate) countries have about 119.9 million hectares of forest plantations. Table 3.11 shows the distribution of these forests, sorted into four regions.

With over 50% of the total, non-tropical Asia and the Pacific has the largest share of the non-tropical forest plantation area, followed by Europe (27%) and non-tropical America (17%) (Figure 3.7).

Non-tropical plantations are highly concentrated, with four countries accounting for 75% of the total area. China has the largest forest plantation estate, with about 38% of the non-tropical total (45.1 million hectares), while Russia, the United States and Japan combined account for 44.3 million hectares (Figure 3.8). The large planted area in China is a consequence of a national strategy adopted in 1949 by the central government and supplemented by a number of later policies, with a strong commitment from all national and provincial institutions.

Figure 3.7 Forest plantation area distribution, four non-tropical regions, 2005



Source: FAO (2006a), adapted by STCP.

Regional and country analysis

- *Non-tropical Asia-Pacific*

The non-tropical Asia-Pacific region comprises 31 countries. Of these, 24 have forest plantations (Table 3.12).

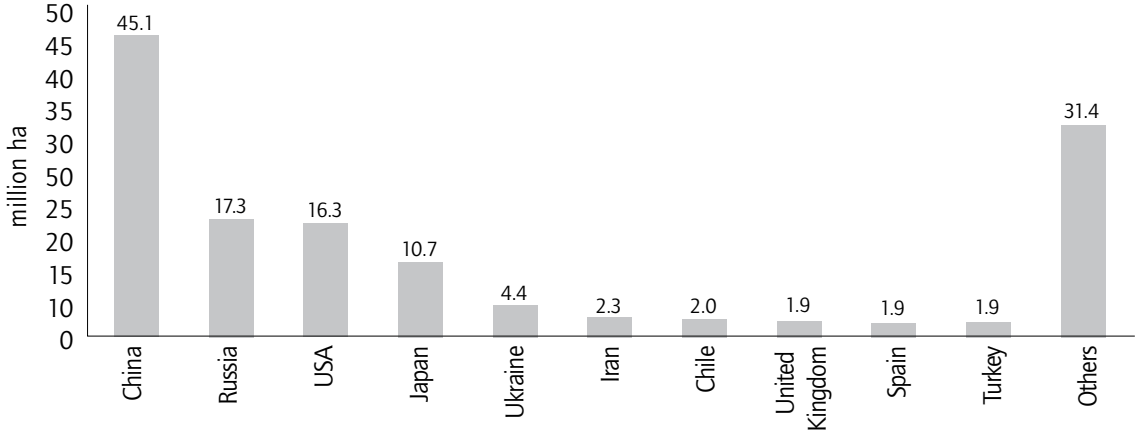
Figure 3.9 shows that the distribution of forest plantation areas is highly concentrated in the region: China has about 70% of the regional total, followed by Japan, with 16.5%. The remaining 29 countries together account for only 13.5% of the forest plantation area in the region, of which Iran (3.5%), Turkey (2.9%) and New Zealand (2.4%) constitute significant shares.

Table 3.11 Forest plantation area, four non-tropical regions, 2005

Region	Land area ('000 ha)	Plantation area ('000 ha)	% of land area
Non-tropical Asia-Pacific	2,830,000	64,622	2.3
Europe	2,260,000	32,015	1.4
Non-tropical America	2,239,000	19,803	0.9
Non-tropical Africa	728,000	3,423	0.5
TOTAL	**8,057,000**	**119,863**	**1.5**

Source: FAO (2006a), adapted by STCP.

Figure 3.8 Ten largest forest plantation estates, non-tropical countries, 2005



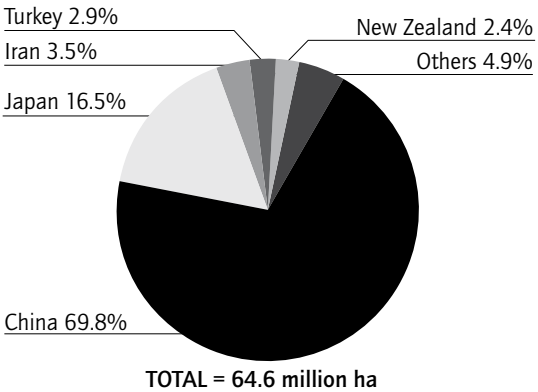
Source: FAO (2006a), adapted by STCP.

Table 3.12 Forest plantation area in non-tropical Asia and the Pacific, by country, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	China	932,743	45,083	69.8
2	Japan	37,652	10,682	16.5
3	Iran	162,201	2,284	3.5
4	Turkey	76,963	1,854	2.9
5	New Zealand	26,799	1,542	2.4
6	Australia	768,230	1,043	1.6
7	Pakistan	77,087	980	1.5
8	Uzbekistan	41,424	300	0.5
9	Syrian Arab Republic	18,377	229	0.4
10	Georgia	6,831	200	0.3
11	Nepal	14,300	133	0.2
12	Israel	2,062	91	0.1
13	Kyrgyzstan	19,180	57	0.1
14	Jordan	8,893	45	0.1
15	Bhutan	4,701	21	0.0
16	Azerbaijan	8,359	20	0.0
17	Armenia	2,820	13	0.0
18	Turkmenistan	46,992	12	0.0
19	Iraq	43,737	10	0.0
20	Tajikistan	14,087	10	0.0
21	Kazakhstan	267,074	5	0.0
22	Kuwait	1,782	5	0.0
23	Lebanon	1,024	2	0.0
24	Qatar	1,100	1	0.0
-	Others (7)	245,134	0	–
	TOTAL	**2,829,552**	**64,622**	**100**

Source: FAO (2006a).

Figure 3.9 Country share of forest plantation area, non-tropical Asia-Pacific, 2005



Source: FAO (2006a), adapted by STCP.

- *Non-tropical Africa*

Non-tropical Africa comprises nine countries with a total land area of about 728 million hectares (Table 3.13) and a total forest plantation area of 3.4 million hectares (0.5% of the total land area).

Figure 3.10 shows the highly concentrated distribution of forest plantation estate in Africa's non-tropical countries. Almost 90% is located in four countries: South Africa (45%), Algeria (21%), Morocco (16%) and Tunisia (6%).

Table 3.13 Forest plantation area in non-tropical Africa, by country, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	South Africa	121,758	1,554	45.4
2	Algeria	238,174	718	21.0
3	Morocco	44,630	534	15.6
4	Tunisia	16,362	202	5.9
5	Libyan Arab Jamahiriya	175,954	168	4.9
6	Swaziland	1,721	161	4.7
7	Egypt	99,545	72	2.1
8	Lesotho	3,035	14	0.4
9	Western Sahara	26,600	–	–
	TOTAL	**727,779**	**3,423**	**100**

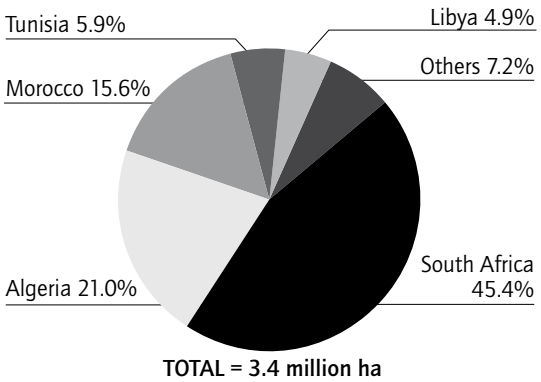
Source: FAO (2006a).

Table 3.14 Forest plantation area in non-tropical America, by country, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	United States of America	915,895	16,238	82.0
2	Chile	74,881	2,017	10.2
3	Argentina	273,669	926	4.7
4	Uruguay	17,481	622	3.1
–	Others (5)	957,512	0	0.0
	TOTAL	**2,239,438**	**19,803**	**100**

Source: FAO (2006a).

Figure 3.10 Country share of forest plantation area, non-tropical Africa, 2005

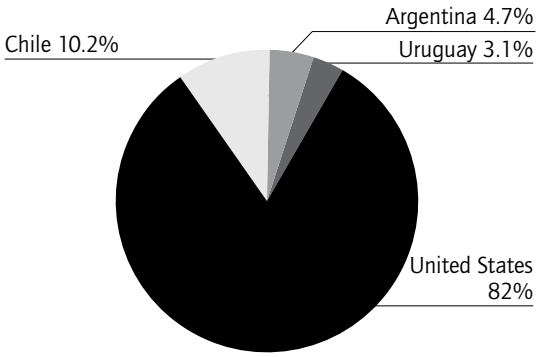


Source: FAO (2006a), adapted by STCP.

- *Non-tropical America*

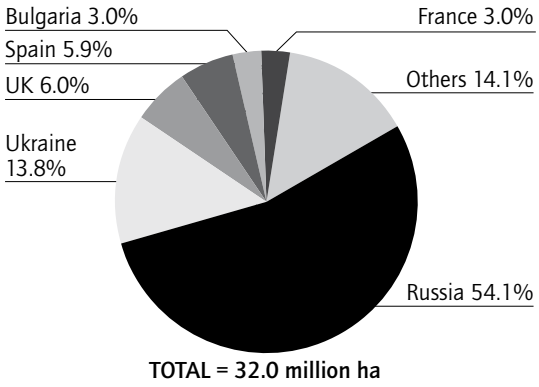
Combined, the nine non-tropical countries of North and South America have 19.8 million hectares of forest plantations (Table 3.14). The lion's share of this is in the United States, and there are also significant areas in Chile, Argentina and Uruguay (Figure 3.11). In Chile, forest plantations cover 2.7% of the country's land area and in Uruguay they cover 3.6%; both these percentages are well above the regional average of 0.9%.

Figure 3.11 Country share of forest plantation area, non-tropical America, 2005



Source: FAO (2006a), adapted by STCP.

Figure 3.12 Country share of forest plantation area, Europe, 2005



Source: FAO (2006a), adapted by STCP.

- *Europe*

Of the non-tropical regions, Europe has the largest forest plantation estate. The region comprises 39 countries, 30 of which have documented forest plantations covering a total area of 32 million hectares, which is 1.5% of the total land area. Table 3.15 shows that 20 countries have in excess of 100,000 hectares of forest plantations. Forest plantations are an especially significant land use in Portugal, covering 9% of the country's land area, Ireland (9%), the United Kingdom (8%), Bulgaria (8%) and the Ukraine (8%).

Germany and Finland are not listed in Table 3.15 because all their forests are considered semi-natural; although most were planted they are now regarded as naturalized (see Box 3.1).

Russia, Ukraine, the United Kingdom, Spain, Bulgaria and France combined have 86% of Europe's plantation forests; Russia alone has 54% (Figure 3.12).

Analysis

According to Pandey (1995), forest plantations in temperate and boreal countries are generally less easily distinguished from natural forests than those in tropical countries:

Box 3.1 German experience in forest plantations

In northern Germany, oak trees were already being planted around rural properties in the Middle Ages. Such trees provided food for animals, bark for energy and timber for the construction of various types of buildings. This experience was applied on a larger scale from the 13th century with the objective of regenerating harvested areas.

Plantations were established around Dortmund in 1343 and in the mountains of Dresden in 1357; the municipal forest of Frankfurt was established in 1308. Oak and beech plantations were planted extensively throughout Germany until the beginning of the 17th century. Coniferous trees were introduced to the country around 1368 when several hundred acres of Pinus sylvestris were planted in the Lorenzer Forest near Nuremberg in order to combat problems of soil degradation and especially to provide timber for housing construction, mining and other industrial uses; this species was especially liked because of its short rotation period. This initiative proved to be the starting point of a large-scale program that converted mixed forests (oak and beech) into monocultural pine, fir and spruce forests. The majority of forests in Germany today originated from this reforestation process.

The 20th century began in a new direction with the reconversion of monocultural forests to mixed forests with different age structures. In accordance with definitions of different types of forests in the temperate and boreal regions used by FAO (FAO 2001), Germany now considers all its forests to be 'semi-natural'.

Source: FAO (2001).

Table 3.15 Forest plantation areas in Europe, by country, 2005

Rank	Country	Land area ('000 ha)	Plantation area ('000 ha)	% of total regional plantation area
1	Russian Federation	1,688,851	17,340	54.1
2	Ukraine	57,935	4,425	13.8
3	United Kingdom	24,160	1,928	6.0
4	Spain	49,945	1,904	6.0
5	Bulgaria	11,055	969	3.0
6	France	55,010	961	3.0
7	Portugal	9,150	834	2.6
8	Ireland	6,889	590	1.8
9	Sweden	41,162	569	1.8
10	Denmark	4,243	341	1.1
11	Estonia	4,227	305	1.0
12	Norway	30,683	300	0.9
13	Lithuania	6,258	284	0.9
14	Belarus	20,748	195	0.6
15	Latvia	6,205	143	0.5
16	Hungary	9,234	136	0.4
17	Italy	29,406	133	0.4
18	Greece	12,890	120	0.4
19	Albania	2,740	102	0.3
20	The Netherlands	3,392	100	0.3
21	Romania	23,034	91	0.3
22	Bosnia and Herzegovina	5,100	57	0.2
23	Croatia	5,592	47	0.2
24	Poland	30,442	39	0.1
25	Serbia and Montenegro	10,200	39	0.1
26	FYR of Macedonia	2,543	30	0.1
27	Slovakia	4,808	15	0.1
28	Iceland	10,025	12	0.0
29	Switzerland	3,955	4	0.0
30	Republic of Moldova	3,296	1	0.0
-	Others (9)	84,767	0	–
	TOTAL	**2,257,945**	**32,014**	**100**

Source: FAO (2006a).

Table 3.16 Industrial forest plantation areas, non-tropical developed countries, 1971–2000

Country	Area in 1970 ('000 ha)	Plantation area added ('000 ha)					
		1971–75	1976–80	1981–85	1986–90	1991–95	1996–00
Australia[1]	200[2]	34	35	33	32	18	17
New Zealand	465	30	46	50	33	43	44
Chile	NA	49	78	85	77	117	121
Republic of Korea	1,480	168	151	107	67	40	37
Japan	8,260	275	190	133	79	54	44

[1] Coniferous only.
[2] Estimated from Figure 12, p. 65, in National Forest Inventory (1998).
Source: FAO (2001), adapted by STCP.

> The forest plantations in developed or industrialized countries are very different from those in developing countries. With the exception of Austria, Spain, New Zealand, Portugal and the United Kingdom, where the exotic species predominate (pine and eucalypts) in the plantations, in the other cases species native to the respective country are used. The result obtained from the forest plantations in these countries, in the majority of times doesn't differ from that of natural regeneration. After 20% of the rotation period has passed, the difference between the forest plantations and spontaneous regeneration has almost disappeared completely, and frequently it is very difficult to evaluate the effective area of forest plantations.

In fact, due to difficulties in establishing the difference between natural forests and forest plantations, particularly in European and non-tropical American countries, the area figures for non-tropical (temperate and boreal) plantation forests are indicative only.

Given the above limitation on data and the focus of this report on the tropics, the discussion here on the temperate and boreal regions is of a general, globalized nature.

Table 3.16 provides information on the expansion of forest plantations in selected non-tropical countries in recent decades. It shows that in Japan, Korea and Australia the area of new plantations established in each five-year block between 1971 and 2000 declined (in Japan's case from 275,000 hectares in 1971–75 to 44,000 hectares in 1996–2000). On the other hand, the rate of new plantation establishment increased over the period in New Zealand and Chile, as those countries sought to develop and expand their timber exports.

In many non-tropical countries the expansion of forest plantations is declining, in some cases in response to environmental concerns about the effects of plantations and because of reductions in government investment, especially in industrial forest plantations. Moreover, in several non-tropical countries, especially in the northern hemisphere, forest plantation productivity is relatively low and land is expensive. This has encouraged investors to turn to other regions where returns might be higher. In the last decade, the move of investors to (temperate) countries in the southern hemisphere has accelerated, but some of those countries are now beginning to place strict conditions on the expansion of large-scale forest plantations. South Africa, for example, has imposed restrictions on forest plantations because of concerns about their effects on water supplies. For this reason, and also because of other factors such as land availability, the main options for investors in industrial forest plantations are now mainly concentrated in the tropical and non-tropical countries of Asia and Latin America. It is worth noting, however, that Australian national, state and territory governments and the plantation timber-growing and processing industry have a joint objective of expanding Australia's plantation estate to 3 million hectares by 2020, mainly by encouraging private-sector investment.

The main limitation to the future expansion of forest plantations in non-tropical countries is the economic return on investment, which in large part is dependent on mean annual increment (MAI, ie plantation productivity[2]) and the length of the rotation. It seems reasonable, therefore, to expect that investments in new forest plantations for timber production in temperate or boreal regions will decline over the next years; on the other hand, the conversion of agricultural land to planted forests could be encouraged as a countermeasure for reductions in agricultural subsidies.

[2] MAI represents the annual volume that the forest can make available in a sustainable production regime.

4 STATUS OF COMMERCIAL FOREST PLANTATIONS IN SELECTED ITTO MEMBER COUNTRIES

Forest plantations worldwide

Commercial forest plantations are increasing worldwide but still account for less than 5% of the global forest area. Figure 4.1 shows that the plantation estate has expanded more rapidly in some regions than in others. In the period 1990–2005, plantation area increased by an average 1 million hectares per year (a 2.9% annual expansion) in (tropical and non-tropical) Asia, by 207,000 hectares per year in South America (2.2%), and by 42,000 hectares per year in Africa.

In Asia, China accounted for a large part of the expansion: plantation area there increased by 460,000 hectares per year in the 1990s and by 1.35 million hectares per year in 2000–2005. Of the ten countries with the largest forest plantation areas worldwide, six – China, India, Indonesia, Japan, Thailand and Viet Nam – are in the Asia-Pacific region. The proportion of timber supply from forest plantations in this region is likely to increase significantly in the near future (FAO 2006a).

In the 1990s the Asia-Pacific region experienced a net loss of forest area of 1.3 million hectares. In 2000–05, however, this trend was reversed, with the expansion of forest plantations offsetting the loss of natural forest to the extent that there was a net gain of more than 600,000 hectares per year over the period (FAO 2006b).

Forest plantations in ITTO member countries

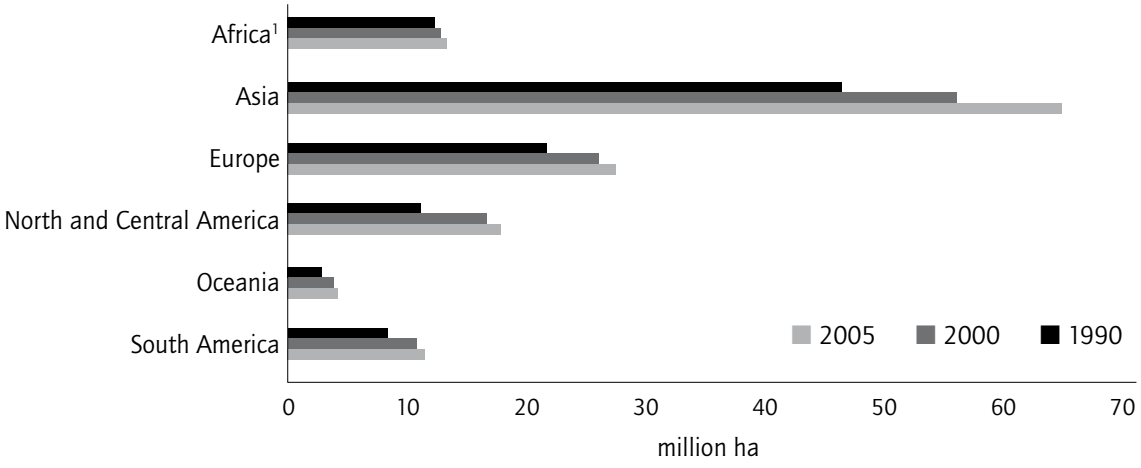
Over the last several decades, with a few exceptions, ITTO producer members made little progress in expanding their commercial forest plantations. The exceptions are India, Malaysia, Indonesia and Thailand in the Asia-Pacific region and, to a lesser extent, Brazil in Latin America and the Caribbean and Nigeria in Africa.

Several factors can explain this lack of progress, but perhaps the most important are the lack of consistent government forest policies and a poor climate for plantation investment, especially in Africa and Latin America and the Caribbean.

A number of internal and external factors, including forest policies, public pressure and macroeconomic changes, are continuing to influence the forest sector of many tropical countries and to shape forest plantation development. Policies that favor other sectors, especially those competing for the use of forest land, such as agriculture, have also had a direct impact on the forest sector.

Two major policy issues have particular importance for the development of commercial forest plantations in tropical countries: (i) supporting private-sector

Figure 4.1 Change in forest plantation area, by region, 1990–2005



[1] FRA statistics for Africa report 5.4 million hectares for Sudan, although SOFO (FAO 2006a) reports slightly over 600,000 hectares.
Source: FAO (2006b), adapted by STCP.

plantation development through the provision of incentives; and (ii) the expansion of state-owned forest plantations.

When well designed and applied, government incentives can be important tools for encouraging the private sector to invest in forest plantations or to mitigate undesirable outcomes. On the other hand, government policies can also act as disincentives for investment in plantations.

Direct government participation in plantation development occurs when the state owns large areas of land and invests directly in plantations. Experience has shown, however, that state-owned plantations have been ineffective in the development of commercial forest plantations to supply timber markets.

In a number of countries, governments have used incentives policies (e.g. subsidies and grants) in the early stages of development to encourage the private sector to invest in forest plantations. After this initial phase, forest plantations have, in many instances, become a basis for forest-industrial-market development. Over time, incentives have become less important and the market has become the major driver of forest investment.

In most tropical countries, including several ITTO member countries, a transition is taking place from state control and investment to more market-oriented approaches. In countries where government initiatives still predominate, the establishment of forest plantations is generally curtailed by government budgetary constraints.

ITTO producer countries that have made major significant progress in forest plantation development over the past few decades are worth highlighting.

Brazil, for example, established large-scale forest plantations through a financial incentive policy that was in place from the mid-1960s to the late 1980s. Once the incentive policy was removed, little progress was made in expanding the forest plantation estate until the mid-1990s, when industrial development (mainly in the pulp-and-paper industry) entered a new phase and massive investments were made in planted forests.

The results of the financial incentive policy adopted in Brazil are well known and, despite many criticisms, was a major factor in the extraordinary change that took place in Brazilian forestry over a period of less than 20 years. Today, Brazil's forest plantation sector has created: (i) a commercial forest plantation estate of 5.6 million hectares; (ii) over 4 million jobs (direct and indirect); (iii) significant technological advances in silviculture and plantation management; (iv) a world-class competitive export-oriented forest-based industry; and (v) socioeconomic development in rural areas. It has also contributed to environmental protection by reducing the pressure to extract timber from natural forests (ABRAF 2006).

In India, almost 70% of forest plantations were established through state programs. In 1992 the Indian government created a national forestry board with the purpose of promoting forest planting and environmental forest rehabilitation projects. Most of the forest plantations were established on public lands but the program also distributed seedlings and supported tree-planting on private lands. Government-supported investment achieved an annual growth in forest plantation area of almost 1 million hectares on degraded lands and about 500,000 hectares on private and communal lands.

In general, African countries have invested less in forest plantations than countries of other regions. Political, economic and social conditions are diverse, varying from the post-war situations of the Democratic Republic of the Congo and Liberia to the relatively well-settled economic conditions of Ghana and Gabon. In Nigeria, forest policies in the 1960s influenced the establishment of the current forest plantation estate. In Sub-Saharan Africa, Ghana, through its Forest Plantation Development Act (2000), was a pioneer in establishing special incentives for the private sector. Some aspects of this legislation were extended in 2002 to rural smallholders.

In general, financial mechanisms have been essential for expanding the area of forest plantations and in many cases have also helped promote silvicultural improvements, research and development, the provision of skilled labor, and technological progress in forest industry, among other positive impacts. On the other hand, the existence of financial mechanisms alone is insufficient to boost forest plantation development and a positive investment climate is essential to sustain the process.

This chapter analyses the status of forest plantations in selected ITTO producer countries based on information obtained through field surveys and secondary sources. The focus is on policies and government institutions, financial mechanisms, and technical and other aspects of plantation development.

Commercial forest plantations

Asia and the Pacific

Over the last two decades, many countries in the Asia-Pacific region have been characterized by dynamic political, social and economic change. The development of forest sectors in the region has been strongly influenced by the institutional context, including forest policies and related development strategies, plans and programs. Despite common acceptance among countries in the region of the importance of balanced approaches to forest development, the adoption and implementation of forest plantation policies remain recognised bottlenecks.

Although some forest policies date back to the 1800s, significant progress has been made in reforming and updating forest policies and legislation under conditions of rapid economic growth, market liberalization and information technology development, which are common to many countries in the region (FAO 2003). In most countries, forest management has gradually been decentralized, allowing the private sector and civil society to become more involved in forest development (FAO 2006a).

In general, forest policies have developed in response to the issue of deforestation, the increasing gap between the supply of and demand for forest products, and the recognition of the potential for multiple forest uses.

In the last two decades, forestry investment policies have been under constant review by leading regional finance institutions, private businesses and government agencies. Despite the recognized importance of forests and forest investment, however, governments and development agencies have been criticized for their mixed results and often-disappointing performance. One issue frequently referred to by analysts is the impact of forest investments on the reduction of deforestation.

The attractiveness of forest plantations as a business option is often questioned by competing sectors. In particular, the long-term nature of the tree-growing business represents a major hurdle for the average investor, who wants to avoid risk and naturally prefers early income rather than waiting for income that might become available only at the end of the rotation.

Various types of forest plantation incentives have been applied in the Asia-Pacific region to address the problem related to the long-term characteristics of forest production. These can be grouped into two categories: (i) *direct incentives* such as low-cost seedlings, land grants and grants to forest growers; and (ii) *enabling mechanisms* such as loans, tax rebates and joint-venture arrangements. Direct incentives seem to play a more important role in less-developed countries than enabling incentives (FAO 2006a).

Table 4.1 shows the most common types of incentives for forest plantations applied in the major countries of the Asia-Pacific region.

In many countries in the region, the introduction of fast-growing large-scale commercial plantations has had significant impacts on the environment and on livelihoods, particularly those of indigenous farmers and other forest-dependent people. In the late 1980s in Thailand, for example, serious public criticism of the allocation of public lands for forest plantations led the government to ban the leasing of land in national forest reserves for this purpose.

On the other hand, the expansion of commercial forest plantations has been shown to be useful for conserving and recovering dipterocarp forests in southern Asia. This is because the expansion of commercial forest plantations has assisted the spread of vegetative propagation methods for commercially important native species such as *Shorea bracteolata, S. leprosula, S. ovalis, S. parviflorea* and *Hopea odorata* (Zabala 1993).

Table 4.1 Forest plantation incentives in selected ITTO member countries in the Asia-Pacific region

Country	State planting	Low-cost seedlings	Land grants	Nursery incentives	Grants to growers	Concession loans	Tax concessions	Joint ventures
India							–	
Indonesia		–	–	–				–
Malaysia	–	–	–	–	–	–		–
Philippines		–		–	–			–
Thailand			–	–			–	–

Source: FAO (2006a).

India

- *Forest policies and programs*

Forest plantations in India are established through a combination of arrangements encompassing various plantation and afforestation schemes, including but not limited to social forestry, productive/commercial forestry, and protective plantations. Today the annual plantation rate is around 1.5 million hectares, with increasing private-sector participation, and there is a total planted area of 32.6 million hectares, which is 50% of India's total forest area.

Over the last decade Indian forestry has undergone major changes based on the national forest policy of 1988 and economic liberalization. Forest administration and plantations have been under strong debate within and between civil society and government. As a result, successive revisions have been made to the country's forest planning systems and political and administrative processes have evolved to now include participatory forest management, decentralization and simplified forestry schemes.

The government/private-sector relationship has changed considerably in recent years. Forest industries are now expected to meet their raw-material needs from non-forest lands by establishing partnerships with farmers. Among the main challenges are forest degradation, the increasing demand-supply gap, and reduced investment (International Institute for Environment and Development 2003). Total annual private forest planting is thought to be greater than annual plantation targets (ITTO 2006a).

The 1988 national forestry policy outlines major forest plantation trends and institutional, social, economic and environmental aspects of plantations. Positioning environmental stability and the massive involvement of the population as its main priorities, the policy sets out a number of objectives which are to be achieved through programs targeted at the conservation of natural heritage, increasing forest and tree cover through afforestation and social forestry programs, expanding the supply of fuelwood, fodder and non-wood forest products, and the efficient utilization of all forest produce. In this sense, most of the forest plantations in the country are oriented towards multiple-use objectives.

Traditionally in India, all legally constituted forests are owned and controlled by the state. Since farmers and households are engaged in tree-growing, a new category of private forest owner, which includes farm forests, home gardens and agro-industrial plantations, has been established and its importance is growing (ITTO 2006a).

- *Institutional aspects*

i) *Public sector*: In Indian society, forest governance is a complex matter. It can be divided into: (i) governance by the state; (ii) governance by the state and civil society; and (iii) governance by civil society (Saxena 2006). When analysing forest governance from the state perspective, the federal administrative system has to be taken into consideration.

Forest resources are governed at the national level by the Ministry of Environment and Forests and at the state level by state forest departments. There are also forest departments at the national and state levels with specific functions and responsibilities. While at the national level the role of the forest department is mostly the provision of advice and guidance, the state forest departments are custodians of the public forest resource and act as the forest authorities. Sometimes they also perform an enterprise function, becoming involved in the production, processing and trade of forest products. All the forested states of India have set up forest development corporations, which are responsible for production within the public forest estate. Although these corporations are set to operate as autonomous businesses, in reality most of them have acted as extensions of the forest departments.

The National Afforestation Program (NAP), launched in 2000, merged all centrally sponsored forest programs (except parks and wildlife conservation). It is implemented in a decentralized manner through forest development agencies, which are autonomous entities at the forest division level in which all the village forest committees within each forest division have representation. The central government transfers funds directly to the forest development agencies. The NAP has been taken up in all states since 2002.

Joint forest management is a national forest management strategy by which the forest department and local communities agree to jointly protect and manage forests through natural regeneration and plantation methods in nearby villages and to share responsibilities and benefits. Joint forest management programs cover 17 million

hectares of mostly degraded forest lands (IIFM 2002, cited by ITTO 2006a). Most communities are engaged in the protection and regeneration of degraded forests in return for certain usufruct rights and other benefits. Forest plantation activities are mostly carried out on degraded areas under various arrangements, including collaboration between villagers and private companies. The scheme has been criticized for working mostly with on degraded forest lands, although the Indian government of India has recently extended it to other types of forests.

ii) *Private sector:* Despite calls for expanding industrial forest plantations to respond to emerging wood shortages, and the priority given in the 1988 forest policy to industrial forests, there have been many obstacles to the involvement of the private sector in industrial plantation development. Proposals have included a mix of targets with industrial wood, fuelwood, fodder and local community benefits. Strong opposition to eucalypt plantations, however, has arisen in many parts of India. Nevertheless, the private sector is increasingly involved as a partner in joint forest management as well as farm forestry and outgrower schemes.

iii) *Civil society*: India has a significant number of national and state-level NGOs involved in forestry, wildlife conservation, environmental protection and community development. They play a crucial role in capacity building and in the implementation of joint forest management. A number of forest-related international NGOs are also active in India (ITTO 2006a).

- *Incentives, subsidies and financing mechanisms*

The NAP prescribes a number of actions to achieve the targets set out in the national forest policy, including the expansion of tree cover to 33% (109 million hectares) of the country's land area by 2012. There are also provisions in the Charter on Environment and Forests, which was established in Coimbatore in 2001, related to increasing the budgetary allocation to forest plantations, with a target of reforesting 15.5 million hectares of degraded land through joint forest management and 15.5 million hectares through plantations. The key incentive of the joint forest management program is the sharing of benefits between the Ministry of Environment and Forests and participating communities.

The Ministry's aim to promote private-sector interest in forest plantations is summarized in guidelines for the simplification of harvesting rules on non-forest private land (*The Hindu* 2006).

Moreover, the forest development corporations manage large commercial plantations, usually with low productivity and few incentives. In this context, forest investments are considered inadequate and recommendations have been made for establishing a reforestation fund, tax concessions, insurance schemes and long-term forestry loans.

The majority of new planting is on public lands and falls under the Twenty Points Program for Afforestation, which provides free seedlings for planting (FAO 2000). The Twenty Points Program covers a wide range of schemes linked to poverty alleviation, employment generation in rural areas, housing, education, family welfare and health, environmental protection, and others. The program was initiated in 1975 and has been restructured over the years.

Tree-growing is emerging as a potentially viable investment option for climatic change mitigation; small farmers stand to benefit from contracts with private companies for carbon sequestration. The outlook for carbon initiatives, however, is dependent on a number of factors. Large-scale forest plantations projects, for example, are likely to encounter resistance from local communities. Population pressure and bad experiences in the past with monocultures could also hinder prospects.

Nevertheless, several forest plantation projects are already under consideration by international development and financial agencies, including those related to carbon sequestration. The Orissa and Andhra Pradesh Project is the first Land Use, Land Use Change and Forestry project to be implemented under the CDM in India. It aims to establish 3,500 hectares forest plantations that will sequester 0.18 Mt CO_2 by 2012 and 0.53 Mt by 2017, while also benefiting small local farmers. The Bagepalli Afforestation Program in the District of Kolar in Karnataka is intended to promote forest plantations as a source of income for small farmers through agroforestry. The project will benefit 1,400 families and the plantation will sequester 8,000 tons of CO_2. Federal 'integrated afforestation and eco-development' projects target local reforestation, especially in ecologically fragile watersheds.

- *Timber species and sustainable production capacity*

Of India's total estimated forest plantation estate (32.6 million hectares), nearly 45% is composed of fast-growing, short-rotation species such as *Eucalyptus grandis*, *E. tereticornis*, *Acacia auriculiformis, A. mearnsii* and *A. nilotica* (FAO 2001). Teak (*Tectona grandis*) accounts for about 8% of the total plantation area. Other commonly planted hardwood species are *Albizzia* spp, *Azadirachta indica, Casuarina equisetifolia, Dalbergia sissoo*, *Gmelina arborea* and *Hevea brasiliensis* (rubberwood). Pines and other conifers make up about 10% of the total forest plantation estate. Private commercial forest plantations are estimated to cover 8.18 million hectares.

Despite the impressive national plantation area, survival rates, growth rates and yields have often been poor due to inadequate site selection and site-species matching, poor planting stock, and a lack of maintenance and protection (Saigal et al. 2002, cited in ITTO 2006a).

Table 4.2 presents a tentative estimate of the sustainable production capacity of India's commercial forests. The average growth rate is estimated to be 10 m^3/ha/year for eucalypts and *H. brasiliensis* and 8 m^3/ha/year for acacias. The total sustainable production capacity from plantation forests is estimated to be 62 million m^3 per year.

As stated above, most of the plantations since the mid 1980s have been established under social forestry schemes on unforested community and private lands. In recent years, the national forest policy has directed the forest industry to get its wood raw material from local private sources. This has prompted some large pulp-and-paper companies to promote farm forestry based on outgrower schemes through the extension of technology for establishing clone plantations, and a buyback guarantee for the pulpwood produced (ITTO 2006a). As result, a large number of tree-farming and agroforestry enterprises have flourished throughout the country. In 2002, private tree-planting covered an area of over 6 million hectares, with 2005 estimates at slightly over 8 million hectares.

Indonesia

- *Forest policies and programs*

The forest governance system of Indonesia's Soeharto government led to an unsustainable timber exploitation regime that has been described as a 'poverty-creating' model of forest management (DFID 1999). In principle, all forests in Indonesia are owned and administered by the state, which may transfer ownership rights to private parties or create concessions (Hammond 1997). Under the Soeharto regime, forest lands were effectively transferred from the hands of the poor to the hands of a small, mostly urban elite via the forest concession system.

Significant policy change began in the late 1990s when Law 22/1999 provided provincial governments with considerable authority over the management of forest resources (Yasmi et al. 2006). The most tangible manifestation of this decentralization in the forestry sector was that district heads were given authority to grant small-scale forest concessions for timber harvesting and forest plantations. Moreover, institutions started to give greater recognition to traditional community rights and customary rights and to the role of community forestry in the establishment of forest plantations.

Table 4.2 Commercial planted area, productivity and sustainable production capacity of forest plantations, India

Timber Species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	2,003	10	20,030	32.2
Pines	640	12	7,680	12.3
Teak	2,561	5	12,805	20.6
Hevea	560	10	5600	9.0
Acacias	1,635	8	13,080	21.0
Others	776	4	3,104	5.0
TOTAL	**8,175**	–	**62,299**	**100**

Source: FAO (2000); STCP database.

For many years, natural forests supplied the wood-processing industry with the bulk of its timber and the forest sector played a key role in the economy; forest resources were used to attract investment. The system worked as long as it benefited from low labor costs and low wood prices, but these created market inefficiencies that accumulated over time and meant that non-subsidised activities were unable to compete.

Profound economic and social changes in recent decades have had a huge impact on Indonesian forest policies. New policies stress a less exploitative utilization of natural forests and the expansion of plantation forests to meet the raw-material needs of the industry (Guizol and Aruan 2004).

A new forest paradigm is emerging in Indonesia that had its beginnings in the severe economic and social conflicts that engulfed the country at the end of the Soeharto regime. In 2003 the Indonesian government took a groundbreaking step by recognizing the claims of local communities on forest lands and their participation in forest management through a national social forestry program. In 2004 the regulation establishing Indonesia's Social Forestry Program was issued; among other things it recognizes that future forest plantations will need the collaboration of the people and that community involvement is essential even in situations where investors have land ownership.

To implement this policy, Indonesia's Ministry of Forestry established five priority programs for 2005–2009, covering:

- the eradication of illegal logging and trade in the forest estate;
- the revitalization of the forest industry;
- the rehabilitation and conservation of forest resources;
- economic development for local communities in and around the forest; and
- the stabilization of forest land areas and strengthened sustainable forest management (SFM).

In line with these programs the Indonesian government has regulated that all pulp mills should source their wood from plantations from 2009 onwards. It is unlikely, however, that sufficient plantation wood will be available by that time. The supply of sawlogs from plantations is also lagging well behind the requirements of the industry.

The following government measures and mechanisms to mitigate the negative impacts of forest depletion have been put in place:

- *reforestation fund*: this is fed by taxes charged on natural logs harvested from Kalimantan and Sumatra (US$4/m^3) and on woodchips (US$0.50/m^3). It has been used to supply seedlings and cover the costs of land clearing and replanting. The taxes are returned to the payee once compliance with planting obligations is verified (Guizol and Aruan 2004);
- *conversion of unproductive land*: to alleviate the gap between wood supply and demand the Indonesian government has planned the conversion of 4.4 million hectares of unproductive land to short-rotation plantations; and
- *research*: the Indonesian government has supported research on fast-growing tree species through research trials in various regions of the country. Private companies have focused their research and development on eucalypt and acacia species.

In addition, the institutional framework has been strengthened and the government has improved relations with its civil society.

Another relevant aspect is the policy to encourage investor confidence in forestry, which is considered by many to be a risky long-term commitment. The country's economic and political uncertainties of the late 1990s and early this century were compounded by an inconsistent forest policy that, for example, banned the export of logs from both natural and planted forests and required that new pulp mills would be based only on forest plantations. The export ban reduces market competitiveness, lowering the price that forest growers receive for their produce.

One of the most feasible solutions to Indonesia's large wood shortage is to establish forest plantations. But actions taken so far have been unable to deal efficiently with the problem due to inherent policy deficiencies, poor implementation, and a lack of mechanisms to involve local communities as stakeholders.

This latter reason is particularly important because, as the availability of large tracts of land for forest plantations continues to diminish, forest communities and farmers will play an increasingly important role in the future wood supply. There is also a need for financial incentives to support long-rotation forests.

To achieve effective results, these aspects need to be addressed in a cohesive and coordinated manner.

- *Institutional aspects*

i) *Public sector*: Prior to decentralization the Ministry of Forestry was responsible for the management and control of forests and the conservation of natural resources; there were also forestry offices at the regional and provincial levels. The regional offices, which were an extension of the Ministry of Forestry, coordinated all technical aspects of forestry in the provinces. Two agencies dealt with forestry at the district level: one was responsible for the district government and the other was a sub-office of the provincial forest service. This dual system of control came to an end in 1999 with the enactment of laws 22/1999 and 25/1999.

The Ministry of Forestry now has a considerably smaller role in the field, and authority over forest management is vested in the provinces and particularly the districts. Several national-level departments also deal with forestry, including the departments of trade and industry, agriculture, transmigration and forest settlement, and mines and energy.

An Inter-departmental Committee on Forestry was established in October 2000 to coordinate long-term policy and planning. Decentralization in forestry covers forest production, the servicing of forestry businesses, and ecosystem protection and biodiversity conservation.

All forest lands except national parks and nature reserves are to be managed by district governments. Under Law 22/1999 there is no hierarchical relationship between the central departments, the provincial forest services and the district forest services.

Among the myriad of existing NGOs in the country the most prominent are the Indonesian Forum of Environmental NGOs (WAHLI), Community Forest System Development Group (KPSHK), Participatory Mapping Network (JKPP), the World Wide Fund for Nature Indonesia, and the Association of Indonesian Forest Concessionaires, an industry body (ITTO 2006a).

ii) *Private sector*: Under the Soeharto regime, forests were managed by large and well-connected companies that were granted forest concessions by the central government covering more than 90% of the production forest.

Private companies undertake most forest management in Indonesia, although six state enterprises operate about 12% of the country's concession area.

- *Incentives, subsidies and financing mechanisms*

Significant efforts have been made to make commercial plantations attractive to the private sector through incentives for tree-planting. Due to the severe financial crisis of 1997, however, the whole system came to a halt and developments within the private sector never really got off on the ground. In the early to mid 1990s, prior to the crisis, the plantation estate expanded by about 250,000 hectares annually.

Large-scale industrial plantations initiated in the 1990s led to land-use conflicts to the extent that, even with subsidies, fast-growing plantations were unattractive to investors (FAO 2006a). The objectives set by the government were:

- improving the quality and productivity of wood production;
- building an alternative raw-material supply for the wood industries; and
- developing an appropriate system for reforestation and forest rehabilitation.

Forest plantation investment is open to foreign investors through various arrangements provided in the legislation. The Industrial Timber Estate program provides private investors with low-interest loans from the Reforestation Fund. The loans cover 32.5% of establishment costs and must be repaid within a seven-year period. Government plans are to expand the plantation estate to 10.5 million hectares by 2030 (FAO 2003).

- *Main timber species and sustainable production capacity*

The main planted species in Indonesia are teak (1.47 million hectares), *Pinus merkusii* and other pine species (0.77 million hectares), acacias (0.64 million hectares), eucalypts (0.15 million hectares), and other broadleaved species (0.90 million hectares), including *Gmelina arborea*, *Albizzia* and *Melaleuca*. A wide range of tree species are planted in homesteads and farms (ITTO 2006a).

Table 4.3 Commercial planted area, productivity and sustainable production capacity of forest plantations, Indonesia

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypt	144	13	1,872	5.3
Pine	770	10	7,700	21.8
Teak	1,470	5	7,350	20.8
Hevea	918	12	11,016	31.1
Acacia	642	6	3,852	10.9
Others	897	4	3,588	10.1
TOTAL	**4,841**	–	**35,378**	**100**

Source: FAO (2006a), ITTO (2006a), and STCP

The total area of planted forest**s** in Indonesia in 2005 was estimated to be about 9.4 million hectares, but only 4.8 million hectares were considered to be productive timber plantations (FAO 2006b). These areas are classified as: industrial forest plantations, non-industrial (protective) forest plantations, social forestry, and enrichment planting. There are also plantations of agro-industrial crops, including 0.92 million hectares of rubberwood plantations (FAO 2001), which could become increasingly important in timber supply.

Table 4.3 presents an estimate of the Indonesian sustainable wood production capacity from existing forest plantations, totalling 35.4 million m^3 per year in the medium term.

Estimates of concessions allocated to industrial forest plantations vary from 2.5 million hectares to 7.76 million hectares, depending on the source. The performance of industrial forest plantations has generally been unsatisfactory, although it has been of a higher standard in the case of pulpwood plantations. A recent evaluation of 65 industrial forest plantations, for example, recommended the continuation of only 30 projects.

In Indonesia, the forest industry is increasingly dependent for its wood supply on high-yield trees such as teak, acacias and eucalypts produced from tissue culture and cloning. These propagation methods have produced large volumes of plantation material, particularly disease-resistant, fast-growing material, since 1997.

Malaysia

- *Forest policies and programs*

Forest policy in Malaysia is the result of combined actions of the autonomous governments of Peninsular Malaysia, Sarawak and Sabah. Forest production has been important for the national economy and especially to the State of Sabah, which for a long time was a significant log exporter. The Malaysian Timber Council (MTC) has always supported forest plantation development, including through initiatives such as the sectoral proposal for the 9th Malaysia National Development Plan (2006–2010). Moreover, special studies have been carried out to assist the government in sustaining the industry's long-term needs for raw materials. In 2005 it conducted a study on a government-specialized office covering all aspects of forest plantation development, and commissioned the formulation of long-term strategic plans.

To address the emerging issues of biodiversity and the participation of local communities, Malaysia's national forestry policy was revised in 1992, with a provision for the establishment of forest plantations. Perhaps more significant for plantations was the creation of the Ministry of Plantation Industries and Commodities in 2004 (previously the Ministry of Primary Industry), which confirmed the high priority afforded to plantation forests in the country.

In Malaysia, forestry is a state (provincial) matter. About 90% of all natural forest and 69% of forest plantations are state-owned, with the remainder private. Indigenous communities are afforded special rights under the federal governance agreement; in

Sarawak, forests cleared by native communities for agriculture before 1958 are recognised as Native Customary Rights Land.

In contrast to some other Asian countries, such as Indonesia and India, Malaysia has not established a clear social forest policy. Instead, social forestry or community-related issues are indirectly mentioned in the national forestry policy under provisions for agroforestry and community forestry. In the first case the involvement of local communities is considered in areas close to forest reserves as a measure for avoiding encroachment on forest lands. On the other hand, community forestry is dealt with in the context of recreation and tourism.

This lack of a clear approach to the active participation of local communities in forestry has been the focus of considerable public attention. Pressure from NGOs and the broader public to involve communities through new approaches has been particularly acute in the case of the Malaysian Timber Certification Scheme. Most critics of the scheme point out its failure to incorporate the customary rights of indigenous peoples and the fact that it was developed without a proper consultation process.

- *Institutional aspects*

i) *Public sector*: under the federal constitution, land use falls within the jurisdiction of the states. Each state is empowered to enact laws, formulate forest policies and manage its forests. On the other hand, there are legal provisions for taking participatory principles into account in governance.

Within each state, consultative committees at the village and district levels strengthen the participation and involvement of local communities. Civil society is well aware of the importance of wildlife and environmental quality. Stakeholders, including environmental NGOs, social groups and forest-worker movements, are active in forestry and forest-related initiatives.

The federal government also provides advice and technical assistance, maintains experimental stations, and funds research and training. The National Forestry Council, established in 1971, serves as a forum in which the federal and state governments can discuss issues and solve problems related to forest policy, administration and management, including the setting of the annual timber harvest.

The Forestry Department of Peninsular Malaysia is responsible for forest-sector planning, forest management, forest development and operational studies, the provision of technical advice and services, and staff training.

The state forestry departments in Peninsular Malaysia and Sabah are responsible for the administration, management and development of forest resources, the regulation of forest harvesting, the collection of forest revenue, and the planning and coordination of the development of wood-based industries in their respective states.

In Sarawak these functions are carried out by the Sarawak Forestry Corporation, while the Forestry Department is vested with regulatory functions. Apart from the forestry departments there are a number of specialized institutions such as the Forest Research Institute of Malaysia, the Malaysian Timber Industry Board (MTIB), the Malaysian Timber Certification Council, and university/forestry faculties (ITTO 2006a).

In recent years, leaders in forestry have urged a shift in the forestry paradigm towards relying more on plantations for timber rather than natural forests. Governments at both the federal and state levels have heeded this advice and have moved to expand the plantation forest area.

The first major change followed the establishment of the Ministry of Plantation Industries and Commodities in 2004. In the past, the establishment of forest plantations in Malaysia was initiated and implemented solely by the various forestry departments. Recognising the greater need for coordinated action, responsibility is now vested in this national ministry.

ii) *Private sector*: government institutions coordinate efficiently with private forest-sector organizations and play an important role in the evolution of the country's institutional framework.

The forest industry is also strongly involved in policy development at both federal and state levels through, for example, the MTIB, MTC, and the Sarawak Timber Industry Development Corporation. The MTC has always supported forest plantation development in Malaysia. Other institutions and organizations also play a role in supporting a proactive stance on the issue of industrial plantation forests.

- *Incentives, subsidies and financing mechanisms*

For many years Malaysia has used financial incentives to promoting forest plantations through two incentive mechanisms: (i) The Promotion of Investment Act (PIA) of 1986; and (ii) the Income Tax Act of 1975. PIA offers incentives to enterprises granted 'pioneer status', and also an investment tax allowance.

Until the Act was revised in 1991, companies with pioneer status were granted full exemption from income and development taxes for a period of five years. Since 1991, tax relief has been in the form of a 70% exemption for a company's statutory income (FAO 2003).

The investment tax allowance is an allowance for 60% of the qualifying capital expenditure incurred within five years of the date of approval of a project. The amount deducted is limited to 70% of statutory income in a given year. Qualifying capital expenditure includes resources for:

- land clearing and preparation;
- plantation;
- irrigation and drainage;
- plants and machinery for crops, animal farming, aquaculture, agriculture and cattle husbandry; and
- the construction of access roads, bridges and infrastructure.

Further incentives to encourage the private sector to develop forest plantations were considered in 2002 and 2003 under a package called *New Strategies Towards Stimulating the Nation's Economic Growth.*

The incentive packages for forest plantations have undergone revisions and the pioneer status scheme was extended for another five years for companies processing agricultural products if they fulfilled certain criteria determined by the Ministry of Trade and Industry (FAO 2003).

In Malaysia, forest plantations face a number of constraints, including issues related to the renting of state-owned land and the availability of subsidized loans and incentives for short-rotation tree crop plantations (oil palm, rubber, etc.), which compete with forest plantations for land.

A major weakness of the pioneer status incentive is the long time period required before the investing company can access the benefits of the investment tax allowance. Moreover, the pioneer status scheme does not offer fiscal benefits for expenditure realized beyond the first five years of the forest plantation.

Malaysian authorities have recognized the urgent need to develop more effective incentives for forest plantations. A system to provide incentives on a case-by-case basis aimed at reducing the supply-demand gap is under consideration. One of the drivers behind current propositions is the overall decline in timber production from natural forests in Malaysia. The total Malaysian industrial log production in 2003 was 21.5 million m³, a slight drop compared to 1999 (22.2 million m³); in 1990 this total was estimated to be 39.1 million m³ (ITTO 2006a).

Moreover, forest certification has emerged in Malaysia as a driving force for forest industries and SFM. In 2005 all of Malaysia's plantations were certified, but little of its native forests (ITTO 2006a).

Table 4.4 Commercial planted area, productivity and sustainable production capacity of forest plantations, Malaysia

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Acacias	180	6	1,080	4.5
Hevea	1,478	15	22,170	91.9
Pines	47	10	470	1.9
Eucalypts	19	15	285	1.2
Teak	12	6	72	0.3
Other broadleaved	14	4	56	0.2
TOTAL	**1,750**	–	**24,133**	**100**

Source: FAO (2006a), adapted by STCP.

- *Main timber species and sustainable production capacity*

The establishment of significant-scale forest plantations in Malaysia started in 1957 with teak. Since then the plantation program has widened to include fast-growing species such as *Acacia mangium, Gmelina arborea, Paraserianthes falcataria, Eucalyptus deglupta,* pines and *Araucaria* spp.

MAI varies between species and regions, although all the above are considered fast-growing species. Table 4.4 presents estimates of the plantation area in Malaysia, by species.

Malaysia has extensive rubber plantations; over the past ten years, new rubber plantations have been established for both latex and timber production, particularly in Peninsular Malaysia. Due to the abundant supply of the raw material, their versatility, and significant industrial investment, rubberwood products have gained profitable export markets. Rubber plantations are managed on a rotation of 25 years, with about 20,000 hectares currently replanted annually. Rubberwood furniture is now known worldwide and represents a significant portion of Malaysia's forest-industry exports (see Chapter 5).

In Sarawak, 1 million hectares of land have been set aside since 1998 for the development of forest plantations of exotic and native tree species. Trees are also widely planted in orchards, urban areas and recreational areas, as well as along roads and highways (ITTO 2006a).

Malaysia has a comprehensive approach to plantation development, involving indirect inputs to introduce advanced silvicultural treatments, genetic improvement techniques, the automation of seedling production methods, and facilities for developing high-yield natural and exotic seedlings.

Tree-breeding activities in Malaysia are presently focused on commercial indigenous species such as *Dryobalanops aromatica, Endospermum malaccense, Shorea parvifolia* and *Hopea* spp, and a few exotic species such as *Acacia mangium, Tectona grandis* and *Hevea brasiliensis.* Malaysia has also invested in wood products development based on plantation timber, with high returns; rubberwood is a good example of this.

Thailand

- *Forest policies and programs*

Thai forestry is regulated by a number of legislative mechanisms, of which the most prominent are the National Forest Act of 1941, the Wildlife Preservation and Protection Act of 1960, the National Parks Act of 1961, the National Reserved Forests Act of 1964, and the Forest Plantation Act of 1992. A draft Community Forestry Bill has been under development and debate in Thailand for more than a decade (ITTO 2006a).

With the purpose of achieving long-term development and a coordinated national forest administration, Thailand established a national forest policy in 1985. The policy has subsequently been revised periodically, changing its focus to fit the evolving situation of the forest sector.

The national forest policy stresses the role of the private sector and communities. It stipulates that at least 15% of the forest area should be oriented towards the production of timber and other forest products. This is reinforced by the principle, set out in the national constitution and the national forest policy, that 40% of the country's area should be covered by forests. Currently, forests cover around 28% of the country.

The national forest policy stipulates that the state shall promote reforestation by the public and private sectors for household and industrial consumption and the expansion of wood exports and integrated pulp-and-paper industries. The policy identified the need for an incentive system to promote reforestation by the private sector.

A logging ban in natural forests introduced in 1989 and the severe Asian financial crisis of 1997 drastically reduced the local production of timber. The logging ban shifted the focus of natural forest management towards conservation. Forest plantations through reforestation and afforestation were seen as important initiatives to ensure future wood supply (ITTO 2006a).

In a strict sense there is no framework for SFM in Thailand, even though the country formally subscribes to the overall concept. Production forestry is concentrated in teak and rubber plantations and, for the time being, there is no comprehensive scheme to restore degraded forests.

The benefits of forestry to villagers are widely recognised in Thailand, even though villagers have not been allowed to harvest trees in natural forests since 1989. The Royal Forest Department has identified various ways to promote forestry in support of local communities, including: community forestry in buffer zones; small-scale forest plantations; and programs for promoting value-added forest products.

- *Institutional aspects*

i) *Public sector*: the Royal Forest Department was established in 1896 as the sole agency for the administration and management of the country's forest resources. It also has responsibility for training field staff and for forestry research.

All natural forests in Thailand are state-owned, but trees established on private lands are private property. Rural people have rights to the collection of certain non-wood forest products, and some 'disturbed' state forests are available for long-term rent at low cost for grazing, cropping and tree-planting (ITTO 2006a).

The constitution provides for the decentralization of federal powers and functions to local governments. The 1992 Tambon (local) Administration Act also gives greater roles to local authorities; accordingly, tambon administrations manage forests within their territories. Achieving a balance between the roles and functions of the Royal Forest Department at its various levels and the tambon administrations represents a significant challenge (Contreras 2002, cited in ITTO 2006a).

The Royal Forest Department began planting teak in 1906 and, by 1980, the area planted annually under the taungya system area was about 160,000 hectares. State enterprises (the Forest Industry Organization and Thai Plywood Ltd) have also established teak plantations to supply industry requirements.

ii) *Private sector*: since the logging ban in 1989 the private sector has become increasingly involved in plantation establishment, especially through the Forest Plantation Act (1992), which allowed the private sector to establish plantations on degraded forest lands.

- *Incentives, subsidies and financing mechanisms*

In 1994 the Royal Forest Department launched a forest plantation promotion project (under the Forest Plantation Act) to encourage and support private landowners and local farmers to establish forest plantations of commercial species and to help the country become self-sufficient in timber (ITTO 2006a). Government incentives for plantation investors were affected, however, by the Asian financial crisis (FAO 2006a).

Direct incentives provided by the Forest Plantation Act include the renting of reserved forest areas (i.e. state-owned land) to the private sector, and the production and distribution of free seedlings to communities and the general public.

The Forest Plantation Act aims to support reforestation by the private sector using tree species such as dipterocarps and teak. To access the general support and incentives offered under the Act, and in order to have the right to fell the trees at maturity, a prospective landowner is required to register the plantation. Incentives for forest plantations were defined under the scope of the Private Reforestation Extension Project (PREP) and the Fast-growing Trees Reforestation Project.

Under PREP, farmers were given a sum close to US$500/ha for a maximum of 32 hectares over a five-year period. The Fast-growing Tree Reforestation Project provided free seedlings and fertilizers and made low-interest loans (1.75 % per year) available.

Table 4.5 Commercial planted area, productivity and sustainable production capacity of forest plantations, Thailand

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	443	12	5,316	12.6
Pines	689	12	8,268	19.6
Acacias	148	8	1,184	2.8
Teak	836	5	4,180	9.9
Hevea	2,019	10	20,190	47.9
Others	748	4	2,992	7.1
TOTAL	**4,883**	–	**42,130**	**100**

Source: FAO (2006a,b), ITTO and STCP.

Other incentives included soft loans from the Overseas Economic Cooperation Fund and direct incentives through forest outgrower schemes provided by a number of forest companies. In all cases, free seedling distribution, technical assistance, and contracts for future supply are available.

- *Main timber species and sustainable production capacity*

Table 4.5 presents data on the species planted in Thailand. There are significant areas of planted eucalypts, pines (particularly *Pinus merkusii*), acacias and teak. The most important plantation species for the timber industry, however, is rubberwood, with slightly over 2 million hectares; planted originally for latex production, the estate has increasingly been harvested for timber. Timber from agroforestry lots, home gardens, roadside trees and farm trees is also of increasing importance (ITTO 2006a). The sustainable wood production from forest plantations is estimated to be about 42 million m^3.

In Thailand, eucalypt and acacia breeding programs have been established and forest plantations based on *Acacia mangium*, *A. crassicarpa* and *Eucalyptus pellita* support large industrial programs aimed at high-volume production.

Africa

Of ITTO's ten African producer countries, nine have Atlantic Ocean ports; the tenth, the Central African Republic, is landlocked.

In most African countries the public sector has had a strong general influence on economic development. This applies strongly in forestry: the public sector has defined national policies and the rules regulating and managing the forest resource and is often also the main investor. Although, in many countries, the role of the state in the economy is declining, its involvement in the forest sector is still substantial. On the other hand, the capacity of the public sector to invest in the forest sector is limited.

Institutional capacity is often listed as a key constraint to the proper functioning of the forest sector. In Cameroon, for example, the mandate of the forest agency greatly exceeds its capacity; it is, therefore, greatly overstretched with a heavy workload, diminishing budgets and very weak technical capacity. The Ministry of Environment and Forests has not recruited personnel since 1992 and loses 10–15 employees per year.

In the Central African Republic, government intervention includes a log export ban to promote local wood processing. The small existing forest plantation estate is poorly maintained and subject to frequent fire. No plans exist to expand industrial plantations, although teak and gmelina trials show that productivity can be high (ITTO 2006a).

In recent decades the Democratic Republic of the Congo has been greatly affected by a succession of wars that have practically destroyed most national institutions and forest plantation programs. The institution responsible for forestry in the country is the Ministry of Environment, Nature Conservation, Water Resources and Forests, which has undergone a reorganization; greater autonomy is expected at the provincial and local levels in the future. A new forest law was promulgated in 2002 (ITTO 2006a).

Liberia's forest law was amended in 2000 and has been in force since 2002; it aims to promote SFM as a basis for national reconstruction. The lack of a consistent forest development policy and especially the long war and political instability explain the insignificant development of forest plantations in Liberia (ITTO 2006a).

Togo adopted a new forest policy in 2000 that emphasises people's involvement and decentralized management in rural areas. A new forest law has been pending in Togo's National Assembly since 2005.

The general trend of changes to government policies related to forestry and forest plantations in African countries suggest that the influence of the public sector in forest plantation development is likely to decline in the future. On the other hand, change is occurring only slowly and the emergent private sector is still very small and insufficiently capitalized.

The establishment of industrial plantations and the deployment of social forestry programs through the active participation of rural populations appear to be feasible alternatives and can support economic growth and social development.

Below, forest plantation developments in five ITTO African member countries are reviewed.

Republic of the Congo

- *Forest policies and programs*

For years, Congo's low population density and lack of infrastructure have limited deforestation. Between 1990 and 2000, the country's deforestation rate was

an estimated 17,000 hectares per year (0.1% of the country's forest area; FAO 2001).

Forest plantations are considered within the national forest action plan through the promotion of agroforestry systems. Under the plan, a master plan was to be developed for forest management and forest development (ITTO 2006a), but in reality change has been slow.

A new forest code was adopted in 2000; among other things, it divides state forest into permanent and non-permanent forest estates, the permanent forest estate (PFE) comprising forests belonging to the state, local communities and public bodies (ITTO 2006a).

- *Institutional aspects*

i) *Public sector*: institutional capacity is very weak and the country's forest governance structure is still developing in the wake of a military coup and a civil war. The economy is undergoing a privatization process but remains highly dependent on the public service and state-owned companies (ITTO 2006a).The main public institution in charge of forests is the Ministry of Forestry Economy and Environment. The 2000 forest code also created other institutional bodies, including:

  - the General Forest Economy Inspectorate, which has a controlling and auditing role;
  - the National Timber Trade Information and Statistical Center, in charge of production and trade statistics; and
  - the National Inventory and Management Center as an independent institutional branch.

  Public forestry institutions in Congo are in the process of capacity building; tax revenues do not provide them with sufficient financial resources to exercise a minimum level of control over the country's forests. In other words, the institutional mandate remains to be implemented, since most institutions under the ministry set-up lack a presence in many parts of the country and civil servants are often unpaid for long periods.

ii) *Private sector:* privatization is bringing a growing number of former para-state forest companies into the market economy. Foreign capital is entering the country, particularly through European, Lebanese and Malaysian companies that are harvesting natural-forest concessions.

  Detailed information on private-sector investments and operations are unavailable, but it seems that, over the past ten years, Congo has had only a few investors in commercial forest plantations. These include: *Unité d'Afforestation Industrielle du Congo*, *Congolaise de Développement Forestier*, *Eucalyptus du Congo Société Anonyme* and *Fibres et Eucalyptus du Congo*. Consultations carried out with local NGOs (*L'Alliance-Homme Environnement d'Afrique*) suggest there is still a need to spread the culture of forest plantations among Congolese communities.

- *Incentives, subsidies and financing mechanisms*

Congo has no specific incentives, subsidies or financing mechanisms to favor forest plantations.

There is a general sense in government of the need to maintain a more stable business climate for private investment in forest plantations (this perception was also observed in other countries of the region). Indeed, the main obstacles to the development of forest plantations in the country are the lack of financial resources and the lack of continuity of partnerships for industrial forest plantations.

- *Main timber species and sustainable production capacity*

Eucalypts have been planted in Congo for quite some time; clonal plantations of *Eucalyptus urophylla* were established in the 1960s.

The estimated current total forest plantation area in Congo is 73,000 hectares. Of this, 68,000 hectares comprises eucalypt species with a relatively high productivity (average 19 m^3/ha/year). Pine plantations are estimated to cover only 5,000 hectares and have a lower productivity (average 14 m^3/ha/year). There are nurseries producing clonal *Eucalyptus* and *Pinus* seedlings.

Recently, the company *Fibres et Eucalyptus du Congo* announced that it will start a program to replant logged areas using new eucalypt hybrids *(E. urophylla* x *E. grandis*). The company will introduce several new practices in order to increase productivity and reduce management costs.

Table 4.6 shows the existing forest plantation area in Congo. Its estimated sustainable timber production is 1.36 million m^3 per year, a relatively high volume considering the small area available.

Table 4.6 Commercial planted area, productivity and sustainable production capacity of forest plantations, Republic of the Congo

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypt	68	19	1,292	94.9
Pine	5	14	70	5.1
TOTAL	**73**	–	**1,362**	**100**

Source: FAO 2006d, ITTO and STCP.

Forest research and development has received little attention in Congo. The few ongoing initiatives are supported by NGOs and international agencies. These include the Congolese Institute for Nature Conservation, the Congo Basin Forest Partnership, and CIRAD (the French Agricultural Research Center for International Development).

Côte d'Ivoire

- *Forest policies and programs*

Côte d'Ivoire's forest code, which dates from 1965, establishes the categories of rights in the forestry domain (FAO 2001). Since 2000, forest activities have been guided by a new forest policy (ITTO 2006a). Forests fall into has two legal ownership categories:

i) public forests, owned by the state, which are divided into two kinds of land use: the *domaine forestier*, which includes the reserved forest area and protected areas, and the *domaine rural*, which includes forest harvesting areas and forested areas reserved for conversion into agriculture land; and

ii) community forests, which are based on traditional customary rights.

- *Institutional aspects*

Despite changes in the legislation, forestry institutions remain weak in Côte d'Ivoire. The Ministry for Water and Forests has been in charge of the forest sector since 2003; prior to that, however, responsibility for forests changed five times in nine years.

Currently, the forestry administration is organized in four areas: i) the protection of natural resources; ii) environment and wildlife; iii) fisheries and aquaculture; and iv) forest education and research.

i) *Public sector*: forest institutions in Côte d'Ivoire remain weak and civil society is not actively involved in forest management (ITTO 2006a). The Society for Forest Development (SODEFOR), a government corporation created in 1966, is responsible for the management of forest reserves and has technical advisory functions for planted forests and social forestry (ITTO 2006a).

ii) *Private sector*: prior to the start of the civil war in September 2002, a relatively strong private sector was involved in forest activities and the timber industry in Côte d'Ivoire. The social, political and economic conditions of the country, however, have reduced private-sector investment generally, and the forest sector is no exception. The country was virtually divided in two by the civil war and there is no clear indication that this will change in the short term (AfDB/OECD 2006).

Given the short-term prospects for the country, little private investment in the forest sector, especially in commercial plantations, is expected over the next few years. Teak has long being planted in the country and is currently the only timber species that can be exported as logs.

- *Incentives, subsidies and financing mechanisms*

There are no incentives, subsidies or financing mechanisms for forest plantations in the country. The few ongoing initiatives of relevance to the forest sector are environmental projects supported by international organizations and NGOs.

- *Main timber species and sustainable production capacity*

Forest plantations in Côte d'Ivoire total an estimated 198,000 hectares (Table 4.7). The main timber species planted are teak, terminalia (*Terminalia ivorensis)*, and eucalypts. Rubber plantations used for latex production cover an estimated 68,000 hectares (ITTO 2006a).

Table 4.7 Commercial planted area, productivity and sustainable production capacity of plantations, Côte d'Ivoire

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Teak	66	11.3	750	40.9
Rubberwood[1]	68	10	680	37.3
Other hardwoods	64	6.2	397	21.8
TOTAL	**198**	–	**1,827**	**100**

[1] *Rubber plantations are not currently used for timber production.*
Source: FAO (2000), ITTO (2006a), STCP database.

Plantation productivity is relatively low, at around 10 m³/ha/year. The total sustainable production capacity is estimated to be about 1.8 million m³/year.

Gabon

- *Forest policies and programs*

Gabon's forest sector is export-oriented; the main market for the country's forest products is Europe. SFM is considered a key issue for Gabonese forestry and, since natural regeneration in logged areas occurs relatively easily, forest plantations have not been a priority (ITTO 2006a).

Nevertheless, Gabon's first forest plantations were established in the 1930s. At that time, there were some concerns about the availability of okoumé, the most valuable timber species. The first okoumé plantations were very small, and limited information about them is available.

The current forest policy dates from 1996; its main focal areas are the promotion of local processing and adding value to exports. The efforts made to increase local processing have reduced log exports (ITTO 2006a), although Gabon is still the largest log exporter in the region.

The 1996 forest policy makes specific reference to the application of SFM, including: the establishment of a forest management policy; the development of new forest harvesting rules; forest harvesting monitoring; the reform of timber licenses to ensure wood supplies to local industries; the imposition of a progressive transformation tax on local forest production; and the progressive reduction of log exports from 75% of production in 1996 to 50% by 2005.

Forest land falls into two main categories: i) PFE, managed by private concessionaires; and ii) protection PFE, managed by the state. Other categories include state-owned rural forest destined for community use, and production PFE with utilization reserved for the state.

Various ministries have a role in forestry, particularly the Ministry of Forest Economy, the Ministry of Inland Waters and Fishing, and the Ministry of Environment and Nature Conservation. The institutional framework has changed in recent years, mostly to respond to the decisions and recommendations of the 1992 Rio Earth Summit.

Gabon's large natural forest resource and export trade tradition have influenced legislation and policies. SFM is an important issue for the country and is explicitly considered under the Environmental Law 16/93, adopted in 1993. The Global Environment Facility has funded a national environmental action plan, which focuses on the conservation and sustainable use of natural resources.

The forest law, which was adopted in December 2001 (ITTO 2006a), requires each forest management unit to prepare and implement a forest management plan and a wood-processing plan.

The 2006–2008 action plan of the Directorate General of Water and Forests, which is responsible for promoting SFM, has the following priorities:

- increase productive forest area;
- increase the share of value-added for forest products;
- contribute to the protection of wildlife and other natural resources;
- enlarge forestry's contribution to the national economy; and

- increased the fiscal contribution to local communities through forestry.

- *Institutional aspects*

i) *Public sector:* the Gabonese forestry institutions are structured to support an export-based forest industry. Until 2005 the government had a monopoly over exports of the most important timber species (okoumé).

The priority of the Gabon Government is centered on the management of natural forests; plantations are largely ignored in legislation, the implementation of forest activities, and research work.

ii) *Private sector:* forest plantations are not a priority for the private sector, either. Private forest managers consider that, since natural regeneration occurs rapidly in logged areas, there is no need to invest in commercial forest plantations.

The timber trade in Gabon involves a variety of business groups, including: large European companies that have been in the country for a long time; Malaysian and Chinese trading companies that have arrived in the last few years; medium-sized companies owned by locals, Lebanese and European investors and joint-ventures between nationals and Lebanese or European firms; and small domestic firms operated by families or communities. It is estimated that there are more than 150 small forest-based firms in Gabon, most of them facing problems related to a lack of technology and capital.

To date, none of these business groups have made investments in forest plantations and are unlikely to do so in the next few years.

- *Incentives, subsidies and financing mechanisms*

There are no incentives or other mechanisms to promote industrial forest plantations in Gabon. Consultations held during the field survey indicate that this is not an issue under discussion, as commercial forest plantations are not a priority.

On the other hand, Gabon has a generally good investment climate that would be conducive to forest plantation development. The country is making progress in attracting foreign investment, improving governance and transparency, and reducing bureaucracy.

Gabon's investment code is similar to those in other Francophone African countries and a revised and simplified version of Gabon's code is now fully in force. There are no restrictions on foreign capital. The investment code gives preferential treatment to all enterprises considered important for the development of the Gabonese economy in regard to taxation, duties, the importation of certain equipment and raw materials, and royalties. The government also reserves the right to give preferential treatment to Gabonese-owned companies. The free transfer of capital is guaranteed and there are no restrictions on the area of activity. All new industrial, mining, farming and forestry operations are exempt from income tax for the first two years of operation.

- *Main timber species and sustainable production capacity*

The main timber species planted in Gabon are eucalypts and pines. There are also some forest plantations based on native hardwoods. Table 4.8 presents data on plantation forest area and estimated

Table 4.8 Commercial planted area, productivity and sustainable production capacity forest plantations, Gabon

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Hevea[1]	10	–	–	–
Eucalypts	3	15	45	17.7
Pines	2	12	24	9.5
Other broadleaved	23	8	184	72.7
TOTAL	**38**	–	**253**	**100**

[1] *Rubber plantations are not currently used for timber production.*
Source: ITTO (2006a), FAO (2006d), adapted by STCP.

productivity; the total annual sustainable timber production capacity, excluding rubber plantations, is an estimated 253,000 m^3.

Gabon's forest research and development program is focused on natural forest management; there appears to be no current research and development relevant to forest plantations.

Ghana

- *Forest policies and programs*

Ghana's first forest policy was established in 1947. A revision was undertaken in 1992 and approved in 1994 as the country's Forest and Wildlife Policy. It has five specific objectives: i) management of the PFE; ii) the conservation of soil, water and biodiversity; iii) forest industry development; iv) awareness of and participation in forestry and wildlife conservation; and v) the development of capacity in SFM.

The implementation of the forest and wildlife policy is guided by a master plan (1996–2020).

The national authority in charge of forestry is the Ministry of Land and Forestry. Under its mandate the Forestry Commission functions as a semi-autonomous corporation for the implementation of the national forest policy. The core business of the Forestry Commission is regulation, protection and the provision of public services.

The Timber Resources Management Act of 1997 replaced all existing legislation and introduced timber utilization contracts, which require social responsibility agreements with local landowners and traditional authorities (FAO 2003).

Log exports have been banned in Ghana since 1997 and taxes are charged on the export of nine timber species.

Important advances have been observed in Ghana's forestry since 1996 with the implementation of the Forestry Development Master Plan. Besides timber utilization contracts, which are an efficient instrument that promote SFM, value-added processing has progressed and private-sector investment in plantation development has increased.

The most recent initiative in Ghana concerning plantations is the National Forest Plantation Development Program, which was launched in 2001 with an annual planting target of 20,000 hectares. This has encouraged the involvement of the private sector and communities in the establishment of plantations in degraded forest reserves, particularly using the modified *taungya* system. This is significantly different to previous arrangements: the participation of farmers in the system is guaranteed because they receive 40% of the wood produced and 100% of the crops. The remainder of the wood is distributed among the government (40%), landowners (15%) and forest-fringe communities (5%). More than 53,000 hectares of plantation were established between 2001 and 2005 using this system.

Under the Ghana Vision 2020, one of the key policy objectives of the government is the reduction of poverty; in line with the national strategy, forest plantation expansion has been transformed as a vehicle for rural job creation and poverty reduction.

The strategic objectives of the National Forest Plantation Development Program in Ghana are:

- promoting poverty reduction and income generation in forest communities. This involves the recognition of the tree ownership rights of farmers and documenting community land ownership to serve as a source of capital;
- promoting private-sector investment in industrial plantations through the provision of incentives;
- improving governance in the regulation and management of Ghana's forest plantations; and
- meeting the growing domestic demand for wood.

These strategic objectives call for the redefinition of the roles and responsibilities of the public-sector institutions engaged in forest plantation development. The strategy explicitly recognizes the land-rights of traditional authorities as well as the need for them to share in the benefits. The implementation of the strategy has commenced through projects that promote collaboration between private companies and the grassroots organizations of farmers, local communities and churches. Other social forestry initiatives are also providing encouraging results, especially in the case of teak. Much of the planting done at the community level (i.e. without private-sector involvement), however, relies on external donor support, with rare exceptions of self-sufficiency.

- *Institutional aspects*

i) *Public sector*: the Ministry of Lands and Forestry is in charge of policy formulation and the coordination of sectoral programs. The role of the Government of Ghana through the ministry and specifically the Forestry Commission is to

formulate forest plantation policy and to channel and pool funds from the government and national sources and donors into the Forest Plantation Development Fund and to seek innovative funding sources such as the World Bank's Prototype Carbon Fund.

One of the main constraints in plantation development has been uncertainty over property rights, as well as market and government failures. Policies have addressed traditionally owned forest lands, which were, in the past, under the full control of tribal chiefs or kings. In the early 1970s, in order to harmonise the various traditional land-tenure systems and to reduce political conflict, all rights for the management and development of natural resources (but not land ownership itself) were transferred to the President of Ghana (ITTO 2006a).

One of the purposes of the National Forest Plantation Development Program is to provide incentives for community, smallholder and private forest plantation development. It also considers that, in off-reserve areas, improved land and tree ownership rights are essential if farmers and other private planters are to invest in and manage trees on farms.

The program stresses the need to clarify the roles and responsibilities of public-sector institutions engaged in plantation development and recognizes the importance of tree ownership rights for smallholders, community groups and private-sector investors. The Forestry Commission now focuses on its management functions and regulatory responsibilities; competing with the private sector in commercial forest plantation development would contradict the Commission's public-sector responsibilities.

The most important immediate task is to provide the right economic incentives for market-based forest plantations by correcting current market and policy failures. Measures that could be taken include: lifting the log export ban; introducing the competitive allocation of timber rights; introducing tree ownership rights; and eliminating export levies. This would result in real increased stumpage values.

Another important initial task is to prepare, with other stakeholders, the guidelines and standards for forest plantations to be financed either by the Forest Plantation Development Fund or the Private Venture Capital Fund. This will be important for demonstrating that good forest plantation management makes sound business sense. Similarly, the Ministry of Lands and Forests has a key role to play in the development and introduction of national certification standards and in ensuring public accountability in the sector.

The Forestry Commission has established a specialist Plantation Department, which has assumed institutional responsibilities for the forest reserve plantations (estimated to comprise 10–15,000 hectares of mature forest plantations and 57,000 hectares established between 2002 and 2006 under the National Forest Plantation Development Program using the modified *taungya* system) previously managed by the Forest Service Division's regional and district offices. The Plantation Department also provides advice to landowners and private investors on establishing forest plantations on degraded forest reserves and assesses and explores financing and technical options for stakeholders.

ii) Private sector: the organization and participation of the private sector in forestry follows the pattern and development history of most countries in the African region. Since the introduction of the log export ban the private sector has focused its activities on harvesting and local processing.

Political stability and a relatively organized forestry sector have encouraged the participation of the private sector in the establishment of forest plantations, differentiating Ghana from most other countries in the region. The success of the National Forest Plantation Development Program relies on private-sector involvement (FAO 2003).

- *Incentives, subsidies and financing mechanisms*

The most relevant forest plantation investment schemes identified in Ghana are:

i) Commercial plantations: these include large-scale planted forests that were established for specific purposes such as timber and fibre production and involve the participation of national and international industrial investors as well as the state. Examples include the following:

- the teak plantation of Bonsu Vonberg Farms Ltd, established in 1993, seeks to plant 10,000 hectares for sawlog production. Funds are provided by Ghanaian and Dutch investors and the scheme subsidises outgrowers who have signed a sales contract intention with the company;

- the Subri Industrial Plantations Ltd is a parastatal initiative created to establish 4,000 hectares of *Gmelina arborea* to produce fibre for a proposed pulp mill. Presently, the company is producing sawlogs; plans for the construction of the pulp mill have been postponed. Five local financial institutions and the African Development Bank are involved in the business;
- the Swiss Lumber Company project is promoting an outgrower scheme for planting tree species on fallow farm areas;
- the Ashanti Goldfields Company Ltd has established plantations of teak, *Gmelina arborea* and eucalypts for logs, fuelwood and pit props; and
- the Samartex Afforestation Project promotes plantations of teak and *Cedrela odorata* on abandoned cocoa farms. The plantations are intercropped with black pepper and cola nut.

ii) Small-scale private forest plantations (farmers and communities) have been established with the support of NGOs and bilateral donor projects. Incentives include the provision of seedlings and technical assistance. The majority of these plantations are based on teak. Examples include the following:

- the Gwira Banso Project involves farmers and focuses on enrichment planting in a forest reserve. In this project the landowners, tenant farmers and a Danish timber company are cooperating in the design and implementation of a sustainable management system; and
- teak plantations under the modified taungya system have been established on communal lands under various types of arrangements in various parts of the country. The Forest Plantation Development Fund has mobilized individual farmers, local communities and NGOs to plant trees on their farms or on degraded community lands. The fund is designed to support the establishment of up to 2,000 hectares per year of forest plantation with incentives and technical assistance.

iii) Commercial forest plantations under public ownership cover almost 40,000 hectares, mostly made up of teak, *Cedrela odorata*, *Mansonia altissima*, *Gmelina arborea* and *Terminalia* spp. The plantations are poorly stocked and provide poles for electrification and exports to India.

In order to further promote forest plantation development the Ghanaian government intends to develop other mechanisms, including:

- making reforestation obligatory for timber utilization contract holders;
- commercial plantation development by corporate agencies and foreign companies; and
- the development of best-practice plantations through the establishment of a venture capital trust or company.

Even though attempts have been made to encourage the Forest Plantation Development Fund to invest in large-scale foreign investments, this does not seem likely to happen in the near future, mainly because, in line with the national policy, the Forest Plantation Management Board focuses on poverty reduction and supports small-scale farmers and local communities.

- *Main timber species and sustainable production capacity*

The main planted species in Ghana are teak, which represents 53% of the planted area in the country,

Table 4.9 Commercial planted area, productivity and sustainable production capacity of forest plantations, Ghana

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Teak	40	15	600	85.5
Rubberwood[1]	19	–	–	–
Other hardwoods	17	6	102	14.5
TOTAL	**76**	**–**	**702**	**100**

[1] *Not currently used for timber production.*
Source: ITTO (2006a), FAO (2006d), adapted by STCP.

and *Gmelina arborea* (21%). Other species include hardwoods like eucalypts, which cover a relatively small area, native species of the region, and rubber. The rubber plantations are managed for latex production.

Table 4.9 presents data on forest plantation area and estimated productivity; the total annual sustainable timber production capacity (industrial roundwood), excluding rubber plantations, is estimated at 702,000 m^3.

Nigeria

- *Forest policies and programs*

Nigeria has a long forestry history, although forest plantations are relatively new. Existing legislation empowers state government bodies to protect, manage and change the status of gazetted forests. The 1988 national agricultural policy targets self-sufficiency in forest production and includes a goal to increase the forest area to 25% of Nigeria's total area.

The implementation of this policy has, however, been inadequate to meet established goals. Forest reserves have been heavily deforested and royalties paid by concessionaires, supposedly to be used in forest management and protection, are diverted to other uses.

- *Institutional aspects*

i) *Public sector*: the forestry sector is under the responsibility of the Ministry of Environment, which, through the Federal Department of Forestry, has overall responsibility for formulating national forest policies.

The 1999 federal constitution provides for shared control over the development of natural resources between the local, state and federal levels of government. There is a lack of clarity, however, in the mandates of the various bodies involved (there are 36 state forestry departments – some of the states even have ministries of forests – and 774 local councils), which leads to inefficiencies and conflicts.

The overall aim of existing policies is to achieve SFM and self-sufficiency in wood production by applying sound forest management principles and techniques and mobilizing human and material resources. The specific objectives are:

- consolidation and expansion of the forest estate in the country;
- the conservation and protection of the forest estate and environment;
- the regeneration of the forests at a rate faster than exploitation;
- the encouragement of private forestry, including in the establishment of forest plantations;
- increasing employment;
- the development of national parks, game reserves and wilderness recreational facilities;
- the development of non-wood forest resources;
- cooperation with other nations in forestry development; and
- the encouragement of alternative sources of energy and efficient methods of wood energy utilization.

Private-sector investments in forest plantations are covered by the Land Use Act, 1980. The chief objective of this Act, which applies to forest plantations, is to make land available to investors. The mechanism is not working properly, however, and private-sector investment in forest plantations has been constrained by inadequate land tenure arrangements. Present trends indicate a progressive change from communal to a more open ownership system.

Dual ownership of natural forests by local and state governments still exists in some of the 17 northern states. Local governments are responsible for arrangements to administer communal forest areas; state governments for forest reserves, game reserves and wildlife sanctuaries; and the federal government for national parks. Sixteen states have large forest areas and special forest laws to administer their tenure.

Several NGOs support activities related to the management of forest resources. Among these are the Nigerian Conservation Foundation, the Nigerian Environmental Study and Action Team, Savannah Conservation Nigeria, and the Forestry Association of Nigeria. There are also local initiatives, such as the Ekuri Initiative in Cross River State, although their influence and impact on forest management, particularly in forest reserves, remains small.

At the federal level, forest research is conducted under the Forestry Research Institute of Nigeria. In recent years, the World Bank, FAO and the African Development Bank have also supported forest research projects. Among other organizations

Table 4.10 Commercial planted area, productivity and sustainable production capacity of forest plantations, Nigeria

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Gmelina arborea	110	15	1,650	39.9
Eucalypts	41	7.5	308	7.4
Hevea	138	10	1380	33.4
Teak	74	9.5	703	17.0
Acacias	2	3	6	0.1
TOTAL	**375**	–	**4,137**	**100**

Source: FAO (2006d), adapted by STCP.

supporting research programs are NGOs and international foundations.

ii) *Private sector*: although little information is available on private-sector investment in forest plantations in Nigeria, it appears to be negligible. Reasons for this include land tenure problems, low wood prices, and risks associated with the country's general investment climate. Other issues affecting plantation investment in Nigeria are frequent drought and uncontrolled forest fire.

From the point of view of the private sector, however, the main constraint to forest plantation development in Nigeria is associated with the economics of investment. Stumpage prices set by the forestry authorities for native forest trees are said to be low, and this makes logs from plantations uncompetitive. Also, in many parts of the country there is limited local demand for small-diameter logs because local industry is underdeveloped.

- *Incentives, subsidies and financing mechanisms*

No relevant incentives for industrial forest plantation have been identified in Nigeria. In fact, this activity has not been regarded as a national priority.

Thus, it seems unlikely that Nigeria will significantly expand its forest plantation estate in the medium term.

- *Main timber species and sustainable production capacity*

Gmelina arborea is the main timber species used in forest plantations in Nigeria, covering 29% of the total area. Other planted timber species are pines, eucalypts, native species (although only to a very limited extent) and rubber. Although rubber is still managed primarily for latex production, its timber production potential is included in Table 4.10, which presents data on plantation forest area and estimated productivity. Despite the fact that forest plantations have not been a national priority, the existing planted area has a substantial timber production potential – around 4.1 million m^3 per year.

Latin America and the Caribbean

In 2005 forest cover in Latin America and the Caribbean was 924 million hectares, which is 40% of the land area and 23% of the world's forests. South America has 90% of the region's forests, Central America and Mexico 9%, and the Caribbean 1%.

In the past few years the region's forest sector has increased its production and trade of plantation-based products. The top six forest plantation countries are Brazil (5.6 million hectares), Venezuela (863,000 hectares), Peru (640,000 hectares), Cuba (482,000 hectares), Mexico (267,000 hectares) and Costa Rica (178,000 hectares). Together these total 8 million hectares, which is 91% of all forest plantations of the region.

The increased environmental regulation of natural resources, the enlargement of protected areas, and conservation policies have all affected wood production from natural forests. The impact on wood supply has been to increase transaction costs and reduce the competitiveness of wood production from natural forests. On the other hand, increased plantation-based production and consumption has begun to substitute for wood produced in natural forests. In Venezuela and Brazil, private-sector initiatives with government support have produced highly productive

and competitive plantations that have favored the development of the forest sectors in those countries.

Forest institutions are still adjusting to the economic reforms of the 1980s as well to the demands and expectations of the public. Broadly, these reforms focused on two strategies: (i) productive forests; and (ii) conservation and protection forests. There has been a tendency to merge institutions linked to forests and other renewable natural resources under a single administrative system for protected areas and forests. These systems have the purpose of improving coordination, reducing costs and avoiding the duplication of functions.

During the 1980s and 1990s the forest industry in the region underwent significant structural adjustment and consolidation, although the process varied greatly between countries and industrial segments. The production increase that occurred in the region for most forest products was the result of higher exports rather than increased domestic consumption.

Brazil

- *Forest policies and programs*

Changes to Brazil's forest policy began with the institution of a forest code legislated through Federal Law 4,771 in 1965. The code represents an important instrument in the modernization of forest activities and specifies that forests are assets of interest to all inhabitants of Brazil.

The most relevant changes introduced by the forest code were:

- the definition of forest areas and other forms of vegetation to be considered as permanent conservation areas;
- the establishment of conservation and indigenous lands; and
- the establishment of a minimum legal reserve area for rural properties.

The legislation applies the principle that property has a social function and confers more responsibility to the private landowner for the conservation of natural resources and land use.

The Brazilian forest code, which is still in force (with some modifications), is a normative system for the control and use of forest resources developed to promote the conservation and development of productive forest resources (natural and planted). In 1965 it was innovative because it introduced, to some extent, the principle of sustainable production capacity and the restoration of degraded areas.

Several stakeholders have suggested a revision of the forest code to: make a clear distinction between productive and conservation aspects of forests; make provisions for the consideration of other development policies of the country; simplify the legislation, especially related to forest plantations; when dealing with permanent conservation and legal reserve areas, provide differentiated treatment for properties on which forest plantations have been established; and ensure a stable legal framework in the medium and long terms.

In 2000 the federal government announced the establishment of the National Forest Program, with the aims of:

- stimulating the sustainable use of natural and planted forests;
- encouraging and supporting forest plantations, mainly in small rural properties;
- rehabilitating permanent preservation areas, legal reserve areas and altered areas;
- supporting economic and social initiatives of traditional and indigenous populations when livelihoods depend on the forest;
- combating illegal land clearing and the predatory harvesting of timber and other forest products; and
- preventing and controlling forest fires.

The National Forest Program is made up of three broad programs: (i) Sustainable Forest Program; (ii) Expansion of Forest Base Program; and (iii) Land Clearing Prevention and Forest Fire Control Program. It has focused its efforts on stimulating forest plantations by providing technical and financial support to small and medium-sized rural producers. Another focus area is the simplification of the legal and administrative procedures involved in the control and monitoring of forest activities, including planting, harvesting, transportation, processing and the sale of forest products and by-products.

Even though the bureaucracy for administering the plantation sector has been reduced, much more could be done in this regard. The forest sector is strongly regulated in Brazil, creating unnecessarily high transaction costs for the private sector.

- *Institutional aspects*

i) Public sector: the Brazilian Forest Development Institute was created in 1967 as part of the Ministry of Agriculture to formulate the national forest policy and to coordinate the implementation of the measures needed for the rational use, protection and conservation of renewable natural resources. It also had a clear mandate related to forest development. At the time the Institute represented a significant advance in public forest administration, acting to suppress parallel institutions that had previously existed in the federal sphere.

It concentrated most of its efforts on the development of the forest sector, following national development policies that led the country towards rapid economic growth in the 1970s. Among other things the Institute developed and implemented the fiscal incentives program for forest plantations.

In 1981 a law was enacted that created, under the auspices of the National Environment Council (CONAMA), the National Environment System, constituted by federal agencies and representatives from the states and the Federal District, private-sector and worker associations, and non-governmental and environmental organizations. The Council has deliberative power and authority to establish norms, criteria and standards relative to the control and maintenance of environmental quality aimed at the rational use of environmental resources.

The Brazilian Environment and Natural Resource Institute (IBAMA) was created in 1985 to incorporate the executive functions of forest resources, fisheries, nature conservation and rubber.

Through Provisional Measure 150, in 1990, the Environment Secretary of the President of the Republic (SEMAM/PR) was created with responsibility for, among other things, IBAMA. In 1992 SEMAM/PR gained the status of Ministry of the Environment, which has had continual changes in its mandate.

Very little was done to develop forest plantations during this period of institutional development. To some extent the National Forest Program, which is the responsibility of the Ministry of Environment, has changed the prospects for forest plantations by creating new mechanisms designed to promote plantations on small properties. New support is gradually being provided through the establishment of special credit lines like PRONAF Florestal and BB Florestal (see Box 4.1), with long-term interest rates and payback periods that are appropriate for women and small landowners.

ii) Private sector: the private sector is the main investor in forest plantations in Brazil. Several private-sector organizations and associations are fully involved in promoting and supporting forest plantations, including through financing and research and development.

Investors are usually linked to industrial operations and operate on a number of fronts, including by promoting partnerships with small producers, government agencies, civil society, research and development agencies, and other stakeholders. The two national private-sector associations most closely linked to forest plantations are the Brazilian Forest Plantation Producers' Association (ABRAF) and the Brazilian Silviculture Society (SBS). There are also several regional or state-level organizations, such as: the Minas Gerais Silviculture Association (AMS), the Bahia Planted Forest Producers Association (ABAFT), the Santa Catarina Forest Company Association (ACR), the Paraná Forest Company Association (APRE), the Mato Grosso Reforestation Association (AREFLORESTA), and the Steel Producers' Forest Development Association (ASIFLOR).

A large number of other forest-based industry associations are interested in plantations, including the Brazilian Pulp and Paper Association (BRACELPA), the Brazilian Mechanical Wood Industry Association (ABIMCI), the Brazilian Wood Panel Industry Association (ABIPA), and the Brazilian Furniture Industry Association (ABIMÓVEL).

A series of initiatives has been developed by the private sector, at both the company level and collectively through associations, to expand the forest plantation estate, increase forest productivity, reduce timber plantation costs, improve plantation timber quality, develop industrial processes and market plantation timber products.

The private sector has also established linkages with research organizations and universities. Through cooperation it has been possible to improve the silviculture and management of

plantations. Moreover, industry associations have played an important role in national discussions related to environmental and forest development policies.

- *Incentives, subsidies and financing mechanisms*

A fiscal incentive program for forest plantations was created in 1966 (Federal Law 5,106). This mechanism financed mainly large-scale forest plantations to support the development of the pulp-and-paper and steel industries (the latter through the provision of charcoal).

The fiscal incentive program for forest plantations was an important economic policy instrument, with significant benefits for the sector's productive chain. During the period that the incentive was in force, the program underwent two important changes:

i) through Decree Law 1,134 (1970) the funds made available to invest in forest plantations through the fiscal incentive scheme were considerably increased; and

ii) the creation of the Sectoral Investment Fund (FISET) through Decree Law 1,376 (1974) introduced modifications to facilitate the implementation of the tax incentive system for forest plantations.

FISET adjusted the fiscal incentive policy to meet the goals defined in the National Pulp and Paper Program and the Charcoal for Steel Making Plan according to the priorities and directives set by the Economic Development Council based on the National Development Plan.

In December 1987, through Decree Law 2,397, the percentage of capital invested in reforestation to be returned to investors was reduced and its use was restricted to specified areas in the country. The fiscal incentives came to an end in 1988.

The fiscal incentive scheme benefited mainly the pulp-and-paper and steel industries but also helped the development of the solid-wood industry. Through the program, around 6 million hectares of forest plantations were established throughout the country.

The area of new forest plantation area established annually declined after 1985. With the increase in plantation timber demand and indications of a possible deficit in the supply of logs from plantations, however, prices increased and a new cycle of investment in forest plantations started.

Most ongoing investments now are direct domestic investments. With the creation of the National Forest Program, and in view of the demand for credit by the private sector, new financing mechanisms have been created (Box 4.1). Some of these are still at an early stage and will need to be scaled up. If, as expected, interest rates decline in the future, more credit could be obtained through existing mechanisms.

The Brazilian private sector has announced significant new investments in forest business. By 2012 the industrial forest sector intends to invest about US$20 billion, comprising US$14 billion in pulp-and-paper and US$6 billion in solid wood products, a large amount compared to those announced by other countries in the region. Chile and Uruguay, for example, are planning investments in the order of US$4 billion and US$2 billion, respectively.

- *Main timber species and sustainable production capacity*

Table 4.11 presents data on forest plantation area and estimated productivity; the total annual sustainable timber production capacity (industrial roundwood) is estimated at 158 million m^3. Productivity levels for most species are high. Eucalypts represent over 70% of the potential wood supply, while pines cover slightly more than 25%.

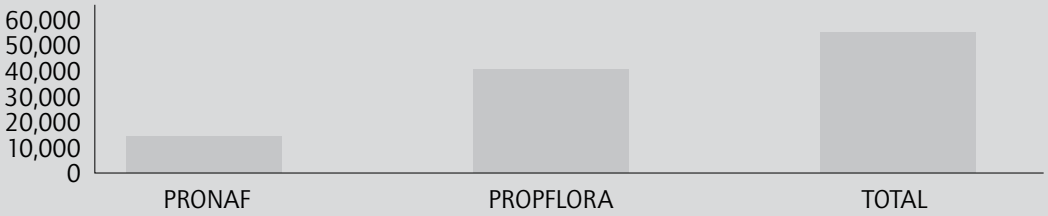
Box 4.1 Credit mechanisms for forest plantations in Brazil

Over the last few years, stimulated by the federal government, various Brazilian institutions, such as the National Economic and Social Development Bank (BNDES) and the Bank of Brazil (BB), have developed financing mechanisms to support the expansion of forest plantations.

Although national funds are available, many large companies have preferred to use their own capital or other sources to finance new forest plantations. These programs focus on financing small landowners. In 2005, for example, the National Agricultural Family Strengthening Program (PRONAF Florestal) and the Commercial Plantation and Forest Rehabilitation Program (PROPFLORA) provided an estimated 51 million Brazilian real for forest plantation activity (see figure below).

Box 4.1 Credit mechanisms for forest plantations in Brazil continued...

Financial allocations under PRONAF Florestal and PROPFLORA, 2005



Source: Data obtained from the Ministry of the Environment and BNDES (2005).

PROPFLORA (Commercial Plantation and Forest Recuperation Program) is a program developed by BNDES. It provides support for the implementation and maintenance of forests for industrial purposes, the recovery and maintenance of preservation areas and legal forest reserves, and the implementation and maintenance of forests for fuelwood production for the agricultural sector.

PROPFLORA also aims to: contribute to the reduction of the timber deficit for industrial uses through the diversification of productive activities in rural areas; generate employment and income in a decentralized way; and leverage the technological and commercial value of the sector. From a social and environmental point of view the program aims to settle people in rural areas and reduce migration to urban areas by supporting viable small and medium-sized rural properties. The program provides attractive financing conditions in terms of interest rates (below market level), and grace and repayment periods, mainly for fast-growing species. The resources are limited, however, as the financing is mainly aimed at small and medium-sized producers.

PRONAF Florestal (National Agricultural Family Strengthening Program) is a partnership between the Ministry of the Environment and the Ministry of Agrarian Development that provides credit lines for small family producers for the introduction of silviculture and agroforestry systems on their properties. The program aims to promote reforestation for environmental benefits, help meet the subsistence needs families, and finance commercial activities. The program provides very attractive financing conditions, with subsidized interest and an interest ratio significantly below the market rate, which make this program particularly appealing to family farmers. The initial difficulties associated with the program are gradually being overcome, although some problems, such as collateral and access to credit, still exist.

BB Florestal (The Bank of Brazil Forest Investment, Cost and Commercialization Program) promotes the implementation and expansion of replanted forest areas destined for industrial use in Brazil. BB Florestal brings together diverse existing lines of credit for the financing of forests and activities linked to forests, such as the establishment of nurseries and the purchase of forest machinery and equipment. With the support of various ministries the program is directed at the entire agribusiness chain, from family farmers to larger farming businesses, cooperatives and exporters in the forest products sector. Under BB Florestal, lines of credit aimed at forest activity such as PRONAF Florestal and PROPFLORA can be used, as well as the structuring of other credit operations to meet specific investor demands. The Constitutional Financing Fund for the North (Fundo Constitucional de Financiamento do Norte), the Constitutional Financing Fund of the Northeast (Fundo Constitucional de Financiamento do Nordeste) and the Constitutional Financing Fund for the Central West (Fundo Constitucional de Financiamento do Centro-Oeste) are used to finance productive activities in the farming, minerals, industrial, agribusiness, tourist, trade and service sectors in the Amazon region.

Administered by the Ministry of National Integration, the constitutional funds are available to rural producers, companies, corporations, associations and productive cooperatives engaged in the activities listed above, through the Bank of Amazonia in the Northern Region, the Bank of Northeast Brazil in the Northeastern Region, and the Bank of Brazil in the Central Western Region.

Source: Wiecheteck (2006).

Table 4.11 Commercial planted area, productivity and sustainable production capacity of forest plantations, Brazil

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	3,407	33	112,431	71.3
Pines	1,835	22	40,370	25.6
Acacias	178	18	3,204	2.0
Teak	50	9	450	0.3
Others	127	10	1,270	0.8
TOTAL	**5,597**	–	**157,725**	**100**

Source: FAO (2006a), ITTO and STCP survey, May 2006.

In Brazil, forest plantations are a viable economic activity. Their success is guaranteed by a set of climatic and structural factors, technology development in silviculture and industry, the quality of infrastructure, and other comparative advantages.

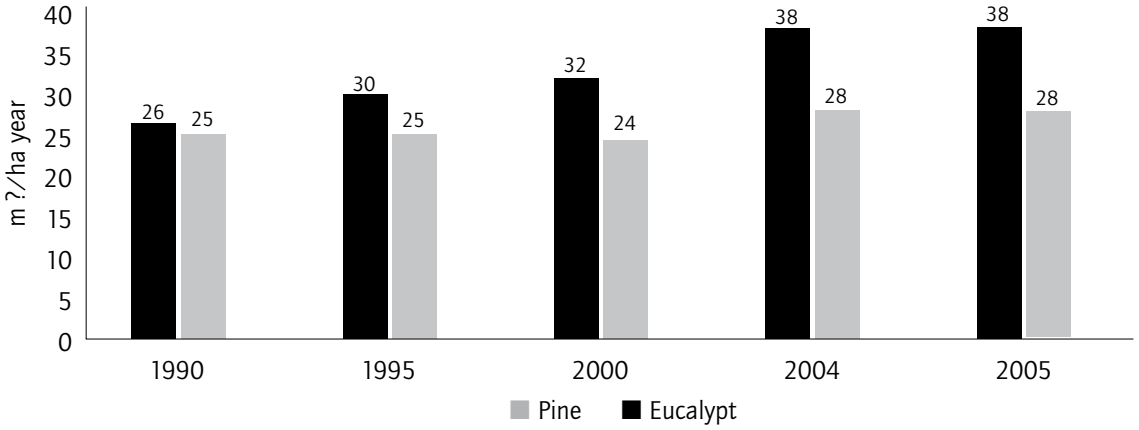
As a result of investments made in research, eucalypt plantations are highly productive; in some plantations, MAI can reach 60 m³/ha/year (BRACELPA 2001). Productivity is also high for pines, and new plantations are producing, on average, growth rates above 35 m³/ha/year (ABIMCI 2002).

A large area of the eucalypt plantation estate comprises high-yielding, fast-growing clonal genetic material adapted to different climates, soils and water availability. Over the past 30 years productivity gains, arising from research and genetic improvements, have almost tripled for eucalypts and almost doubled for pines. Gains in forest productivity in the last 15 years are shown in Figure 4.2.

Currently, forest plantations are established on the basis of: detailed environmental planning; the use of selected seeds or cloned material; suitable seedling production techniques; adequate fertilization; knowledge of pest and disease management; consolidated maintenance treatments; defined management regimes based on timber end use; efficient harvesting and transport systems; and continuous investments in research and development.

Most forest plantations are based on well-structured research programs supported by the major forest industries and conducted in cooperation with local universities and research organizations.

Figure 4.2 Average annual growth (MAI) of forest plantations, Brazil



Source: ABRAF (2006) and STCP (2006).

Ecuador

- *Forest policies and programs*

In Ecuador the forest policy was defined in the Forest and Natural Area and Wildlife Conservation Law (*Ley Forestal y Conservación de Áreas Naturales y Vida Silvestre*) of 1981. The law establishes that government is responsible for the regulation, ownership and use of natural resources. There are also specific provisions in the national constitution dealing specifically with forest issues. Article 266, for example, defines the role of the state in the promotion of forest plantations.

For several years the forest sector was under the jurisdiction of the Ministry of Agriculture. The Ecuadorian Forest, Natural Areas and Wildlife Institute (INEFAN) was established in 1992; the Ministry of the Environment, which was created in 1996, has primary responsibility for the forest sector.

Articles 12 to 19 of the forest law state that the reforestation of forest vocation land (see discussion in Chapter 6) is mandatory and a matter of public interest. These articles also oblige the government, through the Ministry of the Environment, to formulate a National Forestation and Reforestation Plan (PNFR) to be carried out in collaboration and coordination with other public and private-sector entities and with the owners of forest vocation land.

The PNFR was initiated in 2003. In 2005 a study was carried out to define its institutional arrangements and other operative aspects. The results of the study (STCP 2006) were presented and discussed with stakeholders in early 2006 and the implementation of the approved action plan is now in its early stages.

The general objective of the PNFR is to create conditions for the establishment of sustainable and permanent forest plantations in the country, with a focus on rural socioeconomic development and environmental protection. More specifically, the PNRF proposes to:

- generate a permanent forest area that becomes a source of raw material to meet national and international demands;
- improve the environment through the protection of ecosystems at risk of deterioration, works of public interest, water sources for human consumption and irrigation, carbon sequestration processes, wildlife sanctuaries and other environmental services;
- improve the quality of life of rural people by generating jobs, supporting social productive management, reactivating the economy of zones of influence, and generating a productive community infrastructure;
- in the long term, propose and contribute to sustainable forest development in the country;
- under the supervision of the Ministry of the Environment, reinforce forest institutions with the implementation of a PNFR Coordinating Committee and Executive Nucleus for the fulfilment of constitutional and legal obligations related to reforestation, education, seed and seedling production, and research; and
- increase public funding through the collection of taxes and duties as a result of the increase in the production of timber and other forest products for national and international markets.

The main goals of the PNFR over a 20-year period are to establish: (i) 750,000 hectares of industrial forest plantations; (ii) 150,000 hectares of social agroforestry plantations; and (iii) 100,000 hectares of forest plantation for the protection of fragile ecosystems.

The future of the forest sector in Ecuador depends on the success of the PNFR. Existing forest plantations are relatively small and the country has limited natural production forests.

- *Institutional aspects*

i) *Public sector*: the Ministry of the Environment is responsible for sustainable development and environmental quality in the country and for coordinating national policies, norms and regulations, as well as for the basic organization and financing of environmental management. Its mission is to guide environmental management through policies and norms and development and control instruments to achieve the sustainable use and conservation of Ecuador's natural capital, ensuring the rights of the people to live in a healthy environment.

Forest institutions in Ecuador have a strong environmental focus and in recent years have been unstable; a forest subsector has not developed.

The Ministry of the Environment prepared a Strategy for Sustainable Forest Development in 1999, but several problems are limiting its

implementation. Although Ministry efforts are concentrated largely on the control and monitoring of the forest industry, deforestation and illegal timber harvesting continue.

The PNFR is one of the Ministry's current priorities. The achievement of its goals, however, will require more than political will: it will need structural changes to attract investments in plantations. The Ministry has been working with other organizations to improve the investment climate for the forest sector. Changes in several supra-, inter- and intra-sectoral factors are needed.

ii) *Private sector*: the private sector in Ecuador is represented by several organizations at the national and regional levels. The most active of these at the national level relevant to forest plantations are Ecuadorian Teak and Tropical Word Producers (ASOTECA) and the Development Corporation for the Forest and Wood Working Sector of Ecuador (CORMADERA). ASOTECA is an association representing forest plantation companies, while CORMADERA is involved in research and development, seedling production, and forest plantation establishment and management.

The Ecuadorian forest industry is represented at the national level by the Ecuadorian Wood Working Industry Association (AIMA).

The Export and Investment Promotion Corporation (CORPEI), a quasi-government body, works closely with the national representatives of the private sector to strengthen existing organizations and to develop the wood export sector.

- *Incentives, subsidies and financing mechanisms*

Ecuador offers no incentives, financing or other mechanisms to support the establishment of forest plantations. This issue has been part of the discussion agenda over the last few years.

A study carried out to support the implementation of the PNFR (STCP 2006) gave special attention to incentives and sources of funds to finance forest plantations. It identified several domestic financing mechanisms, but in general the existing options were not operational or needed adjustment. New mechanisms are therefore needed to finance industrial plantations in the country because the local private sector is insufficiently capitalised to implement the proposed large-scale forest plantation program. On the other hand, foreign direct investments are, and will continue to be, low because the investment climate in the forest sector is unattractive (Inter-American Development Bank 2005).

Ecuador is exploring other innovative mechanisms to finance the forest sector. Payments for environment services is one option; although this source of funds is likely to be used preferentially for the conservation or management of natural forest, it could also be tailored to promote forest plantations with industrial wood as an output.

- *Main timber species and sustainable production capacity*

Table 4.12 presents data on forest plantation area and productivity; the total annual sustainable timber production capacity (industrial roundwood) is estimated to be 3.3 million m^3. Eucalypt plantations account for more than 60% of this, followed by pines (34%). Teak has increased in importance in the country, although growth rates are relatively modest.

There has been very little investment in research and development for industrial forest plantations in Ecuador (STCP 2006).

Table 4.12 Commercial planted area, productivity and sustainable production capacity of forest plantations, Ecuador

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	81	25	2,025	61.1
Pines	66	17	1,122	33.9
Teak	15	9	135	4.1
Others	5	6	30	0.9
TOTAL	**167**	–	**3,312**	**100**

Source: FAO (2006a); ITTO and STCP survey, May 2006.

There is a need to improve the genetic material used in forest plantations and their silviculture and management. No existing organizations in the country, however, are capable of designing and implementing a structured national research and development program for the forest sector. Universities and other research-oriented organizations have serious limitations in terms of their human resources and funds and are mostly focused on environmental and conservation programs.

Practically all recent research developments have been made by the private sector. The private Juan Manuel Durini Foundation, for example, has invested in research to develop new alternatives for increasing plantation productivity. It has been supported financially by ITTO and other international organizations and the research work has focused mainly on improving the productivity of forest plantations using various local and exotic species.

Peru

- *Forest policies and programs*

In the 1990s a series of forestry and wildlife norms were introduced in Peru but none was characterised as a forest policy. The lack of a clear forest policy was one reason why the sector was plagued by illegal logging and a widespread lack of security for people working in the industry.

The enactment of the Forest and Wildlife Law in July 2000 will, in the long term, have a major impact on the sustainable development of the country's forest sector. Under it, harvesting in natural forests is only permitted under a management plan approved by the forest authority. The law also establishes that natural resources, and in particular forest resources, including both production and protection forests, are part of the national heritage. Forestlands occupy almost 80% of the national territory; of the remainder, 6% is declared as agriculture land and 14% as animal grazing land.

The Forest and Wildlife Law focuses mainly on natural forests. In 2005, a national reforestation plan was approved and is now under implementation; its main objective is to expand forest plantations based on a decentralized process that pays special attention to the generation of jobs and the eradication of poverty. It was prepared based on a consultation process involving stakeholders throughout the country. The process included technical meetings, technical support provided by forest plantation consultants, and eleven regional workshops.

The national reforestation plan has three priority programs: (i) commercial forest plantations for industrial use; (ii) protection plantations with a focus on the rehabilitation of ecosystems and watershed management; and (iii) strategic management with a focus on the competitiveness of the forest sector.

The plan states that commercial forest plantations should be established to generate revenue, support industrial development, and enhance the competitiveness of the forest industry. Protection forests should protect watersheds and assist in the recovery of ecosystem functions. Since forest plantations can generate direct and indirect benefits, the marketing of environmental goods and services could be an option for increasing revenue for local communities.

- *Institutional aspects*

i) *Public sector*: under the 2000 Forest and Wildlife Law, the National Institute for Natural Resources (INRENA), which is part of the Ministry of Agriculture, is responsible for the forestry sector. Within its structure the Forest and Wildlife Department has direct responsibility for proposing policies, plans, programs, projects and norms for the sustainable use of forest resources and wildlife, supervising and controlling their implementation, and protecting biodiversity.

Forest plantations are a relatively new issue in national policies and programs and most of INRENA's activities focus on the environment and timber production from natural forests. As a result, many issues crucial to the development of large-scale commercial plantations in Peru still need to be resolved. Obstacles include a lack of detailed information on potential lands for forest plantations, a lack of knowledge on tree species and genetic material, and a lack of clarity on land tenure.

Forest industry and trade are under the jurisdiction of the Ministry of Production and the Ministry of Foreign Trade and Tourism. Although separating responsibility for the forest sector into different ministries can create conflicts, it seems that the arrangement is working and will facilitate the development of commercial forest plantations in Peru. In any case it seems preferable to arrangements in other countries of the region (e.g. Brazil and Ecuador) where the forest sector sits within the Ministry of Environment, the priority of which is the environment rather than industry development.

The investment climate in Peru is improving rapidly, with political stability, positive macroeconomic indicators, a growing economy and increasing international investment. If these conditions are maintained for the next few years, it is likely that direct foreign investments in forest plantations will increase significantly.

ii) *Private sector*: Peruvian private-sector national organizations include the National Forest Chamber and the Peruvian Exporters Association.

FONDEBOSQUE was created recently with the aim of promoting and developing sustainable forests in Peru. This institution has already contributed significantly to the development of forest plantations in Peru (although that is not its main objective) with a focus on increasing productivity and efficiency to improve the competitiveness of the industry in international markets.

Cooperation between the private sector and government has increased in Peru. Two new bodies designed to improve the development and sustainability of the forest sector are the Forest Resources and Wildlife Fauna Supervision Office (OSINFOR) under the President of the Ministerial Council, with functional, technical and administrative autonomy, and the National Forest Policy Consultative Council (CONAFOR), the highest-level body for consultations on forest policy, which includes representatives from relevant institutions and agencies from the public and private sectors.

- *Incentives, subsidies and financing mechanisms*

Peru has been unable to develop an efficient and competitive forest plantation sector. Until recently forest plantations have not been a priority in the national forest policy and programs, and the private sector has concentrated its operations on natural forests.

Nevertheless, forest plantations have a long history in Peru. The first plantations – of *Eucalyptus globulus* – were established by mining companies around 1870. During the 1960s, plantations received a new boost when the InterAmerican Development Bank financed the first and so far only large-scale forest credit program. This was based on loans with an interest rate of 2% per year over a 20-year repayment period and led to the establishment of around 56,000 hectares of plantations. The program ended in 1974 and little information is available on its long-term impacts.

Since then, various other smaller financing initiatives for the establishment of forest plantations have been proposed and implemented. The *Canon de Reforestación en Amazonia Peruana*, an initiative to promote forest plantations in the Amazon region, was created in 1980; it was based on forest-industry contributions to a fund and operated until 2000. About 100,000 hectares of forest plantations were established in the region under this scheme.

Recently the private sector in the Oxapampa and Villarica regions began to establish 1,000 hectares of forest plantations for industrial purposes using high-yield imported eucalypt genetic material. This initiative is based on domestic direct investment by the private sector.

The national reforestation plan provides the following incentives and mechanisms to support the establishment of plantations: (i) the creation of forest plantation research and development centers; (ii) promotion, education, technical assistance and information management; (iii) the improvement of land ownership conditions; and (iv) the promotion of private investment.

Although important, these initiatives are insufficient to capture investments from the private sector for plantations, despite improvements in the national investment climate.

- *Main timber species and sustainable production capacity*

Due to their location and poor management, the oldest forest plantations, especially those with eucalypts, are probably relatively unproductive. The limited records for these areas do not allow an estimate of the percentage that has reached maturity. It is assumed, therefore, that most of these plantations are not under systematic management, have low productivity (12 m^3/ha/year), and are being used mainly for firewood.

Table 4.13 presents an estimate of the sustainable wood production capacity of Peru's existing eucalypt plantations.

As a result of an initiative of the private sector a nursery was established recently in Oxapampa with the capacity to produce 1 million seedlings annually based on genetically improved seeds (eucalypts and pines).

Table 4.13 Commercial planted area, productivity and sustainable production capacity of eucalypt forest plantations, Peru

Productive area ('000 ha)	281
MAI (m^2/ha/year)	12
Sustainable production capacity ('000 m^2/year)	3,372

Source: FAO (2006a); ITTO and STCP survey, May 2006.

About 1,000 hectares of new forest plantations have been established; the target is to establish 60,000 hectares annually over the next ten years, attracting investments of about US$60 million per year.

Peru has invested relatively little in forest research and development, only a small proportion of which has been directed towards forest plantations. Forest research activities are not a priority of government.

In the same way, technology transfer has been little addressed in institutional programs. Some technological transfer took place to meet the needs of the state, mainly related to the silviculture of species in the Andean region and the formulation of management plans for natural tropical forests.

A study on forest research in Peru carried out in 2001 by the Support for the National Forest Development Strategy Project drew the following conclusions:

i) a national forest research program did not exist: in most organizations, research projects were defined according to the preference of individual researchers. Only the *Instituto de Investigación da Amazónia Peruana* had a strategic plan prepared in collaboration with regional entities;

ii) there were 215 forest research staff in the country, of which 77% dedicated less than 50% of their work time to applied research. In most cases salaries were low and only 8% of the researchers considered their work to have excellent quality (30% evaluated their results as good and the remaining 62% as good to medium);

iii) forest science and technology in Peru was channelled through eleven specialized institutions, of which six were universities that had forest science in their curricula. Others were institutions like *Instituto Nacional de Investigación Agraria* and *Asociación para el Desarrollo Forestal* and the international organizations World Agroforestry Center and the Center for International Forestry Research;

iv) at least 226 species of Peruvian wood species had been studied. The physical and mechanical properties of 175 had been analysed, and 84 had been researched for workability, 94 for preservation and drying, and over 50 for paper production. All these studies were poorly disseminated and their utilization was limited; and

v) the major problems of the forest sector were identified as weaknesses in forest policies; the lack of forest research at the universities; inefficiencies in long-term forest development policies; a lack of national investment in science and technology; and the high taxes levied on research capital and technology transfer.

For Peru's plantation forest sector to become competitive at a regional level it will need to initiate a national program based on applied forest research. To do so, the financial support of private companies, associations and other institutions will be required. The problems related to research could be mitigated with the effective institutionalization and implementation of the national reforestation plan.

Venezuela

- *Forest policies and programs*

Venezuela's 1990 constitution clearly states a commitment to protecting the environment, biodiversity, genetic resources and ecosystems, as well as areas of special ecological importance.

The Soil, Water and Forest Law is the main legal instrument related to the use of natural resources (flora, fauna, soil and water). Its most important elements related to forests are the use of areas affected by agrarian reform, and the use of forests in the public and private domains.

Currently, the most relevant issue is the creation of a high-level committee that will establish principles for the development of a participatory process to facilitate implementation of the national forest policy.

There is no unique policy aimed exclusively at the development of forest plantations, even though the forest plantation area is very extensive and mostly government-financed.

Recently (2006), Venezuela launched the National Productive Reforestation Program) with the aims of contributing to a reduction in the harvesting of natural forests and integrating all reforestation efforts with the participation of communities. In the past, these objectives were assigned to separate organizations.

The National Productive Reforestation Program will be implemented in the period 2006–2010 and has four main phases:

i) seed collection: the aim is to collect 30 tons of seed in four years through collection expeditions;

ii) the establishment of forest nurseries, mainly in schools, institutions and communities, with the objective of producing 92 million seedlings in five years;

iii) the establishment of 150,000 hectares of plantations by 2010; and

iv) the maintenance of the plantations (medium and long-term targets).

The implementation of National Productive Reforestation Program projects will be coordinated by conservation committees comprising rural property owners, class associations, municipal committees, regional and local councils, and other institutions organized by the state under the responsibility of the Ministry of the Environment and Natural Resources (MARN). The government will oversee and finance the projects through the Agriculture, Forest and Fisheries Development Fund (FONDAFA). The program will have a strong community focus.

Three types of projects are foreseen by the National Productive Reforestation Program: (i) forest protection plantations (45,000 hectares); (ii) agroforestry plantations (60,000 hectares); and (iii) industrial/ commercial plantations (45,000 hectares).

Currently there are about 400 approved projects for reforestation using native tree species for protection purposes covering about 10,000 hectares of public land. In 2006, the government allocated a budget of US$20 million in non-reimbursable funds for forest plantations. About 25,000 hectares were expected to be reforested in 2007. Developments are also taking place in agroforestry, but very little in commercial plantations.

- *Institutional aspects*

i) *Public sector*: as in the majority of Latin American and Caribbean countries, the institutional responsibility for forests in Venezuela has been transferred a number of times, passing from one public authority to another. Forestry was initially under the Ministry of Agriculture; later it was transferred to the General Forest Administration under MARN. More recently, two institutions with some responsibilities for forestry were created: the Venezuelan Autonomous Forest Service, in 1989, and the General Forest Administration, in 1994. No changes to this institutional arrangement are expected in the next few years.

The General Forest Administration produces statistical data on natural and plantation forests and the Venezuelan forest industry on a regular basis through its forest statistics annual (*Anuario Estadisticas Forestales*).

Venezuela has a unique approach to the public administration of natural resources. In 1988 the federal government created a public company, CVG, to promote the development of forests and the timber industry in Venezuela's Eastern Region, an area amounting to 52% of the national territory. CVG also has shareholdings in *Companhia Venezuelana de Guayana* and CONARE, two other public companies. Currently, CVG-PROFORCA manages over 400,000 hectares of *Pinus caribaea* plantations in the Eastern Region under the Ministry of Primary Industry and Mining. CONARE, which operates throughout the country, is active in the establishment and management of forest plantations, especially those with native tree species.

ii) *Private sector*: several private-sector institutions are directly or indirectly involved in forest plantations, reflecting different interests.

The most important are:

- Venezuela Forest Plantation Association (ASOPLANT);
- Forest Industry Association (ASOINBOSQUE);
- National Veneer and Plywood Industry Association (ANICC);
- Venezuelan Pulp, Paper and Board Producers Association (APROPACA); and
- National Particleboard Manufacturers Association (ANFA).

Additionally, there is a large number of local and regional clubs and associations that operate within a given industrial segment and are not specific to forest plantations.

- *Incentives, subsidies and financing mechanisms*

There are many difficulties in accessing finance at a competitive cost for forest plantations in Venezuela.

Table 4.14 Characteristics of FRG financing, Venezuela

Information	Characteristics
Sector financed	Agroforestry and agribusiness, manufacturing and handicrafts, hotel, forest and forest products, mining and general services
Company size	Large enterprises, micro, small and medium companies
Use	Creation, amplification, strengthening of companies, research, technological development
Guarantees	Real estate: (1:1) equivalent/proportional real estate (1:1.5) or the criteria of FRG
Interest rate	Preferred and competitive (up to 3% per year)
Financing period	Maximum of nine years/depending on the types of specific project evaluated

Source: STCP survey, May 2006.

Table 4.15 FONDAFA financing policy

Item	Micro-company	Small-sized company (1)	Small-sized company (2)	Medium-sized company	Technological innovation
Investment limit per project (tax units – UT)[1]	350–1,000	1,000–4,500	4,500–10,000	10,000; no limit	4,000; no limit
Investment limit per project (US$'000)[2]	3.1–9.0	9.0–40.6	40.6–90.2	90.2; no limit	27.5; no limit
Owner's minimum investment	0%	10%	20%	30%	To be defined
Maximum amount financed	100%	90%	80%	70%	To be defined
Credit limit (USD 1,000)	3.1–9.0	8.1–36.6	32.5–72.2	63.2–631.6	27.5–631.6

[1] One UT is equivalent to 19,400 bolivars (VEB); [2] US$1 = VEB$2,150.
Source: STCP survey, May 2006.

This is due to the lack of a favorable investment climate for forest businesses related to a lack of judicial security and to policies on the productive use of land, particularly concerning property rights.

On the other hand, there seem to be more opportunities for the financing of forest plantations in the public sector. The strategic plan of CVG-PROFORCA (PRODEFOR III), for example, has a short-, medium- and long-term orientation towards the recovery, strengthening and growth of the forest sector through the expansion of the wood raw-material supply through plantations.

Slightly over 300,000 hectares of *Pinus caribaea* plantations are to be established during the implementation of this plan in 2006–2021; the first phase calls for the establishment of 100,000 hectares at a cost of US$83 million.

Finance is to be obtained from the Guyana Regional Fund (FRG), which supplies resources to programs and projects for the development of small and medium-sized companies. The overall goal of the fund is to improve quality of life and generate sustainable jobs in the Eastern Region. Table 4.14 shows the main characteristics of financing granted through the FRG.

Additionally, FONDAFA meets the needs of projects included in the National Productive Reforestation Plan, a plan linked to MARN. This fund is administered by the Ministry of Agriculture and Land (MAT), with the Venezuelan Central Bank as the financing agent, and has a budget of US$20 million for forest projects. Funds from FONDAFA are made available through projects previously approved by the respective authorities (MARN, MAT and others). They are non-reimbursable, but several criteria must be met to obtain access to them (Table 4.15).

- *Main timber species and sustainable production capacity*

The first forest plantations with an exotic species (*Pinus caribaea*) date from 1961 and 1965 in the north of the State of Monagas and the south of

Table 4.16 Commercial planted area, productivity and sustainable production capacity of forest plantations, Venezuela

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	104	25	2,600	28.4
Pinus caribaea	690	7	4,830	52.8
Gmelina arborea	69	25	1,725	18.8
TOTAL	**863**	–	**9,155**	**100**

Source: FAO (2006a); ITTO, STCP survey, May 2006.

Anzoátegui, respectively. They were planted to test the feasibility of establishing extensive areas on the plains. *P. caribaea* is the most planted species in Venezuela, although there are also significant areas of eucalypts and *Gmelina arborea*. Table 4.16 shows that the productivity of *P. caribaea* plantations is very poor; that of eucalypt and gmelina plantations is better.

A large majority of forest plantations were established by the public sector and were not created solely for industrial purposes. The main objectives were development in the target regions, the creation of jobs in rural areas, and the generation of non-financial benefits (eg the rehabilitation of degraded areas). These objectives have given rise to differences in silvicultural approaches.

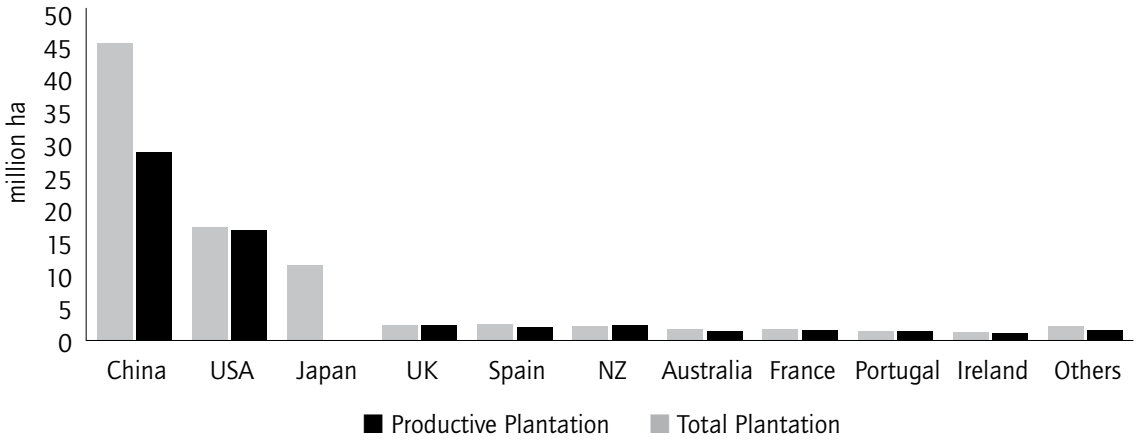
Although the area of plantations in Venezuela is significant there is no technical research and development program on the silviculture of the main species. The public forest plantations, representing 75% of the national total, have, in general, very low productivities.

Only since 2001 has attention been given to genetically improved pine seeds to suit soil and climatic conditions. Under the CVG-PROFORCA (PRODEFOR III) strategic plan, the aim is to completely reform the national forest research program.

Non-tropical ITTO consumer countries

Covering an area of about 82 million hectares (Figure 4.3 and Table 4.17), forest plantations in ITTO consumer member countries play a significant role in global wood production. A large portion of these plantations (87.5%) are found in only three countries (China, the United States and Japan);

Figure 4.3 Plantation area in top ten ITTO consumer countries, 2005



Source: FAO (2006a,b).

Table 4.17 Total and productive forest plantation area in ITTO consumer countries, 2005

#	Country	Land area ('000 ha)	Total plantation area[1] Area ('000 ha)	Total plantation area[1] Share of total area (%)	Productive plantation area[2] Area ('000 ha)	Productive plantation area[2] Share of total production (%)
	ASIA-PACIFIC					
1	China	932,743	45,083	54.8	28,530	52.7
2	Japan	37,652	10,682	13.0	0	0.0
3	Republic of Korea	12,041	0	0.0	0	0.0
4	Nepal	14,300	133	0.2	43	0.1
5	New Zealand	26,799	1,542	1.9	1,542	2.8
6	Australia	768,230	1,043	1.3	1,043	1.9
	Subtotal	1,791,765	58,483	71.1	31,158	57.6
	AFRICA					
7	Egypt	99,545	72	0.1	1	0.0
	Subtotal	99,545	72	0.1	1	0.0
	NORTH AMERICA					
8	United States	915,895	16,238	19.7	16,238	30.0
9	Canada	922,097	0	0.0	0	0.0
	Subtotal	1,837,992	16,238	19.7	16,238	30.0
	EUROPEAN UNION					
10	Austria	8,273	0	0.0	0	0.0
11	Belgium/Luxembourg	3,282	0	0.0	0	0.0
12	Denmark	4,243	341	0.4	281	0.5
13	Finland	30,459	0	0.0	0	0.0
14	France	55,010	961	1.2	961	1.8
15	Germany	34,927	0	0.0	0	0.0
16	Greece	12,890	120	0.1	0	0.0
17	Ireland	6,889	590	0.7	579	1.1
18	Italy	29,406	133	0.2	133	0.2
19	The Netherlands	3,392	100	0.1	4	0.0
20	Portugal	9,150	834	1.0	834	1.5
21	Spain	49,945	1,904	2.3	1,471	2.7
22	Sweden	41,162	569	0.7	569	1.1
23	United Kingdom	24,160	1,928	2.3	1,902	3.5
	Subtotal	313,188	7,480	9.1	6,734	12.4
	TOTAL	**4,042,490**	**82,273**	**100**	**54,131**	**100**

[1] FAO (2004); [2] FAO (2006b); Statistics for New Zealand, Australia, the United States, Belgium/Luxembourg, France, Italy, Portugal and Sweden are for total plantation area and are from FAO (2004).

countries with negligible plantations include Austria, Belgium-Luxembourg and Canada.

ITTO consumer countries have nearly half (44.1%) of the world's plantation area, but the proportion of global commercial production plantations is significantly smaller that that (29.4%). According to FAO (2006b) Japan does not have productive plantations, and only a portion of China's total plantation estate is reported as productive. Plantation productivity is highly variable between countries, species and timber end-uses.

The analysis of the status of commercial forest plantations presented in this section focuses on three ITTO consumer countries – China, Finland and New Zealand – located in different regions. The purpose is to report on the underlying policy, economic and social reform processes that have contributed to the establishment of forest plantations and the development of favorable investment conditions.

People's Republic of China

- *Forest policies and programs*

Private forest ownership was gradually eliminated after the establishment of the People's Republic of China (PRC). The first legislation related to land use was the Land Reform Act of 1950, which nationalised forest enterprises and feudal land estates. Landless farmers were granted forest ownership certificates, especially for forest land on steep terrain.

Since the Land Reform Act, several legislative changes have taken China's land tenure system towards economic liberalization and the greater participation of the private sector in forestry. Legislative reforms were initiated in 1978 and successive amendments have been applied to existing laws.

Three pieces of legislation are considered milestones in this process. First, the possibility of private firms renting forest land from collective forest lands[3] became possible through the Household Production Responsibility Scheme of 1981 (Xu et al. 2004).

Second, the Three Fix Policy, also of 1981, contributes to the assignment of forest plantation responsibilities to households by: clarifying access rights to forests; establishing rules for the utilization of private plots; and defining production responsibilities (see also below).

[3] Forest lands owned by local associations of farmers and rural dwellers.

Third, the enactment of the 1984 Forestry Law gave prominence to reforms initiated in 1978 and also introduced additional policy measures, such as the wasteland auction system, which gave private operators access to forest resources for planting and logging operations through auctions instead of grants obtained via administrative bidding mechanisms. Amendments to the Forestry Law made in 1998 provided increased flexibility to private-sector investments through a series of financial incentives and the establishment of the Forest Environment Benefit Compensation Fund (FAO 1997).

Despite these various reforms, the law continues to recognize only two categories of forest land ownership: (i) state-owned forests under the control of state forest enterprises and forest farms; and (ii) non-state forest, with various land tenure arrangements.

A number of policy measures outside the forestry institutional framework have been favorable to plantation development, including: the end of collectivization; increases in food security and agricultural production; reduced pressure for land due to increased urbanization and rural migration; new arrangements concerning land tenure; and, above all, market liberalization (FAO 1997).

Thus, without changing the core issue of the state ownership of forest lands and forest resources, reforms have acted to stimulate forest plantation development in the country.

- *Institutional aspects*

The path to the socialist market economy had three phases:

i) *planned economy phase*: in 1978–1984, structural economy reforms were directed to micro-management with the aim of introducing incentives mechanisms.

A major step towards the greater participation of the private sector during this phase was the implementation of the Three Fix Reform (3D reform), which established the principle that "trees belong to those who planted them". This process alone brought substantial changes to the Chinese forest sector. A multiplicity of arrangements emerged on the basis of cooperation between the state and rural collectives.

Another reform of overwhelming importance for Chinese forestry was the Targeted Afforestation Responsibility System. The country's leading authorities became responsible for guiding the establishment of forest plantations and, because of the National Compulsory Tree Planting Campaign,

Table 4.18 Main forest programs in China since 1978

Program	Years	Coverage (area)	Targets	Achievements to date
National Greening Campaign: the National Compulsory Tree-Planting Campaign	1987–current	–	–	27.9 billion trees planted in 1987–97
Three-North Shelterbelt Development Program	1978–2050	551 counties in 13 provinces, 40.6 million ha (50% of northern China)	Afforestation of 35.08 million ha by 2050	25.67 million ha planted by 1999
Shelterbelt Development Program along the upper and middle reaches of the Yangtze River	1989–2000	271 counties in 12 provinces	Afforestation of 67.05 million ha	4.8 million ha planted in 1989–99
Coastal Shelterbelt Development Program	1991–2000	195 counties in 11 provinces	Afforestation of 3.56 million ha	1.08 million ha planted in 1991–99
Farmland Shelterbelt Development Program in Plain Areas	1988–2000	918 counties in 26 provinces	Set standard	850 counties reached standard in the period 1988–1999
Taihang Mountain Afforestation Program	1990–2010	110 counties in 4 provinces	Afforestation of 4.0 million ha	3.28 million ha planted in 1990–1999
National Program on Combating Desertification	1991–2000	598 counties in 27 provinces	Control desertification in 7.186 million ha	Desertification controlled in 8 million ha over 1991–1999
World Bank Loan National Afforestation Project	1990–1997	306 counties in 16 provinces	High-yielding, fast-growing timber forests	1.39 million ha of plantations generated

Source: FAO (1997), adapted by STCP.

all citizens were obliged to plant trees. Moreover, a 1997 policy resolution stated that "the decline and growth of forest resources shall be a major component in assessing the political achievements of the leading official at the country level". All institutions in China were mandated to participate in the nation's forest plantation programs, and forestry performance indicators were used to measure institutional performance (FAO 1997).

ii) *planned commodity economy*: in 1985–1991, intense debates took place over the preferred direction of the economy. A shift in priorities from rural to urban areas affected the managerial functioning of businesses, including profit orientation and management practices. The opening of special economic zones was initiated. Other measures marking the period were those related to the reform of state enterprises, the forestry legal system, and forestry research zones.

iii) *long-term targets and strategy of China's reform*: the period 1992–1998 was characterized by the emergence of the market economy as a clear economic reform target; it was to be achieved by the creation and consolidation of innovative policies that focused on improving the macro/social and economic climate and market mechanisms. The General Outline for Restructuring the Forestry Economic System contained guidance on how to achieve targets for 2010 in line with a forest-industrial vision for the country.

Table 4.18 provides an overview of major forestry programs undertaken in China since 1978. These are in line with the reforms and the targets set within the PRC's national planning system (Ninth Five-Year Plan and the Plan to Year 2010). According to China's Ministry of Forestry, "this plan and program put forward the guiding principle, basic policy, goal, tasks and strategic layout for forestry development on the basis of analysis of main problems in the forestry sector and outstanding contradictions and future favorable conditions for forestry development" (Tarasofsky et al. 2005).

Another plan prepared under the Ministry of Forestry was the 1995 Forestry Action Plan for China's Agenda 21, which put forward a strategic goal and measures for forestry development and outlined a blueprint for forestry development in the new century. This plan became one of the guiding documents for the mid-term and long-term development of forestry (Tarasofsky et al. 2005).

- *Incentives, subsidies and financing mechanisms*

Forest plantations in the non-state sector have benefited from a variety of incentives, which have evolved from direct support in cash, seeds and seedlings to more sophisticated enabling mechanisms. To promote interest in forest plantations, a fund was established at the end of the 1970s with resources from taxes and fees imposed on timber harvesting and trade (Palo and Uusivuori 1999).

Bank loans for forest plantations started in 1988. Xu et al. (2004) highlighted the importance of a

Table 4.19 Categories of major forest plantation incentives in China

Incentive	Characteristics	Source/period	Target group	Impact
Financial incentives				
Investment	Cost-sharing	Government 1949–	State-owned enterprises, collectives, farmers	Large
Subsidy	Cost-sharing	Government 1949–	Collectives, farmers	Large
Low-interest loan	Cost-sharing	Government, international aid 1988–	State-owned enterprises, collectives, farmers	Large
Services				
Technical assistance	Increasing productivity	Government 1949–	Collectives, farmers	Small
Seed and seedling supply	Cost-sharing, quality control	Government 1949–	Collectives, farmers	Large
Pest and disease control	Increasing productivity and reducing risk	Government 1949–	State-owned enterprises, collectives, farms	Unclear
Fire control	Increasing productivity and reducing risk	Government 1949–	State-owned enterprises, collectives, farms	Unclear
Institutional change				
Forest tenure reform	Providing incentives for forest investment and management	Government, local community 1981–	Collectives, farms	Large
Market reform	Providing incentives for forest investment and management	Government 1985–1987	State-owned enterprises, final products	Small

Source: Xu et al. (2004), adapted by STCP.

range of incentives, subsidies and enabling measures such as institutional changes to forest tenure and market reforms. The main categories of incentives and their major characteristics are listed in Table 4.19.

The major instruments to support fast-growing plantations were:

- *public investment under state planning*: public funds earmarked for high-yielding, fast-growing plantations;
- *local investments*: direct financing by autonomous regions, provinces and counties for timber plantations, including high-yielding, fast-growing plantations;
- *forestry loans from state banks*: the transfer of agricultural funds to forest funds in search of long-term accrued interest. The state has facilitated this scheme since 1986, favoring the establishment of high-yielding, fast-growing plantations;
- *collection of refundable levies for regeneration funds*: taxes of 20–50% on log prices levied to fund afforestation projects. This practice was initiated in the Province of Fujian and replicated in several other provinces;
- *outgrower schemes through agreements between rural collectives and companies*: the rural collectives provide labor, and production outputs are earmarked for the company through a sales contract.

An important type of direct incentive that has gradually been replaced is subsidies for farmers to convert steep cropland into forests and grasslands. This subsidy was paid in the form of grain over a five-year period to induce farmers to stop cultivating in steep terrain. The incentive also included cash for land conversion and free seedlings. The incentives compensated for forgone agricultural production.

- *Main timber species and sustainable production capacity*

Table 4.20 presents data on forest plantation area and productivity. The establishment of high-yielding, fast-growing plantations is part of China's forestry strategy. Earlier efforts in this direction succeeded in the 1970s through the establishment of high-yielding Chinese fir stands (*Cunninghamia lanceolata*). Other widely planted tree species including *Pinus elliottii, Populus* spp and many species of *Eucalyptus*. China's plantations have an estimated total annual sustainable timber production capacity (industrial roundwood) of 278.9 million m^3.

According to the current National Wood Supply Strategy and its National Fast-growing High-yield Plantation Program, US$8.7 billion will be invested to establish 13.3 million hectares of fast-growing plantations. It is estimated that by 2010 China will have 20% of the world's forest plantations (60 million hectares).

Table 4.20 Commercial planted area, productivity and sustainable production capacity of forest plantations, China

Timber species	Productive area[1] ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Eucalypts	1,334	15	20,010	7.2
Cunminghamia lanceolata	5,938	12	71,256	25.6
Acacias	129	5	645	0.2
Hevea[2]	592	10	5,920	2.1
Pines	12,909	10	129,090	46.3
Other coniferous	4,559	8	36,472	13.1
Other broadleaved	3,045	5	15,225	5.5
TOTAL	**28,530**	–	**278,858**	**100**

[1] Industrial area based on Brown (2000); [2] Rubber plantations are not currently used for timber production.
Source: FAO (2000), STCP database.

High-yielding, fast-growing plantations accounted for 15% of total plantings over the period 1988–1992 (FAO 1997). Chinese fir has achieved a productivity above 15 m^3/ha/year; the average MAI of clonal poplar (*Populus* spp) plantations is 22 m^3/ha/year. More than three-quarters of production is from conifer plantations.

The success of plantations in Chinese forestry is attributable, in part, to national efforts in forestry research. The Chinese Academy of Forestry, which comprises 14 institutions and has a qualified research staff of 2,000 people, is the country's main forest research institution.

There are also more than 50 forest research institutions at the provincial level with a total of 6,500 researchers and 182 forest research institutions at the prefecture level with a staff of 4,000. In addition there are over 250 independent forest research institutions. Forest research is supported by a network of 29 ministerial laboratories housed at various research institutions and universities. Technical development is organized into five experimental regions at the prefecture level and 35 experimental or demonstration regions at the national level.

Finland

Forestry is an important pillar of Finnish economic, social and cultural life; forests occupy an area of 26 million ha, which is about 86% of the country, and serve multiple purposes. Although Finland does not officially register forest plantation area, and is shown in FAO (2006b) to have negligible plantations, it has long practiced enrichment planting in natural forests using indigenous tree species, which has led to a significant increase in wood production. A portion of its forest estate can therefore be classified as plantation.

Table 4.21 shows that Finland has about 5.5 million hectares of forest plantation under this classification, which is 20.9% of the total forest area; the area includes forests established through seeding and planting and plantations established on agricultural land (Metla 2007).

Figure 4.4 shows total annual forest regeneration and planting in Finland over the period 1970 and 2005. Towards the end of the period the proportions being planted, seeded and regenerated naturally had stabilized.

- *Legislation and policies related to forest plantations*

Forest-related legislation in Finland focuses on wood production and environmental conservation. It is broad in scope, applying sustainability principles and the requirements of the European Union and international conventions and legislation. Reformed in the 1990s, it includes the following important instruments:

i) the *Forest Act*, enacted in 1997: this is a major milestone in Finnish forestry. It encompasses all activities in private and state-owned forests and prescribes responsibilities for government and the private sector. In a broad sense it sets parameters for harvesting methods, regeneration and the conservation of biodiversity;

ii) the *Sustainable Forestry Financing Act* was issued in 1997. This focuses on: guaranteeing the sustainability of wood production; maintaining biological diversity; and managing forest ecosystems. The Act has opened a window for supporting environmental conservation by landowners, when previously the focus was predominantly on wood production;

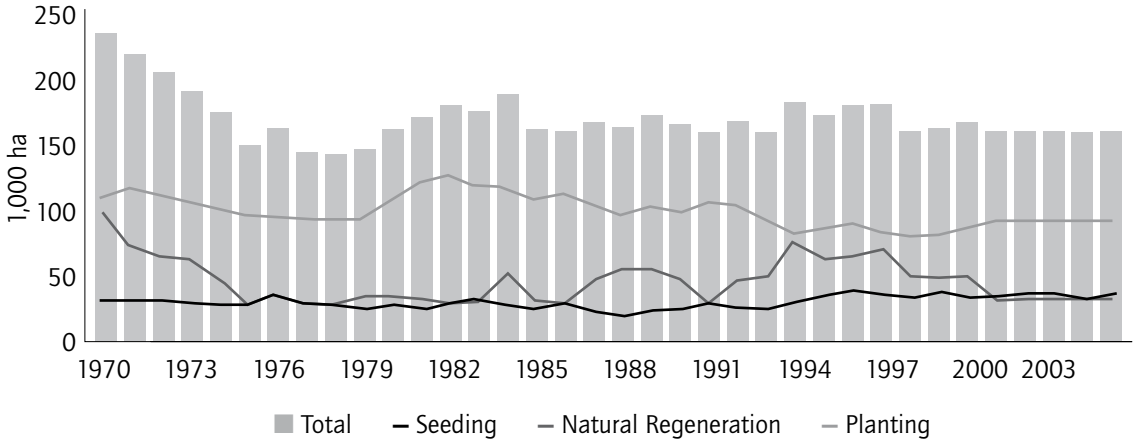
iii) the *Nature Conservation Act* enacted in 1997. Its objectives are to: maintain biological diversity; safeguard the natural heritage (landscape and natural beauty); strengthen the sustainable use of natural resources and natural environments; increase knowledge on nature and general natural history; and improve research on nature. The Act also sets out conditions for the utilization of

Table 4.21 Forest area in Finland, 2003

Type	Area ('000 ha)	% of total forest
Natural forests[1]	20,100	78.4
Forest plantations[2]	5,528	21.6
Total forest area	25,628	100

[1] Considered as forest land; [2] Considered as artificial regeneration.
Source: Metla (2005, 2007), adapted by STCP.

Figure 4.4 Total annual forest regeneration and planting in Finland, 1970–2005



Note: Natural regeneration area is the area of seed-tree and shelterwood fellings.
Source: Metla (2007), adapted by STCP.

forests and the expropriation of forests to protected areas. The application of this law has been impaired by the limited financial resources available for compensatory measures;

iv) the *Act on Environmental Impact Assessment* enacted in 1994 and amended in 1999. It targets peat land areas in excess of 150 hectares and non-fragmented forests greater than 200 hectares in size and is also applied to control the removal of trees and the regeneration of exotic trees; and

v) the **Income Tax Act**: forest increment was previously taxed but the current system is based on net revenue from forestry operations.

The implementation of Finnish forest policies is marked by the coordination of national institutions and civil society including national, provincial and local forest-owner associations. The responsibility for enforcement is trusted to regional forestry centers and involves minimal red tape and sanctions. The emphasis of the forest policy is on facilitating consensus between interested parties.

Since 1960 forest plantations and regeneration in Finland have been supported by national forest programs, with a main focus on forest production and initiatives to encourage financial investment. Between 1964 and 1975, three important programs – on forest planting, silviculture and infrastructure investments – were formulated and their implementation initiated with the support of the World Bank (Palo and Uusivuori 1999).

- *Institutions and programs*

Forestry is the responsibility of the Ministry of Agriculture and Forestry. The Ministry of Environment is responsible for environmental conservation.

The Forest and Park Service (Metsähallitus) is responsible for state-owned forests and protected areas. It is also responsible for generating revenue for the state, providing jobs for local communities, and environmental protection. Metsähallitus has a large degree of financial autonomy, generating net revenue for the state through the sale of logs, seedlings and permits for hunting and fishing on forest lands.

On the other hand, forest production is fully supported by the state and by Finnish society in general. National, regional and local associations of forest owners encourage sustainable forest development, contributing strongly to the development of sound forest-related legislation, forest policies and forest law enforcement. The Tapio Forestry Development Center is responsible for the technical development of silviculture for SFM, including the auditing and monitoring of forestry practices.

The regional forest centers are independent organizations financed partly by taxes and partly by fees charged for services, while Tapio is their coordinating organization for development work. The state acts more as a facilitator in support of the oversight of legislation and policies.

The current national forest program was launched in 2001. It is structured around 23 proposals that are continuously analysed and revised according to changes in the operating environment. By and large, forest planning based on successive national forest programs since the 1960s has been successful; timber production levels would be significantly lower without them (Palo and Uusivuori 1999).

- *Incentives, subsidies and financing mechanisms*

Together with official timber markets, public policies have created appropriate conditions for forestry investments. Direct incentives have been provided in the form of subsidies and soft loans for forest improvements, including regeneration.

An important aspect of the incentive system is taxation, which allows the deduction of all costs from taxable revenue and provides tax relief for owners who have bought forest property. Subsidies cover some silvicultural activities and biodiversity conservation; other environmental conservation support is also available for the pre-commercial thinning of young stands. Financial support covers 60–70% of the total costs depending on the activity. Loans for road maintenance and drainage are planned over a period of twelve years.

- *Main timber species and sustainable production capacity*

Finland's boreal forests have a low diversity of forest species, only a few of which – the conifers Scotch pine *(Pinus sylvestris)* and Norway spruce *(Picea abies)* and the hardwoods birch *(Betula* spp*)* and aspen *(Populus tremula)* – are utilized to any great extent. The climate restricts the range of exotic species suitable for forest plantations, and mostly only native species are used, although trials with *Pinus contorta* and *Larix* spp have been reported. Forest rotations are long, varying between 60 and 120 years for coniferous species and 60 and 80 years for birch.

Forest land classification in Finland is defined by the Forest Research Institute of Finland (Metla; Metla 2007) based on three main classes according to site productivity:

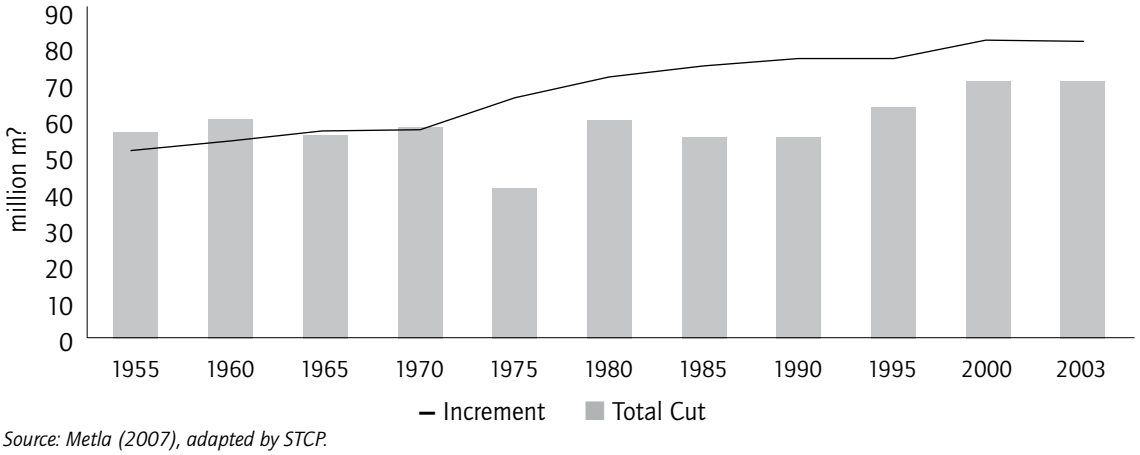
- forest land: MAI is at least 1 m^3/ha/year;
- Scrub land (unproductive forest land): MAI is between 0.1 and 1 m^3/ha/year;
- Waste land: MAI is less then 0.1 m^3/ha/year.

'Forest lands' cover over 20 million hectares. Scrublands are estimated to cover 6 million hectares. Gains in productivity were achieved between 1950 and 1980 through the drainage of peatlands and their transformation into productive forest land.

The total standing volume of Finnish forests is 2.0 billion m^3 and the total annual wood increment in 2003 was estimated to be slightly over 80 million m^3 in 2003, increasing to 100 million m^3 in 2006 (Metla 2007). Figure 4.5 shows that the total growing stock has been increasing since at least 1955 and the total cut has been growing since 1975.

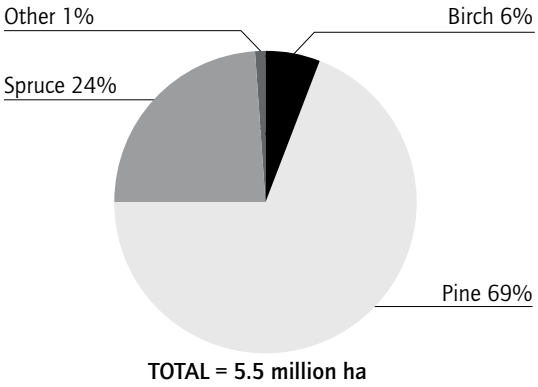
Metla is the main public institution conducting forest research in the country. An independent organization

Figure 4.5 Total annual forest increment and removals, Finland



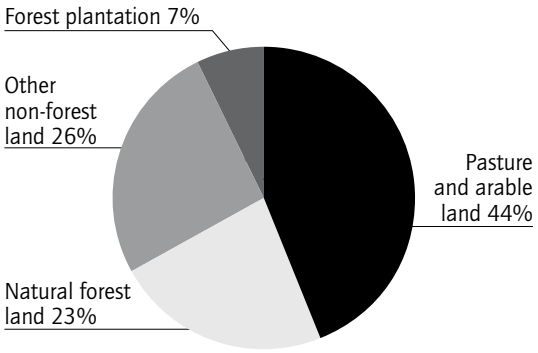
Source: Metla (2007), adapted by STCP.

Figure 4.6 Forest species in forest plantations, Finland



Source: Metla (2007), adapted by STCP.

Figure 4.7 New Zealand land use



Source: MAF (2006), adapted by STCP.

under the jurisdiction of the Forestry Department of the Ministry of Agriculture and Forestry, it has two research centers and seven research stations.

Over the years, forest owners have tended to favor forest plantation methods for re-establishing their forests because of the availability of improved seedlings, the possibility of higher yields through fertilization, and access to improved management methods. Forest planting on former agricultural fields has also been promoted by the government to boost wood production. These include forest plantations on arable fields, which have already exceeded 235,000 hectares (Metla 2007).

Figure 4.6 shows the mix of forest species in plantations in Finland. Pines account for 68% of the total, followed by spruce (24%); birch and other minor species account for the remainder.

Table 4.22 gives an indication of the potential productivity of forest plantations (or areas managed under forest planting), taking into account the total estimated area of each species used under the plantation regime and their estimated MAIs. The MAIs of Finnish forests, whether planted or naturally regenerated, increase from north to south, and vary from 1 m^3/ha/year to 5 m^3/ha/year.

The estimated total sustainable production capacity for forest under a planting regime in Finland is 15 million m^3/year, representing about 17% of the country's total annual cut (estimated at 82 million m^3/year). Yields are broadly representative of Finnish ecological and climatic conditions and could be increased somewhat with more intensive soil preparation and silvicultural practices. Silviculture treatments like pre-commercial thinnings, however, often lag behind the target. This is a major concern for the forest sector and a central issue in forestry planning and research.

New Zealand

The development of New Zealand's forest plantation sector is widely regarded as a success story. According to the Ministry of Agriculture and Forestry (MAF 2006) the total plantation area in 2005 was 1.8 million hectares, which was 7% of the total land area (27 million hectares, Figure 4.7).

Table 4.22 Commercial planted area, productivity and sustainable production capacity of forest plantations, Finland

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Pines	3,575	2.5	8,937	58.3
Spruce	1,320	3	3,960	25.9
Birch/other	605	4	2,420	15.8
TOTAL	**5,500**	–	**15,318**	**100**

Source: Metla (2007), adapted by STCP.

The successful development of New Zealand forestry has been made possible by government efforts to establish a sound policy environment for large-scale forest plantations, providing incentives for the industry and technological support through research and development programs.

- *Legislation and policies related to forest plantations*

The development of legislation and policies related to forest plantations can be divided into two distinct periods.

Early on, a fear of natural forest depletion led to the creation of a state forestry service and the adoption of policies promoting industrial forest plantations. This period was characterized by a gradual change in the perception of wood and forests as renewable resources and in the attitude among settlers that forests were an obstacle to agriculture development (FAO 2006a). By recognizing the importance of forest plantations in the face of the inability of native forests to meet the country's needs, the government played an important role in this initial phase.

The second period involved revisions to legislation that led, over time, to the establishment of an integrated forestry administration, a well-funded research program, a wide range of direct and indirect forest incentives and, above all, government initiatives to demonstrate the relevance and viability of commercial forestry. In recent years, forest plantation legislation and policies have been aligned with the overall growth and transformation of New Zealand's economy.

Rhodes and Novis identified five periods in the development of New Zealand plantation forestry (FAO 2004):

i) *large-scale government planting* (1919–1938): this 'experimental' phase led to the expansion of *Pinus radiata* research, together with subsidies and other types of incentives;

ii) *consolidation and focus on utilization* (1939–1958): in response to a lack of market acceptance of radiata pine plantation timber, the New Zealand government prioritized research on wood utilization, later expanding it to include wood processing;

iii) *planting partnerships and developing an export industry* (1959–1984): this period was marked by policies designed to replace loans with a grant scheme, under which grants were equivalent to 50% of plantation costs. Other policy initiatives were also introduced, including allowances for income-tax deductions from investments in forest plantations, taxation relief for forestry income, and the application of special bank accounts. The impacts of such policies were clearly reflected in growing investments: the area of forest plantation increased three-fold over the period, reaching 1.0 million hectares;

iv) *end of subsidies and removal of disincentives* (1984–2000): The need for incentives was questioned and another path adopted, leading to the removal of disincentives such as agricultural subsidies, tariffs, price controls and import licenses. Forest planting was understood as an investment in which government action should only facilitate the rules of an efficient market; and

v) *post privatization* (2000–2006): during this period, New Zealand society and the government became more aware of the economic importance of forest plantations. Provisions were made to maximize the value of wood resources through the implementation of integrated strategies. Other characteristics of this phase were: recognition of the importance of commercial forest plantations by environmental groups as 'an essential source of perpetually renewable fibre and energy offering an alternative to the depletion of indigenous forests'; certification, which currently covers half the country's plantations under the Forest Stewardship Council's scheme; and land settlements of indigenous Maori peoples, according to the Treaty of Waitangi, which will gradually transfer state forest plantations to Maori jurisdiction to the point where Maori people will own nearly 41% of the resource.

- *Institutions and programs*

A large number of institutions are involved in forestry and forest plantations in New Zealand. Policy enactment and enforcement is the responsibility of the Ministry of Agriculture and Forestry (MAF), which works with other government departments to provide information that promotes and facilitates sustainable resource use. MAF also provides policy advice to the government on the trading environment and the regulation of product safety, biosecurity and related matters.

Some of the major institutions linked directly to forest plantations are:

- *New Zealand Forest Owners' Association*: this was formed in the 1920s to promote the establishment of productive planted forests. Today its members

Box 4.2 Use of enabling incentives, New Zealand

A number of developed countries, including New Zealand, are paying increased attention to enabling incentives rather than the provision of tangible encouragement in the form of direct incentives for economic activities, including forest plantations. Governments have worked to remove structural obstacles and develop appropriate conditions for forest plantation investments – the 'business climate'. In many countries one of the major emphases has been on 'enabling incentives' that focus on downsizing obstacles and barriers and facilitating the operational environment. Actions include improving governance, clarifying tenure arrangements, providing research and technical assistance, and enabling access to well-established product markets. Actions such as these often have a greater positive influence on the sector than do direct incentives (such as free seedlings, subsidized credit or the sharing of planting expenses).

New Zealand has been at the forefront in developing an enabling environment for plantation investment, particularly by improving infrastructure (e.g. roads, railways, modern port facilities, hydroelectric power stations), which facilitated large-scale processing initiatives based on plantation timber. These public-sector investments encouraged private-sector investors by demonstrating the commitment of government to supporting the establishment of a feasible forest plantation sector and the development of wood-processing industries.

Source: FAO (2004).

own or manage more than 80% of New Zealand's forest plantations. The Association is dedicated to the promotion and strategic positioning of commercial plantation forests, particularly of radiata pine. Eight committees deal with: communication; education/training and safety; fire prevention; forest health; forest resources and environment; research; taxation/finance and valuation; and transportation;

- *New Zealand Farm Forestry Association*: this has 29 branches throughout the country. Membership is diverse, comprising farmers, foresters, urban dwellers who own rural land, small landholders, tree enthusiasts, and others interested in farm forests for reasons such as lifestyle, investment, research and production. Members own over 200,000 hectares of forest and grow a range of special-purpose timber species, including radiata pine;
- *New Zealand Institute of Forestry*: this is the national body representing the forestry profession. It is committed to promoting the practice of forestry and serving the wider community through education, accountability, and its code of ethics and performance standards.

Other institutions that are associated to some extent with plantation timber, mostly linked to the wood-processing industry, includes the New Zealand Timber Industry Federation, the New Zealand Forest Industries Council, the New Zealand Pine Manufacturers' Association, the Forest Industry Engineering Association of New Zealand, and the New Zealand Imported Tropical Timber Group.

- *Incentives*

Forest plantation incentives were first conceived in New Zealand in the 1800s, when the Forest Tree Planting Encouragement Act, 1871, granted two acres of land to farmers for each acre they planted (FAO 2004). Measures have also included the provision of cash for forest management and tree-planting, government subsidies for plantation establishment, and a forest fund to support plantations.

Recent policy development has focused more on enabling policy measures and instruments than on direct incentives. This is illustrated by the partnership between government and the private sector that was established through the Wood Processing Industry Strategy, the main purpose of which is to improve investment options in value-added wood processing (Box 4.2).

New Zealand has applied a series of clearly targeted and highly effective measures to develop the plantation sector. These include:

- *the deregulation of the economy and the end of direct subsidies*: these measures helped ensure that the plantation-based forest industry became efficient, market-oriented and internationally competitive;

Table 4.23 Commercial planted area, productivity and sustainable production capacity of forest plantations, New Zealand

Timber species	Productive area ('000 ha)	MAI (m^3/ha/year)	Sustainable production capacity	
			'000 m^3/year	% of total production
Radiata pine	1,611	25	40,275	91.5
Hardwoods	51	15	765	1.7
TOTAL	**1,811**	–	**44,020**	**100**

Source: MAF (2006), adapted by STCP.

- *imposing a lower degree of political interference*: the introduction and development of clear-cut rules provided a stable economic climate and sent positive messages about the regulatory framework. Companies could focus more on their competitive merits and became less prone to risk;
- *the privatization of state-owned plantations*: this secured access to wood resources, allowed the management and utilization of the resources according to market-based rules, and protected private companies from conflicting and constantly changing political objectives;
- *the development of effective working relationships between the forest and agricultural industries, as well as the forest industry and the environmental movement*: this led to a better understanding between groups, and varying degrees of support for the objectives of each group; and
- *the compilation and publication of high-quality forest industry statistics, wood-supply forecasts and other forestry information, often through joint initiatives of government and the private sector*: these are essential for good policy development, short-, medium- and long-term planning, and the monitoring of the ongoing development of the industry (Rhodes and Novis 2002).

New Zealand's forest plantation development shows the value of establishing the right political and economic climate. The New Zealand experience can help in the establishment of a similar climate in other countries, although the specific policy initiatives and realities of each country should always be taken into account.

- *Timber species and sustainable production capacity*

Introduced to New Zealand from the United States in the early 20th century, radiata pine is the dominant exotic forest plantation species, constituting 90% of all forest plantations in New Zealand. The plantation area has increased continuously since 1930, although the rate slowed during the Second World War. The total planted area increased more than threefold between 1970 and 2005, from 500,000 hectares to about 1.8 million hectares. Minor species are Douglas fir (*Pseudotsuga menziensii*), eucalypts, and other hardwoods, which comprise 6%, 2% and 1% of the total planted area, respectively.

Radiata pine is commonly felled between 26 and 32 years and, as a result, few plantations are older than 32 years. Yields are high, with an MAI of 25–30 m^3/ha/year. Table 4.23 shows that the estimated sustainable production capacity of New Zealand's forest plantation estate is around 44 million m^3/year.

Scion (formerly Forest Research and, before that, the New Zealand Forest Research Institute) is the main provider of research on forest-related research. It receives funding from both government and industry and is organized into overlapping 'portfolios' grouped into: manufacturing technologies seeking to develop methods of processing logs into high-value products; and sustainability and risk, with two related goals: developing a sustainable forestry, wood- and fibre-processing industry, and implementing risk evaluation and management strategies.

Another institution, Future Forests, develops state-of-the-art tree improvement and novel gene technologies, with a particular focus on enhancing strength, stiffness and stability. Forest Industries Training was set up in 1991 under the Industry Training Act, absorbing several forestry training and education organizations.

5 CASE STUDIES

This chapter covers three case studies of experiences related to industrial forest plantations. The lessons learned from these can inform the development of new programs and actions geared to stimulating and developing forest plantation activity in the tropics as a way of improving social, economic and environmental conditions.

Case study 1: commercial teak plantations

This case study examines teak (*Tectona grandis)* forest plantations, which have been established successfully in several tropical countries across the three tropical regions.

It is estimated that the total global planted area of teak is around 6 million hectares, making it the third most planted hardwood species in the tropics. In some countries, such as India, teak is the most planted species.

Teak has long been cultivated in pure plantations. Productivity can be high and the timber is valuable. Moreover, the species has few problems with blights and pathogenic agents, especially when compared with other high-value species such as mahogany (*Swietenia macrophylla*) and cedar (*Cedrella odorata*), which in some regions are subject to potentially devastating attack by the wood borer *Hypsipyla grandella*.

The productivity levels achieved by teak are generally higher than those achieved by mahogany and cedar. The species has been introduced to several countries and has shown an ability to grow well in diverse climatic and soil conditions.

High-grade teak timber can obtain prices of US$4,500/m³ or more. The timber has a high natural resistance to insects and fungi, is very stable and easy to process and dry, and is highly valued for its appearance. These characteristics make teak a uniquely valuable timber that can be used in a wide range of applications.

History and recent developments

The first records of teak utilization date back to the fourth century A.D., when large quantities of the timber were exported from India to Yemen for the construction of palaces, temples and ships. Later, when the Portuguese navigators arrived in India, teak was used to construct their caravels. The species was important for ship construction at that time because ships made from European timbers were heavily attacked by sea wood borer when they sailed in tropical waters.

Based on the existing register, the first teak plantation was established in 1680 when the species was introduced to Ceylon (today Sri Lanka). There is some indication, however, that plantations were established much earlier – during the seventh century – in Java (see below).

Owing to its extensive use in the marine industry and with the aim of guaranteeing the future supply of teak timber for its navy, the British Empire began planting teak in India, its colony, in the 18th and 19th centuries.

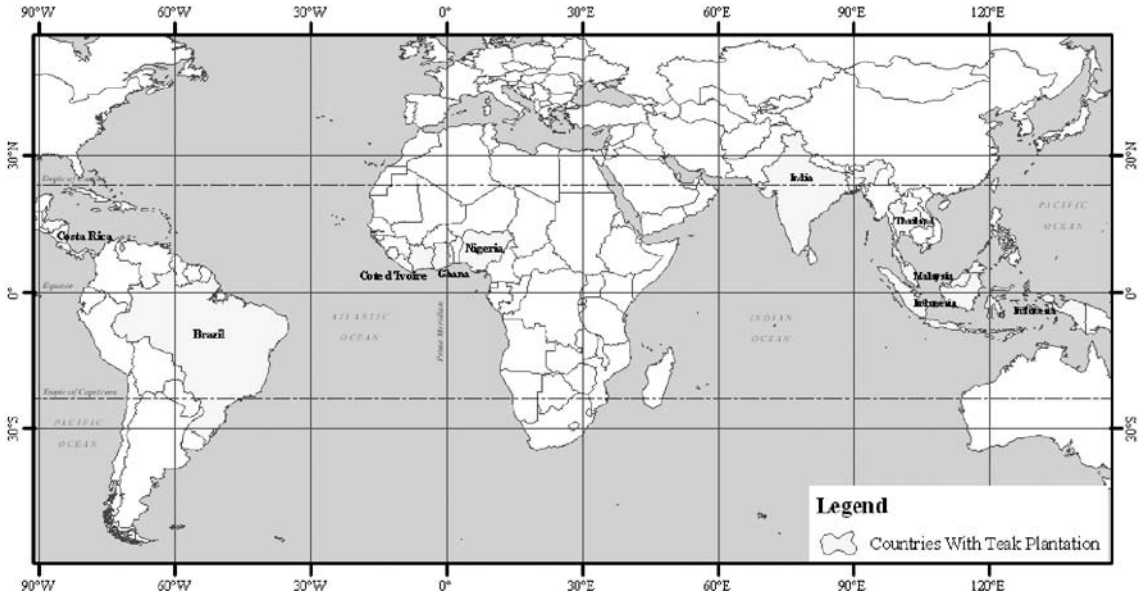
In Java and on other small islands in Indonesia, large-scale plantations began around 1880 and by 1970 the estate had grown to 0.9 million hectares. These were grown by farmers using an agroforestry system called *taungya*, which consisted of planting trees in the midst of traditional agricultural crops such as rice and cotton. This technique is still used today in some parts of Southeast Asia. Teak was introduced to Latin America and the Caribbean in the late 1800s. According to existing records the first specimens were grown in the Royal Botanical Gardens in Trinidad. Commercial plantations in the region were first established in 1913, initially to meet the demand for fuelwood for the boilers of sugar mills and brick factories.

The cultivation of teak began in Africa in 1902, when seeds brought from India and Myanmar were grown in Nigeria. In 1905, teak was introduced to Ghana, which today has about 40,000 hectares of commercial teak forests. Teak was planted in Côte d'Ivoire in 1927 with seeds obtained from plantations in Togo.

The area of teak plantations expanded in the tropics after World War II, particularly in the 1960s and 1970s, after small plantations were introduced to Florida and Hawaii to test the suitability of the species. In the same period, the first commercial plantations were established in Brazil in the State of Mato Grosso.

Compared to the rest of the tropics, teak plantations have spread slowly in Latin America and the Caribbean: by the end of the 1970s there were only 12,000 hectares

Figure 5.1 Main countries with teak plantations



Source: STCP.

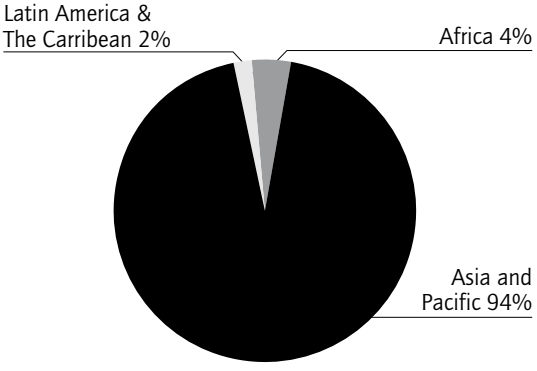
in the entire region. The growing international demand for teak timber, however, coupled with restrictions on the harvesting of native forests, has increased the interest of investors in the region in this species. Costa Rica and Brazil in particular have been able to attract foreign investors to finance large-scale teak plantations. Brazil now has more than 50,000 hectares and the planting rate is accelerating. Even so, given the potential for teak in the region the area of plantation there is modest.

Main plantations and geographic distribution

Teak occurs naturally in India, Myanmar, Laos and Thailand. In Indonesia there is still some debate over whether the species is native or was introduced perhaps about 600 years ago. Significant teak plantations are now found in all three tropical regions (Figure 5.1), although most is in Asia and the Pacific (Figure 5.2).

India's teak plantations account for 43% of the world total. Indonesia has the second-largest area (1.47 million hectares, or 25%), followed by Thailand (836,000 hectares, or 14%). Combined, these three countries account for more than 86% of the plantations of the Asia-Pacific region and more than 80% of the world total; other countries in the region with plantations are Malaysia, Cambodia, Myanmar, Fiji and Papua New Guinea. Table 5.1 presents information on the areas planted to teak in the main tropical countries.

Figure 5.2 Distribution of commercial teak plantations, by tropical region, 2005



Source: STCP database and other sources.

It is worth noting that not all this total is considered productive. Significant areas of teak plantation, mainly in some Asia-Pacific countries, especially India, are reported to be non-industrial. For the purposes of this study, however, the total commercial area was assumed to be the planted area as reported in official statistics.

In Africa, the commercial teak plantations are concentrated in Nigeria, Côte d'Ivoire and Ghana (covering almost 3% of the world's teak plantation estate or 163,000 hectares). Latin America and the Caribbean has a total of 133,000 hectares.

Table 5.1 Commercial teak plantation area in the main tropical countries, 2005

Country	Commercial teak plantation area ('000 ha)	Share (% of total area)
India	2,561	42.9
Indonesia	1,470	24.6
Thailand	836	14.0
Others	726	12.2
Subtotal Asia-Pacific	5,593	93.6
Nigeria	70	1.2
Côte d'Ivoire	63	1.0
Ghana	40	0.7
Sudan	25	0.4
Others	51	0.8
Subtotal Africa	249	4.2
Brazil	50	0.8
Costa Rica	30	0.5
Others	53	0.9
Subtotal Latin American & Caribbean	133	2.2
TOTAL	**5,975**	**100**

Source: STCP database and other sources.

Current situation

Teak has an estimated 75% share of the global high-value tropical timber trade, a share that could increase were sufficient supply available. This makes teak a very interesting option for investors.

A combination of investments in genetic improvement and developments in silviculture and management practices has increased the productivity of teak plantations. Table 5.2 shows teak plantation productivity in selected countries. In Brazil, for example, teak plantations have an MAI of 9–15 m³/ha/year, a relatively high MAI for a high-value timber. Nigeria reports the highest productivity – up to 20 m³/ha/year.

Since genetic research and silvicultural development are still in their incipient stages it is possible that yield could be further increased, especially in Asia and Latin America.

For a number of political and economic reasons, investments in teak plantations have declined in recent decades in many countries, especially in Africa, and few efforts have been made to improve forest practices or the productivity of existing plantations. On the other hand, in countries where the investment climate is more favorable, investment to expand and improve the quality of teak plantations is expected to continue. The following additional points can be made:

Table 5.2 Mean annual increment of teak plantations in selected countries

Country	MAI (m^3/ha/year)
Brazil	9–15
Costa Rica	7–15
Ghana	3–8
India	4–9
Indonesia	4–11
Thailand	4–9
Nigeria	6–20
Côte d'Ivoire	8–15

Source: FAO (2000), STCP database and other sources, ITTO (2005), adapted by STCP.

- public polices now tend to provide incentives for plantations, so teak plantation investment is coming more from private sources than the state, which has been the main investor in the past;
- restrictive legislation will continue to reduce harvesting in natural forests and plantations will gain market share;
- the market demand for teak timber is increasing and the price is expected to continue to be attractive; and
- there is growing environmental pressure from consumers in favor of plantation timber.

Table 5.3 presents the estimated global sustainable production capacity of teak plantations. The countries shown in the table have a total production capacity of 31.3 million m³ of teak roundwood per year, which is 7% of the total volume of tropical timber harvested globally. India, Indonesia and Thailand together have an estimated sustainable production capacity of 24.3 million m³ per year (78% of the world total).

Almost as important as volume is the quality of the wood. In general, Asian plantations produce a denser, darker and more uniform wood than those in Brazil and Costa Rica, probably because rotations are between 80 and 120 years in Asia and 25–30 years in Latin America. As a result, the products obtained are different, with logs produced in Asia tending to capture a higher price.

Main challenges

The main issues for the future supply of teak are related to: (i) environment and governance; (ii) the credibility of investors; and (iii) genetic and silvicultural improvements. These aspects are discussed below.

i) Environment and governance: for many years, natural-forest teak was harvested at an unsustainable rate, which drastically reduced stocks and led to debate over teak management and harvesting restrictions. Today only Myanmar manages its natural teak forests for timber production. Environmental problems have also been detected in old teak plantations, mainly in Asia, where inappropriate harvesting practices have created serious environmental problems, including:

- the physical and chemical degradation of the soil, with the consequent loss of nutrients and fertility;

Table 5.3 Sustainable production capacity of teak plantations in the major tropical countries, 2005

Country	Commercial planted area ('000 ha)	MAI (m^3/ha/year)	Sustainable production ('000 m^3/year)
India	2,561	5	12,805
Indonesia	1,470	5	7,350
Thailand	836	5	4,180
Others	726	4.5	3,267
Subtotal Asia-Pacific	**5,593**	–	**27,602**
Nigeria	74	9.5	1,260
Côte d'Ivoire	66	11.3	756
Ghana	40	15.0	200
Sudan	25	4	100
Others	51	4	204
Subtotal Africa	**256**	–	**2,353**
Brazil	50	9	450
Costa Rica	30	13	390
Others	53	10	530
Subtotal Latin American & Caribbean	**133**	–	**1,370**
TOTAL	**5,982**	–	**31,325**

Source: FAO (2000), STCP database and other sources.

Box 5.1 Fiji's experience with forest plantations

Compared to most other Pacific Island nations, Fiji has a sizeable plantation area and an advanced wood-processing industry, despite significant issues surrounding land tenure. Timber has become Fiji's third-largest export commodity, accounting for 2.5% of Fiji's GDP. The forest sector is an important generator of revenue, with royalties providing important income for rural communities.

Softwood plantations in Fiji mostly comprise *Pinus caribaea*, which, in 2005, covered 46,000 hectares and supplied 260,000 m^3 of roundwood. An interesting aspect of timber plantations in Fiji is the increasing importance of plantation mahogany (*Swietenia macrophylla*) to Fijian trade. Since World War II over 50,000 hectares of mahogany have been established in the country. Close to 18,000 hectares of plantations are ready for final cut and could generate considerable revenue; sawnwood mahogany is quoted in international markets at US$1,320 per m^3.

Sources: ITTO (2005).

- the degradation of forest lands; and
- the emergence of blights and diseases in remaining plantations.

The challenge now is to reduce the impact of harvesting in intensively cultivated areas. This will requires investment in research and development, which in tropical developing countries is not always available.

Discussions relating to governance are mostly focused on illegal logging and illegal trade. The problem is exacerbated by failures in the monitoring and control system but can also be aggravated by poor law enforcement.

ii) Investor credibility: in the 1980s some companies took advantage of the high price of teak and misinformation among investors to raise funds from foreign investors by promising unrealistic returns. This created high expectations that were not met and, as a result, teak investment funds lost credibility. It took some time for teak plantation ventures to recover credibility, but some investors are still reluctant to invest in them.

iii) Genetic and silvicultural improvements: despite encouraging growth rates in countries like Brazil, Ghana and Costa Rica, most teak plantations still have a relatively low productivity. There is a need to invest in genetic research, silviculture and plantation management practices in order to increase productivity and wood quality.

Outlook

The outlook for industrial teak plantations in the tropics is good. Better than most other species, teak combines two essential elements: productivity (ie it is fast-growing) and high-quality timber. Moreover, the species performs well under a wide variety of climatic and soil conditions.

The growing market for plantation timber will favor teak plantations in the future. A reduction in the supply of timber from natural forests and associated increases in price and the environmental concerns of consumers will be the main driving forces that promote plantation timber in international markets. Moreover, technological developments will reduce the differences in wood quality between native long-rotation plantation teak timber and that produced in fast-growing, shorter-rotation plantations.

As the supply of plantation timber increases, a significant challenge for teak growers and investors will be to work with the industry to obtain and retain high-value markets for superior timber products.

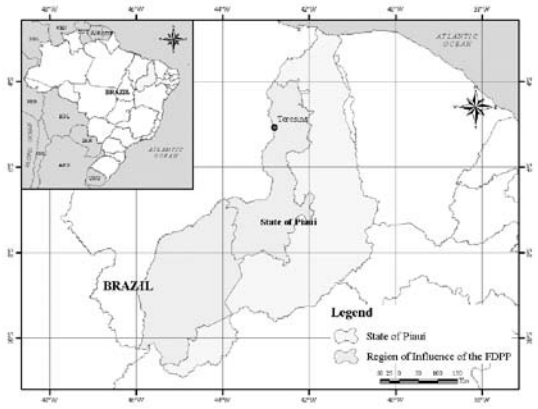
Teak is not the only high-value plantation success story in the tropics: Box 5.1 describes Fiji's experience with mahogany and Caribbean pine.

Case Study 2: Piauí Forest Program, Brazil

The Government of Piauí, a state in northern Brazil, recently established the Forest Development Program of Piauí (FDPP), an innovative program based on forest plantations.

Piauí is the tenth-largest state in the country, accounting for 2.9% of the national territory (Figure 5.3). It has one of the country's lowest human development indices and has therefore attracted special attention from private and government institutions committed to local development.

Figure 5.3 Location of Piauí and the region of influence of FDPP



Source: STCP.

Forestry development is still in an initial stage in Piauí. The FDPP could be a path for economic development that encompasses both social advancement and environmental responsibility.

Recent developments

Government agencies have been in charge of sectoral regional and development projects in the basins of the San Francisco and Parnaiba rivers since the 1930s. The Development Company of the San Francisco and Parnaíba Valleys (CODEVASF) was created in 1974 by the merging of the Commission of the San Francisco Valley and the Supervision of the San Francisco Valley. The agency has the objective of promoting the development of the San Francisco and Parnaíba river basins through the sustainable use of the region's natural resources and the organization of productive activities for poverty alleviation and economic and social integration.

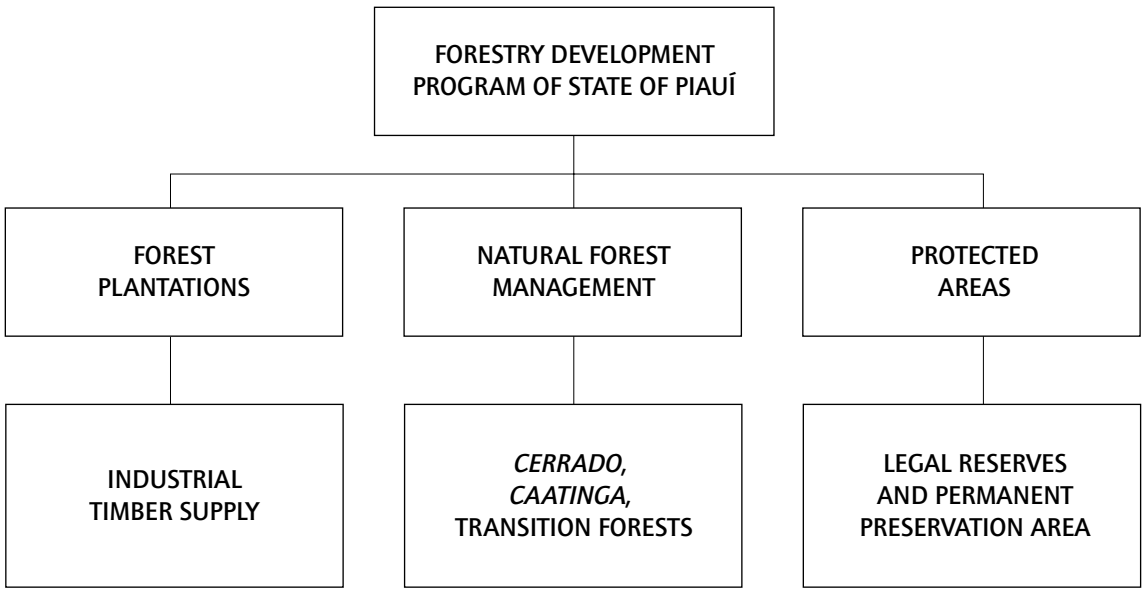
CODEVASF commenced operations in the Parnaíba River basin in January 2000 with an operational mandate over an area of 330,000 km² (including parts of two states – Maranhão and Piauí). CODEVASF coordinates and implements agribusiness farming districts and basic sanitation works, electrification and transportation, either directly or through contractors. In the Parnaíba River basin, it carries out studies to support the formulation of the Plan of Action for the Integrated Development of the Parnaíba Valley (PLANAP). For this purpose the company has received significant technical and financial contributions from various international institutions.

Geographical area of the FDPP

Forestry Development Program

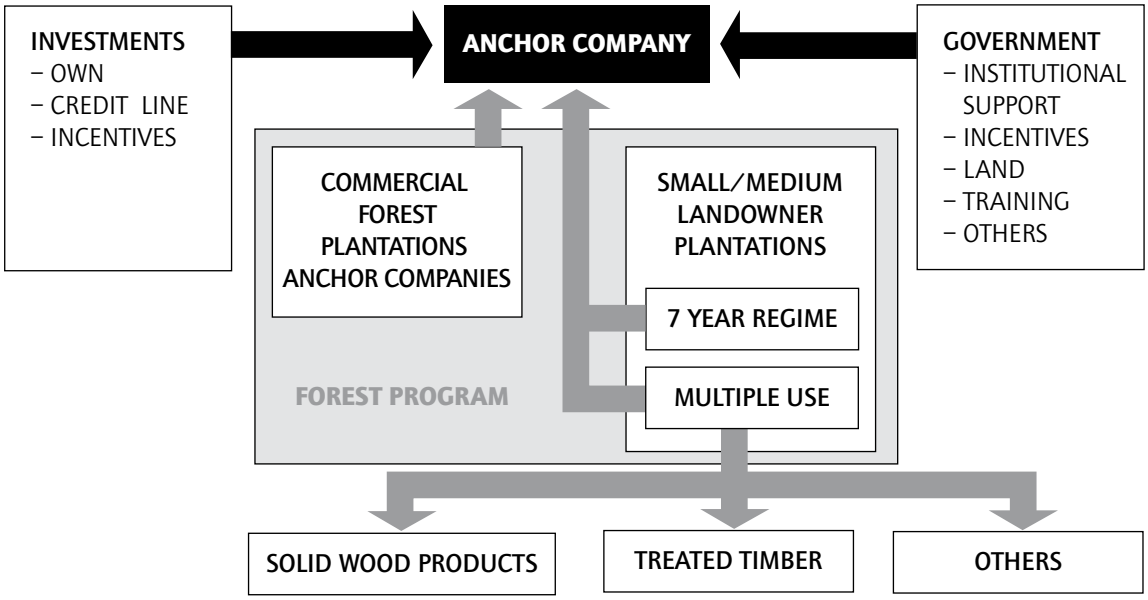
The FDPP has three components (Figure 5.4): natural forest management; the preservation and conservation of natural areas; and forest plantations. It was launched in 2005 and is in an early stage of implementation. An initial step was a zonification study for forest plantations, natural forest management, and environmental protection, which has helped

Figure 5.4 Main components of the FDPP



Source: CODEVASF (2006).

Figure 5.5 Functioning structure of the forest plantation component of the FDPP



Source: CODEVASF (2006).

define the type of management and intervention suitable for different parts of the area of influence. The three components are described below.

Forest plantations

The main objective of the forest plantation component of the FDPP is the establishment of a new industrial sectoral development model. The program outlines the potential capacity of processing-based plantation forestry to boost economic, social and environmental sustainability.

The FDPP recognizes the natural advantages of the region for developing forest plantations, including a favorable environment (with respect to climate, soil and topography), land availability, and conducive legal, infrastructural and socioeconomic characteristics.

This component is based on the following premises:

- forest plantations will be introduced to deforested, altered, degraded or under-utilized areas;
- there will be job and income generation in support of small landowners and medium-sized farmers through the promotion of forest outgrower schemes;
- partnerships will be developed through the establishment of 'anchor companies'; and
- forest plantations will be promoted under a multiple-use concept.

Figure 5.5 depicts the forest plantation scheme diagrammatically.

A total land area of 2 million hectares was previously identified with the potential for the establishment of a planted area of 635,000 hectares; this would be equivalent to 10% of Brazil's current forest plantation estate. Box 5.2 presents initial results of the FDPP.

In addition to the commitment of the Piauí state government, a well-structured forest development program and a sound policy of fiscal incentives are key to success. The state is also investing in infrastructure, labor and water availability (Parnaíba River), which are limiting factors for the establishment of similar programs in other regions. Moreover, CODEVASF plays a key role in fundraising and the capture of financial resources as well as in the promotion of agreements between parties and inter-institutional cooperation.

Natural forest management

The FDPP's natural forest management program has two major projects. The main objectives are to achieve sustainability and generate income through the implementation of forest management plans and planned forest harvesting, and to reduce forest degradation and illegal logging.

Besides wood production, the projects are also targeted at multiple-use planning, including the production

Box 5.2 Preliminary results of the FDPP

The results of the FDPP are already visible in various regions of Piauí. Actions carried out to date include the establishment of an agreement between CODEVASF, INCRA (the National Institute for Settlement and Rural Reform) and INTERPI (the Land Institute of Piauí) for land demarcation and titling, with 2 million Brazilian real already assigned for operations. The goal for 2006 is the land-titling of 500,000 hectares. Currently there are 3,720 hectares of forest plantations, 3,000 hectares for the use of agribusiness, 600 hectares to produce wood for the pig-iron and steel industry; and 120 hectares for forest outgrower plantations. All forest plantations have productivity prospects in excess of 30m^3/ha/year. Research and development is also under way with the purpose of defining optimal procedures for maximizing productivity through partnerships with local universities, EMBRAPA Florestas (the Brazilian Agricultural Research Corporation) and CODEVASF; 5–6 tree species best adapted to the conditions of the region will be selected. In order to build skilled staff for the implementation of the plan, The FDPP plans to support the establishment of an undergraduate forestry program at the Federal University of Piauí and a training course for forestry technicians and other vocational courses through the Industrial Learning National Service (SENAI). In the area of forest outgrowing, the goal is to establish 30,000 hectares of forest plantations in a seven-year period through partnerships with small and medium-sized landowners that create profits for such landowners. Moreover, with the purpose of creating an effective legal and institutional framework for the FDPP, a set of legal drafts are under discussion for the widening of forestry legislation and the creation of a control agency to be operational by 2007.

Source: CODEVASF (2006).

of charcoal, honey and other non-wood forest products such as dyes, medicinal herbs, and fruits. Cattle production is also considered in association with forest plantations. In particular, projects aim to generate jobs and income for small landowners. To fulfil these purposes, the projects will draw on resources from the National Forest Program and the Global Environment Facility. (See Box 5.3 for an ongoing forest management project in Piauí.)

Protected areas and conservation units

Although the FDPP is focused primarily on forest plantations it will also:

- establish a system of natural protected areas and ecological corridors, in addition to the creation of conservation units;
- develop economic mechanisms such as the Ecological ICMS (green tax on goods and services)

Box 5.3 Project Green Energy ("Energia Verde" project)

Among the natural forest management actions being implemented in Piauí, one that warrants particular attention is Green Energy, which is in its inception phase. This is the largest ongoing private natural forest management project in the region. It will be implemented in the caatinga biome and comprises an area of 115,000 hectares located in the Curimatá and Redenção of Gurguéia regions. It has the support of the Global Environment Facility/Caatinga Integrated Management of Caatinga Ecosystems and River Basins Project and the National Forest Program of the Brazilian Ministry of the Environment. The project has already received a green light for implementation and its forest management plan has been approved by IBAMA. Under the forest management plan an area of 6,000 hectares will be harvested per year, generating a sustainable production of nearly 1.7 million m^3. Besides wood production, the project is set to produce about 420,000 tons of charcoal and 81,000 kg of honey annually. According to the company Chapada da Gurguéia Farm, the project will generate over 2,000 direct jobs and 6,000 indirect jobs.

Source: CODEVASF (2006)

to favor the creation of natural private reserves and the conservation of existing green areas;

- Monitor and control the ecological impacts of FDPP activities; and
- carry out research on local biodiversity for the promotion of species conservation and sustainable use.

The aim is to create a federal, state and municipal system of conservations units in the state. The implementation of a State Plan for Conservation Areas is another priority; its purpose is to define the borders and geo-positioning of all the conservation units in the state. A public database is also planned to assist in the formulation and implementation of natural forest management plans.

Priority areas for the creation of conservation units have been identified and studies are under way on a pilot project for forest rehabilitation along major rivers. Civil-society organizations are being mobilized for the rehabilitation of the watersheds of the Parnaíba River. The Parnaíba Basin has deteriorated over a long period due to unplanned land use, the degradation of protected areas, and the pollution of water bodies by untreated sewage.

It is still early to speak about lessons learned from the FDPP but the nature of the program suggests that it could have a very significant positive impact. First, the FDPP is a regional effort aimed at creating synergy to help the development of one of Brazil's poorest areas. Second, the program is attempting to bring about the sustainable and integrated utilization of important remaining semi-arid forest resources, which previously have been exploited without any regard to their conservation. SFM offers an alternative to large-scale commercial grain production which, unless checked, will eventually destroy the region's remaining forest resources.

Case study 3: the successful marketing of rubberwood, a tropical plantation timber

The rubber tree (*Hevea brasiliensis*) has long been planted for latex production. After 20–25 years of tapping the productivity of rubber trees declines and latex production becomes uneconomic. The trees are then felled and replaced.

Due to the expansion of rubber plantations, and in view of the increase in the global demand for natural rubber (a deficit is projected between 2010 and 2020), many of the old rubber plantations have been or will be replaced. In the past the timber from trees at the end of a production cycle were often abandoned in the fields or burned to facilitate the establishment of new plantations.

Industrial technology and market changes have made if possible to utilize rubberwood as a byproduct of the main latex production business. This development was catalysed by the large supply in several Asian countries coupled with increasing demand for tropical timbers and a reduction in the supply from natural forests, which led to increases in international prices for tropical timber products.

Rubberwood utilization started in the 1970s and production increased sharply during the 1980s and 1990s. Malaysian exports of rubberwood sawnwood, for example, increased from 903 m^3 in 1979 to 103,478 m^3 in 1990.

With growing market interest in the primary products of this species, and to enhance local processing, in 1990 the Malaysian government decided to tax sawnwood exports. It seems that this was a good decision because, as a result, exports of sawnwood rapidly decreased and investments in secondary processing grew. Large investments were made to produce added-value products, including furniture and reconstituted wood-based panels using rubberwood. Malaysia's lead in promoting the use of rubberwood was soon followed by other countries in the Asia-Pacific region, notably Thailand and Indonesia and, more recently, China, Viet Nam and others.

Recent developments

In 1876, as the value of latex grew, rubber seeds were smuggled from Brazil and planted in the Singapore Botanical Gardens, where the species performed well. This is said to be the origin of the first rubber-tree plantations in Asia.

On the other hand, attempts to establish rubberwood plantations in the Amazon region failed, especially due to 'leaf disease', a disease caused by the fungus *Microcyclus ulei* that kills plantations in their initial phase (Box 5.4). This made it impossible to implement monocultural plantations in the region and, as a result, Brazil, once the world's biggest producer of latex, gradually became a rubber importer.

Rubberwood has a density of 560–640 kg/m^3 (air-dried), a light colour, and a uniform grain with no distinction

between heartwood and sapwood and no apparent growth rings. Its easy workability and low cost are strong advantages. The price of rubberwood is, on average, around 40% the price of other tropical timbers.

Rubberwood is not a perfect timber, however: it has a high concentration of free sugar and starch, which makes it subject to attacks by fungi and other wood-damaging organisms. It needs to be processed immediately after harvesting and submitted to a preservative treatment, mainly to avoid staining by fungi. Drying needs to be done carefully, too, to avoid defects. Most of the technical problems associated with rubberwood have been solved through research and development programs, carried out mainly in Malaysia.

The main products manufactured from rubberwood are furniture and furniture parts, panels, mouldings and other decorative articles. Low-quality logs and wood residues are used for reconstituted panels, firewood and charcoal production.

Malaysia, a leading rubberwood-processing country, has relaxed the prohibition of exports of some types of sawnwood in order to supply the needs of industry in other parts of the world, especially the fast-growing Chinese furniture industry. Taking into consideration the projected global latex deficit and also the potential for rubberwood production, the Malaysian government has announced a plan for the replanting of 375,000 hectares of its rubber plantations.

Despite the dominant role of Malaysia in rubberwood production, Thailand has the world's largest rubberwood plantation estate. The Government of Thailand has strengthened a program offering genetically improved seeds with the aim of stimulating small-scale farmers to re-plant rubber trees. This is important because small-scale farmers own more than 80% of Thailand's rubber plantations.

In recent years rubber plantations have been established in Brazil in areas classified as 'leaf-disease free'. Brazil has also developed disease-resistant varieties and high-production clones are now available. Brazilian rubber plantations, however, are used only for latex production; to date the local industry has shown no interest in utilizing the timber.

Box 5.4 Fordlandia: The dream of a rubber Eldorado

After the successful introduction of the rubber tree to Southeast Asia, an international cartel was formed by the English and Dutch which dominated the international rubber trade and controlled its price. In the 1920s Henry Ford, an American car manufacturer, attempted to break the monopoly by embarking on a daring rubber-tree plantation project in Brazil with the aim of making his company self-sufficient in the supply of rubber tyres. The project was, however, a huge failure, with losses reaching US$200 million at current values.

Ford bought an area of 10,000 km^2 near Santarém in the State of Pará, in the heart of the Amazon forest, and built an America-in-miniature, complete with hospitals, schools and cafes, in which typical American food was served and traditional American holidays were observed.

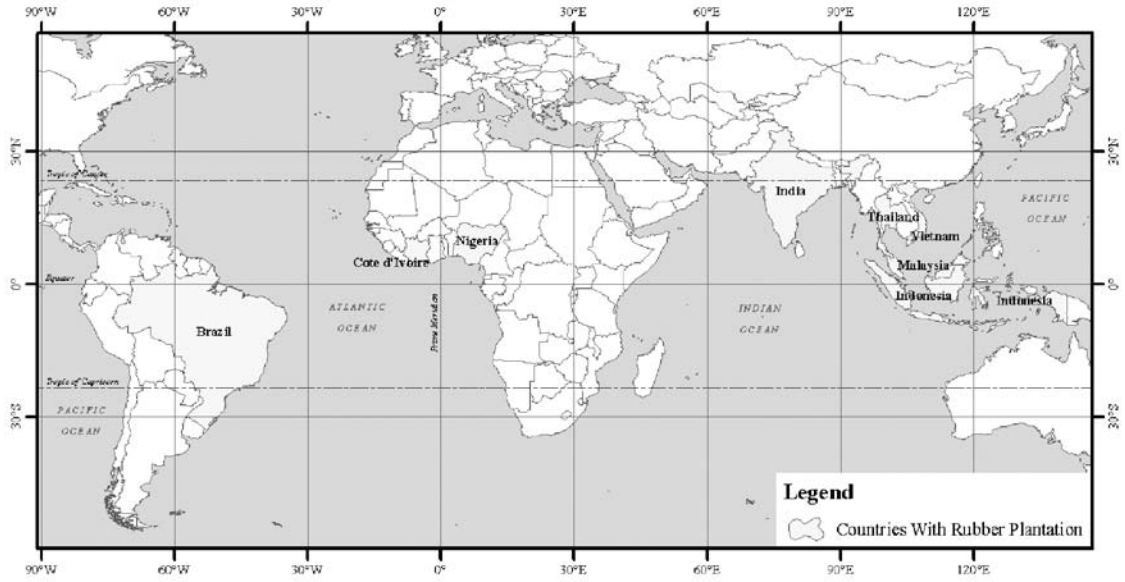
After successive mistakes, including a lack of knowledge about the planting and management of trees, and a worker revolt in 1930 triggered by the obligatory use of badges by workers and a tough work regime, the project failed. The biggest disaster was caused by an attack of the leaf-disease fungus *Microcyclus ulei*, which killed most of the planted rubber trees.

Realizing that the site selected for the rubber-tree plantation was unsuitable, the project moved to Belterra. Plantations there were also plagued by the fungal disease and productivity was well below that expected. The final blow to Henry Ford's dream of self-sufficiency came with the development of synthetic rubber, which buried the Amazon project forever.

When Ford abandoned the project, the lands – including the 6,720 hectares planted to rubber – were sold to the Brazilian government for the sum of US$250,000. This gave rise to a Brazilian program of genetic improvement of *Hevea brasiliensis*. The ruins of the Ford's dream are still standing in the forest as witness to the largest enterprise ever seen in the region.

Source: STCP.

Figure 5.6 Countries with the most significant areas of rubber plantations



Source: STCP.

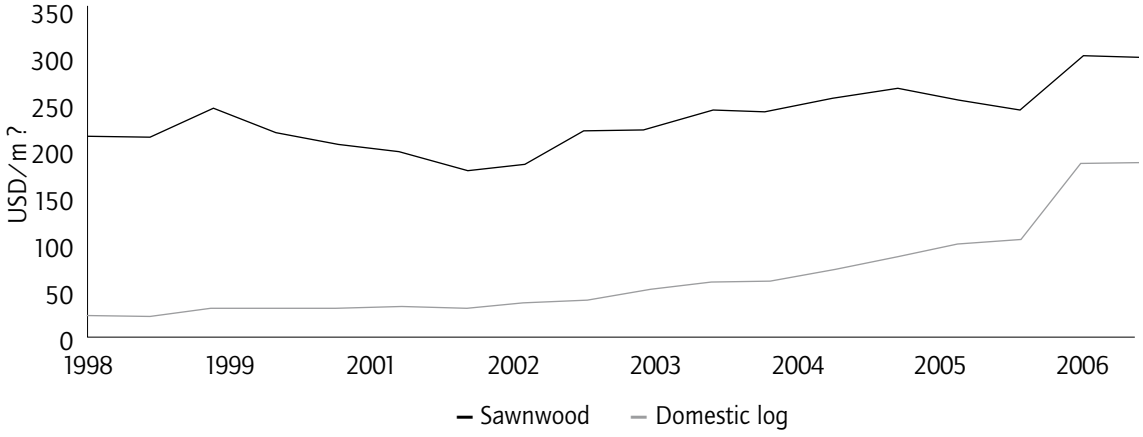
Geographic distribution

Rubber is planted in more than 30 countries, mainly in Southeast Asia, where it has adapted well. Plantations can also be found in Africa and in Latin America and the Caribbean. Figure 5.6 shows the countries with the most significant rubberwood plantations – Brazil, Côte d'Ivoire, India, Indonesia, Malaysia, Nigeria, Thailand and Viet Nam. In total there are an estimated 6.4 million hectares of rubber plantations worldwide.

Rubberwood market

Figure 5.7 shows that rubberwood sawnwood and particularly log prices increased significantly in the Malaysian domestic market over the period 1998–2006. The area of rubber plantations has been declining in most countries (exceptions include Thailand and Viet Nam – see below), reducing the supply of rubberwood and boosting its price. The trend of increasing prices is expected to continue.

Figure 5.7 Rubberwood prices in the Malaysian domestic market (ex-factory)



Source: ITTO (2005), ITTO Tropical Timber Market Reports (1998–2006).

Table 5.4 Sustainable production capacity of rubberwood plantations in leading tropical countries, 2005

Country	Planted area (1) ('000 ha)	MAI (m^3/ha/year)	Sustainable production ('000 m^3/year)
India	560	10	5,600
Indonesia	918	12	11,016
Thailand	2,019	10	20,190
Malaysia	1,478	15	22,170
Others	1,111	10	11,110
Subtotal Asia-Pacific	6,086	–	70,086
Nigeria	138	10	1,380
Côte d'Ivoire	68	10	680
Cameroon	42	10	420
Ghana	19	10	190
Others	37	10	370
Subtotal Africa	304	–	3,040
Total for all tropical countries	6,390	–	73,126

[1] Commercial plantation area.
Source: FAO (2000), ITTO (2005), STCP database and other sources.

Ninety-seven per cent of Thailand's total sawnwood exports are rubberwood. Fifteen per cent are destined for Malaysia and the rest go mostly to China.

Table 5.4 provides estimates suggesting that, based on the existing area of plantations (excluding countries with relatively small areas of rubber plantations, such as Brazil), the sustainable global production capacity of rubberwood is about 73 million m^3 per year.

Outlook

The global rubberwood plantation estate is undergoing significant changes. Thailand and Viet Nam are investing heavily in planting and replanting areas with this species with the aim of supplying the growing demand for latex and timber. Much of the timber will be exported to China.

Japanese demand for rubberwood is also increasing, replacing traditional tropical timbers such as *Shorea*. Rubberwood has environmental appeal, helping to increase its market share in Japan.

In general, however, the profitability of rubber plantations depends mainly on latex prices in the international market; timber remains a byproduct. Until recently, demand for natural rubber was high and prices increased; nevertheless, commodity prices can fluctuate significantly and a strong decline in the future is likely to reduce investment in rubber plantations.

This situation creates uncertainties in the market and is a source of risk for investments, not just in plantations but also in the rubberwood-processing industry and the trade.

Many rubber production areas, particularly in Malaysia, have been converted to oil palm plantations, which are more profitable and less labor-intensive than rubber. This poses one of the biggest threats to future rubberwood supply. On the other hand, there are cases where investments have been made in forest plantations without a clear view of how the timber will be utilized (Box 5.5).

Although, in general, rubberwood has been a marketing success, there have been cases in which timber utilization has been inadequate. In the past, genetic improvements and management focused on latex production. Intensive tapping seriously reduces growth and the quality of the wood. As a result the timber productivity of most rubber plantations is low and the quality of the logs is often poor.

Box 5.5 Inadequate consideration of timber utilization

Ideally, investments in plantations are made with a clear idea of the end-uses to which they will be put, but there are many examples where this has not been the case. Plantations have been established, for example, to supply logs for processing plants that were projected but never constructed. Often in such cases the timber must be sold in markets at lower prices than originally envisaged.

Many plantations have been established with a vague idea of the market or in the hope that a market will be created during the rotation period. This has frequently led to inadequate silviculture and poor species selection. In Malaysia, for example, the Compensatory Plantations Project designated about 35,000 hectares of land for the establishment of plantations of Acacia mangium in the period 1985–1987. These plantations, financed with loans from the Asian Development Bank, were expected to produce "timber for general use". In the end, the species proved inadequate for sawlog production and the economic benefits were insufficient to cover loan repayments. In the same way, thousands of hectares were planted in Sabah during the 1980s with *Gmelina arborea*. When the timber was harvested there was no market for it. The timber was eventually sold to Taiwan for packaging production at a price that covered only the harvest and transportation costs. In Pakistan, the production of industrial timber from *Eucalyptus camaldulensis* and *E. citriodora* plantations proved inefficient because the high growth rates reduced the quality of the timber harvested in the first thinning; the logs were not even suitable for charcoal production. Elsewhere, however, both species are used successfully for charcoal production.

Source: FAO (1996).

As rubberwood production has become an important economic supplement to the profitability of rubber plantations, new plantations are using different genetic material and planting and management practices. In Malaysia, which has pioneered the development of clonal material with favorable timber characteristics, some investors are considering establishing rubberwood plantations exclusively for timber production; this, however, is not expected to happen on a large scale.

The extent to which plantations established and managed on small properties will contribute to timber supply is another question. Because the timber is highly susceptible to fungal and insect attack, harvesting and transport operations need to be fast and efficient, which is not easy when plantations are spread among smallholdings. Much of the rubberwood planted recently, particularly in countries that have stimulated the establishment of plantations on small properties, will be of inadequate quality for value-added products. This means that the supply of logs to the export industry will probably be less than expected and prices will be lower.

Outside the Asia-Pacific region the expansion of rubber plantations is expected to occur mainly in Brazil. The productivity of plantations established in the State of São Paulo is high and already about 60,000 hectares are planted there; São Paulo is considered free of the leaf-disease fungus. Existing plantations have shown no problems to date and some clones are said to be very high-yielding for both latex and timber. Clones that yield about 200 m^3/hectares of logs at the end of the rotation have been reported, but so far the timber industry has shown no interest in this raw material.

Even though it has been an important (if not the main) substitute for natural tropical timber, rubberwood could lose some of its market share in coming years, particularly if its price continues to rise, as the market searches for alternative raw materials. Investing in productivity to reduce production costs is the key issue for the future of rubber plantations, especially if their profitability depends on the combined production of latex and timber. Both genetic improvement and silvicultural improvements will be needed to increase the value of rubberwood logs for the processing industry.

The recent decline in international rubber prices is again changing the outlook. It could, for example, encourage the harvesting of over-mature stands that were tapped for longer than normal because of the high latex price. On the other hand, other more profitable and less labor-intensive crops such as oil palm might replace rubber. This would cast doubts on the long-term sustainability of rubberwood in the key producing countries.

6 PROSPECTS FOR AND CONSTRAINTS TO INDUSTRIAL FOREST PLANTATION DEVELOPMENT

This chapter discusses the prospects for and constraints to industrial forest plantation development in Republic of the Congo, Côte d'Ivoire, Gabon, Ghana and Nigeria (Africa), India, Indonesia, Malaysia and Thailand (Asia-Pacific), and Brazil, Ecuador, Peru and Venezuela (Latin America and the Caribbean), taking into account economic, legal, ownership, technical, environmental and social aspects.

The countries were selected for analysis on the basis of a preliminary assessment, taking into consideration the stage of development of their forest plantations.

Main factors affecting investment in industrial forest plantations

In the tropics, as in other parts of the world, the level of investment in industrial forest plantations is highly correlated with the business climate and the returns on investment that are likely to be achieved.

The InterAmerican Development Bank recently carried out a study, assisted by STCP, on the attractiveness of forest investments in Latin America and the Caribbean, developing what it called the Forest Investment Attractiveness Index to measure the climate for investments in sustainable forest businesses (Box 6.1). This section is based largely on that study.

The factors affecting investments in industrial forest plantations occur at three levels:

i) *supra-sectoral factors* are the macroeconomic and other general factors that affect business profitability in all sectors of a national economy;

ii) *inter-sectoral factors* are factors related to other economic sectors that affect the profitability of investments in the forest-industrial business;

iii) *intra-sectoral factors* are those factors within the forest sector that affect the profitability of forest-related investments.

The intensity of the effect of a factor depends on the level at which it is expressed (i.e. either supra, inter or intra). To a large extent, intra-sectoral factors are determinant for an investor; supra-sectoral factors, although important, are usually beyond the control of investors or the policy settings within the forest sector.

Supra-sectoral factors

The supra-sectoral factors that most influence the level of investment in industrial forest plantations are: gross domestic product (GDP), interest rates, foreign exchange rates, international trade, political stability, government transparency, and the tax burden. Each of these is discussed below.

GDP

GDP is equal to the total expenditure for all final goods and services produced within a country in a stipulated period (usually a 365-day year). Most economists consider the rate of growth of GDP to be a fair barometer of economic activity in a country over a given period of time.

In general, a high GDP growth rate is the result of a dynamic economy and a favorable investment environment, which, in turn, stimulates production and consumption as well as new business opportunities.

Among the tropical countries examined in this chapter, the highest annual GDP growth rates over the most recent five-year period were in India (6.8%), Nigeria (5.6%), Ghana (5.1%), Thailand (5.0%) and Ecuador (4.9%).

Interest rates

Interest rates are one of the main macroeconomic instruments by which governments adjust monetary policy. Since interest rates define the cost of capital and its profitability for investors, they are a crucial factor in investment decisions.

Thus, a country will be more attractive to investors if it has a low real interest rate (which is the basic interest rate defined by the government based on change to consumer prices, minus inflation). In other words, a high interest rate reduces business attractiveness; as for investors, financial investments with a rate of return lower than the interest rate are not economically feasible.

In the last few years Brazil has had a high real interest rate (10–12% per year), which has limited some types of investments. This factor is particularly important in tropical countries, which, in general, have relatively

Box 6.1 Direct investments in forest businesses in Latin America: attractiveness for forest investment

Direct investment (DI) is emerging as the major development strategy of global and modern economies. In recent years, annual DI in the Latin American forest sector has been approximately US$6 billion.

An investor's decision on the allocation of capital to a certain region and activity is influenced by factors likely to affect company strategies and their aim of maximizing profit. To help forest investors in the pre-identification of countries offering the best investment climates, the InterAmerican Development Bank, with the support of STCP, developed the Forestry Investment Attractiveness Index (Indice de Atracción de Inversión Forestal – IAIF) in 2005. The IAIF measures factors associated with the business climate that determine the attractiveness of the forest sector for DI. By applying the methodology in different countries, the IAIF allows a comparison of their relative performance in a given year and also shows how the business climate of a country is changing over time.

The IAIF aggregates existing indices, specific indicators, and primary data. It is based on the hypothesis that the level of DI in sustainable forest businesses is directly affected by the attractiveness of a country for investment.

Using a mathematical model, the IAIF incorporates the main factors that affect forest businesses, generating a final index value that represents the investment climate in a given country. It is composed of three sub-indexes: i) supra-sectoral; ii) inter-sectoral; and iii) intra-sectoral.

The total index value of a country is a weighted sum of the sub-indices, with a higher weight given to intra-sectoral factors (intrinsic to forest activities), an average weight given to inter-sectoral factors, and a lower-than-average weight given to supra-sectoral factors. The IAIF of a country is in the range 0–100; the higher the grade, the more attractive a country for forest investments.

As a result of the study, the InterAmerican Development Bank ranked Latin American and Caribbean countries according to their attractiveness to forest businesses and investment. Brazil and Chile topped the ranking, with 60 and 53 points, respectively, followed by Argentina and Uruguay, with 44 points each. Even leading countries, however, face constraints associated with some important performance indicators.

The IAIF has become an important tool for countries in the region for demonstrating the attractiveness of forest-based investments and for identifying aspects that need to be addressed to increase attractiveness. The InterAmerican Development Bank has also developed what it calls the Process to Improve the Business Climate for Forest Investment (PROMECIF), a cyclical process of activities to help develop, implement, monitor and evaluate actions to help countries attract DI to their forest sectors.

Source: InterAmerican Development Bank (2005).

high interest rates. It has a significant bearing on the appeal of investments in forest plantations because they are long-term businesses in which capital plays a vital role.

Exchange rates

The exchange rate is the relationship between the value of the domestic currency of a country and a foreign currency (ie the international 'price' of the currency) and can be taken as a measure representing the market equilibrium for the currency (the adjustment between supply and demand of the currency by economic agents). It can also be influenced by a government's monetary policies.

The foreign exchange rate establishes the relative price system between goods and services produced by a country in comparison with those of other countries.

Inappropriate exchange rate policies can result in domestic currency instability, which increases the risk for DI. Note, however, that a change in the exchange rate can affect economic agents in different ways, as follows:

- *domestic investors:* the real profitability of domestic investments can be affected by foreign exchange instability, increasing or decreasing purchasing power at real prices in foreign currencies;

- *foreign investors*: by investing capital in another country the foreign investor becomes vulnerable to that country's currency variations. This means that the investor can lose purchasing power in international markets if, when repatriating the invested capital, the domestic currency has depreciated. On the other hand, foreign investors stand to gain if the domestic currency appreciates;
- *exporters:* exporters benefit from a lower foreign exchange rate because their products will be more price-competitive internationally. On the other hand, an appreciating domestic currency can jeopardize exports because their relative price will increase; and
- *importers:* contrary to exporters, importers benefit from domestic currency appreciation because, in relative terms, foreign goods become cheaper. Conversely, when the foreign currency appreciates, imports tend to diminish because they become more expensive in the importers' domestic currency.

Currency stability is crucial to any business engaged in trade or foreign investment. A country's foreign exchange rate stability can be assessed using the international country risk index, generally over a 12-month period. Ecuador, for instance, has improved its foreign exchange stability by using the US dollar as a base for economic transactions. According to Political Risk Services (PRS 2004) data, Thailand, India and Malaysia have also shown foreign exchange stability in recent years. In Brazil, however, the exchange rate has fluctuated significantly.

International trade

International trade affects investment attractiveness through the 'clearing market' mechanism, which theoretically drives the market towards an equilibrium. Thus, imports affect the aggregated supply level, leading to variations in the product equilibrium price, affecting it indirectly. On the other hand, exports add to aggregated demand, generating an impact directly proportional to the product price. The impact on profitability and consequently on business attractiveness is immediate.

One of the main indicators in the evaluation of a country's international trade is the 'freedom to trade internationally', which is derived from the Economic Freedom of the World Index (EFWI, Gartzke et al. 2006). This index measures the variety of restrictions that affect international trade – tariffs, quotas, hidden administrative barriers, and foreign exchange and capital controls. In order to create a favorable investment environment a country should maintain low commercial tariffs, an efficient customs service, a free foreign exchange market, and a low level of restrictions on capital flows.

The main variables used to evaluate the international trade of a country are: international trade tariffs; commercial control barriers; the size of international trade; the difference between foreign exchange and parallel markets; and foreign capital flow control.

According to EFWI data, of the countries examined here, those with relatively high economic freedom in 2005 were: Malaysia (7.6 points out of a possible 10), Thailand (7.5 points), Ghana (7.4 points), Peru (7.4 points) and Indonesia (7.3 points).

Political stability and governmental transparency

To attract investment a country must not only be politically stable it must also communicate this to the rest of the world.

The transparency of a government reduces the potential for corruption, which is often interwoven with and prevails over governmental policy. A country governed under transparent policies can offer greater security to the investor, thereby reducing investment risk. In general, the greater the political stability and governmental transparency, the lower the risk.

Based on the 'political risk' indicator provided by the International Country Risk Guide, countries with relatively high political stability and governmental transparency are: Malaysia (77 points out of a possible 100), Thailand (69 points), Brazil (66.5 points), Peru (64 points), and Ghana and India (63.5 points).

Tax burden

The tax burden is the sum of taxes and contributions paid to a country's government, including taxes on income, raw materials, sales and business profits. It has a direct effect on profitability – the greater the tax burden the lower the profitability – and therefore represents a barrier to investment.

The 'tax burden share of GDP' index can be used to analyse and compare the tax burdens of different countries. Significant changes in the level of this index occur only slowly.

According to 2002 data from the United Nations Online Network in Public Administration and

Finance, among the tropical countries analysed in this study, those with a relatively small tax burden relative to their GDPs are: Congo (9.8%), India (9.9%), Venezuela (12.2%) and Indonesia (12.8%). On the other hand, Brazil has one of the highest tax burdens relative to GDP (38%).

Inter-sectoral factors

Inter-sectoral factors include the economic and social infrastructure, licenses and legal permits (ie bureaucracy), labor, access to credit, governance (eg law enforcement), the treatment of capital flows, and agricultural policies. Each of these is discussed below.

Economic infrastructure

A country's economic infrastructure comprises mainly its transport, communication and energy infrastructure. Favorable infrastructure generally provides higher profitability because it reduces production costs.

The existence of an adequate and efficient transportation infrastructure, for example, helps investments in a given region or country. This is particularly important in the case of forest businesses because transportation has a large impact on logistical costs, especially those related to raw-material supply and primary product sales.

An efficient communication network allows the rapid transmission of information, providing the possibility for the integration of a company's operational areas, a fundamental requirement for the reliable control of operations. Good communication also facilitates contact with markets.

The energy infrastructure drives industrial activity and makes it possible to process the wood raw material. Thus, the cost and availability of energy can be attractive or limiting factors for investment in wood-processing.

One way of measuring this economic infrastructure is the WRI (2007) 'energy consumption' factor. The principle is that greater per capita energy consumption implies a strong degree of industrialization and, consequently, better infrastructure. Of the selected tropical countries, those with high per capita energy consumption are: Malaysia (2,418 kilograms of oil equivalent – kgoe – per person), Venezuela (2,293 kgoe per person), Thailand (1,557 kgoe per person) and Brazil (1,124 kgoe per person).

Social infrastructure

Social infrastructure includes water and sanitation infrastructure, education and health. The quality of the social infrastructure affects labor productivity. Generally a good social infrastructure allows higher productivity levels, leading to lower production costs and greater profitability and, consequently, a greater ability to attract investment.

This factor is usually evaluated using the United Nations Human Development Index, which measures three basic dimensions of human development: i) longevity of life and health; ii) education; and iii) per capita GDP.

According to 2005 data from the United Nations Population Division, of the selected countries, the following have high Human Development Index values: Malaysia (0.796, out of a possible maximum of 1.0), Brazil (0.792), Thailand (0.778), Venezuela (0.772) and Peru (0.762).

Licenses and permits

An investor who wishes to start a new business in a country usually faces a range of bureaucratic and legal difficulties. The government can make it easier or more difficult by the extent to which it requires licenses and legal permits for the establishment or management of a company.

Especially in developing countries in the tropics, the procedures for corporate registration often require a large amount of time and, for certain investments, therefore act as a limiting factor. Cumbersome procedures can encourage illegal practices such as bribery.

The 'regulations' indicator of the Index of Economic Freedom prepared by the Heritage Foundation can be used to measure this factor. It attempts to measure the existing degree of difficulty in starting up and managing a company. The more regulations that are imposed, the greater the impediment to investment.

Among the countries surveyed in this study, regulations are at 'stable and moderate' levels (ranking 3) in Brazil, Ghana, Malaysia and Thailand (Heritage 2006).

Labor

The main aspects of labor that influence investment attractiveness are labor legislation, productivity, labor education, and wages.

Labor legislation can improve job security and remuneration, although over-rigorous legislation can become a limiting factor. Ensuring that laws governing labor and contracting are flexible is important for the competitiveness of companies. Labor productivity is the relationship between production output and the hours worked or the number of employees.

A country with a skilled and stable labor force and low wage rates can be attractive for investment. This derives partly from the fact that the wage rate is the price of labor and represents the equilibrium price of its supply and demand.

Labor indexes prepared by the World Bank, the United Nations Development Program, the International Labor Organization and others can be used to measure the labor factor. The World Bank's Basic Literacy Rate Index for adults, for example, suggested that, in 2004, the more literate of the selected countries were Venezuela and Thailand (93% each), Ecuador (91%) and Indonesia (90%).

On the other hand, according to the Labor Market Regulations Index (Gartzke et al. 2006), countries with relatively low labor bureaucracy are: Nigeria (7.0 out of a possible 10), Ghana (6.9), Malaysia (6.8) and Thailand (6.2). According to data from the United Nations Development Program, countries that invested most in research and development were Brazil (1.0% of GDP), India (0.8%), Malaysia (0.7%), and Venezuela (0.4%).

Access to credit

The access to credit in a country is determined by the existence and stability of the financial services that make the necessary resources available for operating and expanding businesses. The existence of financial institutions should be considered, along with their conditions for providing finance.

Access to credit can be analysed through the Credit Market Regulation Index, a component of the EFWI (Gartzke et al. 2006). It measures the degree of government intervention in the credit market, considering that the lesser the market regulation the higher the credit that can be allocated to the private sector.

The following countries have the least regulation in the credit market: Peru (8.5 points out of a possible 10, with a high score indicating low regulation), Nigeria (7.8 points), Gabon (7.3 points) and Côte d'Ivoire (7.3 points). The other countries considered in this study have a greater degree of regulation, with scores below 7.0. In this case, however, lower scores do not necessarily mean that the investment climate is weak.

Governance

Law enforcement and judicial transparency are the foundations of an effective justice system. In a favorable investment climate the justice system will ensure the protection of private property rights and guarantee norms of contract protection. The greater the legal support for private property, the greater the economic freedom to attract investment. This is an extremely important factor in the case of commercial forest plantations, which are normally associated with large areas of land.

The Heritage Foundation's Property Rights Index analyses the extent to which the government protects private property using the law and the extent to which private property is legally protected against expropriation. According to this index, the following tropical countries provide moderate or stable levels of protection for private property: Brazil, Gabon, Ghana, India, Malaysia and Thailand.

Capital treatment

Investors are always concerned about how the government of the host country will treat their capital. Restrictions imposed on the remittance and repatriation of funds can reduce the attractiveness of investment, especially in the case of foreign direct investment.

Many countries have mechanisms for regulating foreign capital in the domestic environment in order to make it more favorable and reliable for the foreign investor. The main mechanism is a judicial order, which guarantees contracts and contains clear and attractive norms for the entry of foreign capital.

The Foreign Direct Investment Index tallies the annual value of foreign investment invested directly in a country. Larger volumes imply that a country's policies are favorable for foreign investment.

The tropical countries considered in this study with relatively large volumes of foreign direct investment in 2005 were Brazil (US$18.2 billion), India (US$5.3 billion), and Malaysia (US$4.6 billion). Foreign direct investment in both Nigeria and Peru was over US$1.8 billion and in Venezuela reached US$1.5 billion. The size of the country also influences foreign direct investment volumes.

Agricultural policies

In most tropical countries, agriculture, forestry and animal husbandry are the main land uses. In general, laws and government policies treat these uses differently, creating distortions that affect the decision-making of investors. In many cases, laws and policies favor agricultural use to the detriment of investment in forestry.

The InterAmerican Development Bank (2005) identifies four basic ways in which agricultural policies create distortions that undermine forest use and investment: credits, taxes, subsidies, and land taxation.

Several tropical countries, especially in Latin America, have rural policies and development programs that frequently offer more favorable and accessible credit conditions, fiscal benefits and technical assistance to the agriculture investor than to the forest-based investor. These advantages can be related to interest rates, schedules, collected commissions and discounts, payback periods, depreciation and disbursement, and (self) financing counterparts.

In the majority of tropical countries, restrictions on forestry activity are imposed by the benefits created by domestic agricultural policies. Nevertheless, some tropical countries stand out for rural development policies that consider forest activities – these include Brazil, Costa Rica, Indonesia, Ghana and Nigeria.

Intra-sectoral factors

The main intra-sectoral factors that affect investment in forest businesses are: forest resources; support to forest industrial businesses; domestic markets; and forest vocation land. Each of these is discussed below.

Forest resources

The availability and productivity of the forest resource is one of the main intra-sectoral factors that affect investment in the forest sector of a given country.

All else being equal, the larger the forest resource and the faster it grows the cheaper will be the wood raw material, the greater will be competitiveness in the market, and the higher will be the profitability of the business.

The attractiveness of the forest resource as an investment is related to three aspects:

1) *existence*: in addition to the physical existence of trees, this aspect includes the commercial quality of the timber species, the economic accessibility of the resource, and its legal availability for commercial purposes;
2) *availability*: the effective supply in the market is associated with the owner's interest, legal authorization for utilization, adequate transport infrastructure, proximity to the consumer market, timber price, etc;
3) *MAI of tree species:* productivity has a strong impact on the attractiveness of any investment – high MAIs are associated with low production costs and high business profitability.

Most tropical countries have a favorable physical environment for developing industrial forest plantations with high MAIs. On the other hand, few tropical countries have the public policies or levels of public investment needed to support research and development for improving the productivity of forest plantations. In those countries where investments have been made by the private sector, such as Brazil (for pines and eucalypts), exceptional gains in productivity have been achieved. In Southeast Asia, especially Thailand, Malaysia and Indonesia, important breakthroughs have been achieved in rubberwood production thanks to the development and application of adequate public policies.

Domestic market

Irrespective of the kind of business, the market has a fundamental influence on investment decisions. The size of the domestic market is a good indicator, since a large domestic market creates more opportunities and attracts more investments. It can be calculated as: (domestic consumption - production) + (imports - exports).

Using data from FAOSTAT (2006), domestic market size was estimated for each country and compared to the global forest product market, expressed as a percentage. Brazil's domestic forest product market stands out, with approximately 5.3% of the global market, followed by India (4.6%), Indonesia (2.1%) and Nigeria (1.2%).

In recent years the market acceptance of timber products from plantations has been good due to the increasing unavailability of, high prices for, and environmental concerns about the use of timber from natural tropical forests.

Forest vocation land

Nascimento (2005) defines forest vocation land as those lands "that due to their physical site features such as soil, topography, and the rainfall it receives, should be kept under forest cover or other sustainable

land use if soil- or water-related negative externalities are to be avoided". Land on which the income derived from forests (including the 'social' income associated with non-marketed goods and services) is higher than would be derived from other uses is considered to be forest vocation land. Forest vocation land is often a more competitive land use compared to agriculture and livestock-raising when the conservation and restoration costs resulting from these other uses are taken into account.

The availability of forest vocation land for forest enterprises is a key aspect of attracting investment to the sector; fluctuations in availability can have a significant effect on the land price.

Forest vocation land can be identified based on the following criteria: physical (soil, climate and topography) conditions; economic conditions (eg unsuitable for agriculture); and legal conditions (eg the availability of land titles). The more favorable these conditions, the greater the attractiveness of forest plantations.

Another option for estimating the potential forest vocation land in a country is FAO's 'potential arable land indicator', in which equivalent potential arable land, dry lands and deserts are subtracted from the country's total area (see FAO 2000 and Nascimento 2005). The land registration/ownership aspect was not considered due to a lack of consistent data.

Brazil stands out as the tropical country with the largest potential forest vocational land area, with approximately 390 million hectares. Indonesia has about 168 million hectares, followed by Congo, which has more than 123 million hectares.

Main constraints on industrial forest plantation development

Industrial forest plantation development faces a number of constraints; these vary among ITTO producer countries but there are also many common factors. Differences relate mainly to the importance of forest plantations to the national economy, the size of the forest resource, the involvement and strength of the private sector, and the support received from international organizations.

The constraints affecting industrial forest plantation development increase risk and generate additional costs for investors, thereby making forest plantations less attractive as a business opportunity.

Based on a comprehensive review of the literature on the factors affecting the investment climate in forest businesses, an extensive field survey in selected ITTO producer countries, and a questionnaire survey targeted at 51 countries, six main constraints to industrial forest plantation development have been identified. These are discussed in the remainder of this chapter.

1) Lack of information on the current status of commercial tropical plantations

In almost all ITTO producer countries, information on existing forest plantations (planted area, roundwood production, sustainable production capacity, growing stock, timber industry, trade, etc) is limited. When available, it is scarce, imprecise, outdated and poorly organized.

In many cases, forest plantation information systems are short-lived because of their dependency on projects and the lack of integration into existing institutional set-ups. Systematic approaches to overcome this situation have been few; those that have been attempted have been unable to meet the mainstream needs for public information and the data needs of national planning systems.

FAO's long-standing FRA has helped to fill information gaps, especially through regional action. Recent reports have provided a series of reviews and data updates on the key issues for forest plantations, including public policies, institutional changes and incentives, and in-depth analyses of the underlying conditions and long-term prospects for forestry development.

In Africa, FAO has worked to link forest plantation development and national and regional efforts to mitigate natural disasters. The FAO Forestry Outlook Study provides valuable information for understanding current sectoral trends in the face of growing prospects for privatization and the transformation of national institutions. In Latin America and the Caribbean, FAO has acted as a facilitator of dialogue in the sector through its support for national forest programs.

ITTO has supported projects aimed at implementing and strengthening information systems. In most cases, however, the problem is that the work is discontinued once the project is completed, apparently because such information systems are not a priority for many governments.

Box 6.2 Invasion of the Aracruz nursery

Aracruz is the world's largest producer of eucalypt pulp. In July 2006 the technical facilities of its nursery in Barra do Ribeiro in the State of Rio Grande do Sul, southern Brazil, were invaded by about 2,000 women of Via Campesina, an international movement that coordinates peasant organizations in different continents. The nursery's security force was overcome and the demonstrators, who threatened employees, destroyed part of the nursery as well as the company's research laboratory.

The losses caused by the invasion included the destruction of approximately 1 million seedlings that were ready for planting. The facilities of the laboratory were totally destroyed, including seeds and the genetic material of ongoing research projects. According to a survey made by the company's technicians, damage to the nursery totalled US$300,000.

In addition to infrastructure damage, some 600 hybrid eucalypt combinations, the development of which began some 15 years ago, were lost. These hybrids would have been used in commercial plantations over the next seven years, with productivity gains estimated at 15%.

The damage due to losses in productivity gains has been valued at US$6 million, taking into consideration the current resource base. Had Aracruz expanded its activities in the state by building a new mill for the production of an additional 1 million tons of pulp per year, this potential loss could have reached US$20 million. Aracruz estimates that it will take seven years to produce new material with a growth potential equivalent to what was lost.

Source: various, adapted by STCP.

These and other international efforts to improve information systems in forestry have been unable to overcome government inefficiencies in this area. The paucity of reliable information on a number of forest-related issues contributes to a lack of transparency and reduces the likelihood of favorable investment decisions.

2) Land tenure

Land tenure and, in particular, the absence of well-defined property rights have been key obstacles to attracting investment in industrial forest plantations in ITTO producer countries.

The resolution of conflicts over land tenure rights and improved law enforcement are pre-requisites for achieving industrial forest plantation development.

Increased land tenure security should be an important element in any strategy to promote industrial forest plantations in the tropics, but the situation is often very complicated. In Nigeria and most sub-Saharan countries, land ownership and land-use rights must accommodate traditional land tenure alongside official land registration. Land tenure issues are complex because overlaps between national, state and local-level legislation and traditional customary practices are common. Given current trends towards an 'open land market' approach, conflicts at all levels of the law might be expected to increase.

The question of the empowerment of local communities and chiefdoms (aiming to return power to communities) is a key issue to be settled in developing a strategy for special arrangements between the private sector and communities.

In tropical countries, land tenure and property rights systems comprise communal, individual (private) and public land tenures. In most African countries, overlapping traditional tenure systems, as well as the government ownership of land, make private ownership difficult.

Land pressure is lower in Gabon and Congo than in Côte d'Ivoire, Nigeria and Ghana, which have large populations and complex tenure arrangements. Ethnic minorities living largely traditional lifestyles in forests add an extra level of complexity and give rise to important questions of equity and human rights.

Social movements have created pressure on industrial forest plantations because they are perceived to play a limited role in poverty reduction. In some cases the pressure is applied by specific interest groups. In Brazil, for example, social movements exert pressure on the federal and state governments by encroaching on privately owned industrial forest plantation areas (Box 6.2). A lack of law enforcement has led to uncertainty over new private-sector investments in forest plantations in Brazil.

Other land-related issues are directly linked to government decisions that have created uncertainties and therefore reduced private-sector investment in forest plantations. The unclear definition of forest estates and a lack of land zoning (eg the identification of forest vocation land) is a general problem in most ITTO producer countries.

3) Lack of capacity

The field surveys carried out for this study indicated that a lack of human resources is one of the main constraints to industrial forest plantation development in the tropics. This problem is faced by both private and public sectors.

The lack of trained personnel is reflected at all levels, from managerial to field staff. In some countries, vocational training is non-existent and an obstacle to the implementation of plantation programs. The integration of a well-trained labor force with adaptation capacity partly explains the success of forest plantation programs in New Zealand, Chile, South Africa and Brazil. The private sector should not rely solely on public-sector initiatives and should also take action to build capacity in the sector.

Another issue facing the sector is the broadening range of skills needed to negotiate the development and implementation of public policies and to plan strategically in accordance with defined national policies.

In general, techniques related to genetic improvement, tissue culture, planting material, forest management and harvesting, etc, are still insufficiently mastered and are rarely applied on a large scale.

Medium-sized and large private companies have been able to solve this lack of qualified labor. They have established cooperative arrangements with national and international research institutions and universities, engaged external consultants, and implemented in-house training programs. This results in additional costs to the companies but, in most cases, these costs have been offset by productivity gains.

In most ITTO producer countries, governments have contributed only marginally to capacity-building related to forest plantations; exceptions include Brazil, Malaysia and Mexico. Governments need to be more proactive, working in close cooperation with the private sector, international organizations and NGOs to find ways of facilitating industrial forest plantation development.

4) Insufficient research and development

Despite significant recent achievements in the establishment of forest plantations in the tropics, much still needs to be done on basic and applied research.

In almost all ITTO producer countries, research is still treated as a government duty, yet only a few countries have public research institutions with adequate infrastructure and staff and a focused development program.

Technology has had a major impact on forest plantation practice through nursery automation and improvements in site preparation, silviculture and labor productivity. Even greater advances have taken place in forest genetics, especially through seed-tree improvement and the development of hybrids of high-yielding, fast-growing tree varieties. In Malaysia and Brazil, several institutions and companies have been successful in this field.

In Malaysia, rubberwood has been the subject of intensive genetic research and the production of hybrids and varieties that optimize latex and wood production. The Malaysian experience suggests that rubberwood clones can achieve MAIs of around 26 m^3/ha/year, which means that rotations can be shorter. The production of improved genetic stock has also been adopted elsewhere in the Asia-Pacific region, especially Thailand and Indonesia.

Eucalypt timber production has expanded in Brazil as a result of research and development on high-yielding varieties. An example of these efforts is the production of hybrids of *Eucalyptus grandis* and *E. urophylla*, which have boosted plantation productivity by more than 100% in the last 20 years. In some cases, industrial plantation yields are averaging 50 m^3/ha/year.

In many countries, mainly in Africa, research is part of international development programs or projects. The priorities of research vary according to the donor's interests, individual preferences, or other reasons that might not be closely related to the national interest.

As a result, despite significant investment and a relatively large number of programs or projects, only limited research results have been applied by those involved in forest plantation development, particularly in the private sector.

Several countries recognize the need to reform their forest research institutions. In general, however, poor management and a lack of cooperation with the private sector and other organizations mean that scientific research is almost completely absent.

Due to a lack of coordination in forest plantation research and development at the national and international levels, efforts often overlap, institutions remain weak, and investments in time and financial resources are wasted. As a result, the resources allocated to forest research in developing countries are inadequate. In general, governments continue to be the main source of finance, but the trend is to reduce funds for forest research in state institutions on the assumption that the gap will be filled by the private sector.

5) Lack of financing mechanisms

The financing of industrial forest plantations is constrained by a number of factors: (i) the high initial investment required for establishment; (ii) the long period between initial capital outlay and harvesting, resulting in a capital cost due to interest payments, and (iii) the high biological and economic risks involved in forest plantations. Proper financing mechanisms are therefore essential to support private investment in forest plantations.

In the past, incentives have been used to encourage private investments in forest plantations. Incentives include the provision of inputs (seedlings and fertilizers), the development of specific local infrastructure, grants, tax concessions, differential fees, subsidized loans and cost-sharing arrangements. In the case of industrial forest plantations, incentives might be justified because they accelerate industrial development. A fast increase in scale is especially critical in commodity-based industries, such as pulp-and-paper, where economies of scale are essential for competitive operation.

The governments of Brazil, Malaysia and New Zealand have all promoted commercial forest plantations through incentive mechanisms. There is no doubt that

Box 6.3 Fiscal incentive program to encourage commercial forest plantations in Brazil

The success of the Brazilian forest sector is linked to the establishment of a fiscal incentive program in 1967 by the government to encourage investments in forest plantations in order to support the development of the country's paper and steel industries. The program was designed taking into consideration the national strategy to develop several economic sectors. Under a fiscal incentive program (FISET Sectorial Investment Fund), individuals and companies were able to set aside 50% of income tax payments for forest plantation projects, and direct subsidies from FISET were granted for the establishment of forest plantations. As a result the rate of forest plantation establishment increased rapidly during the 1970s and 80s. In 1989, when FISET was discontinued, 6.2 million hectares of forest plantations had been established in Brazil. After that, the plantation rate dropped significantly and a large share of the existing plantations were abandoned or damaged by pests or fire. Nevertheless, Brazil has almost 6 million hectares of forest plantations today, largely as a result of the fiscal incentive program, as well as a globally competitive forest industry. The plantation area, however, has not grown sufficiently to match the capacity of the domestic forest industry and Brazil is now facing a 'forest blackout' (wood supply deficit). In order to mitigate this, new incentive mechanisms to promote the establishment of large-scale forest plantations are under discussion in national fora. The Brazilian government is reluctant to reintroduce the incentives employed in the past. On the other hand it has recognized the need for proper credit lines that support private investments to expand forest plantations. As a result, credit lines for the establishment of forest plantations are available at BNDES, a federal institution engaged in the implementation of national economic and social development priorities. Limitations on the financing of forest plantations remain, however. Forest companies complain that existing financing mechanisms are neither sufficient nor appropriate. Interest rates are said to be high and grace and repayment periods too short, taking into consideration that the forest production cycle is long. Nevertheless, progress has been made and the terms of BNDES loans are better than those available in the commercial banking system. The Brazilian government is also setting up targeted financial mechanisms to promote forest plantations on small properties by individual landowners.

Source: Tuoto (2005).

incentives have played an important role in starting the process of sector development in those countries. Incentive mechanisms to encourage investment by the private sector can be linked to increased employment, incomes and salaries and also to increased tax revenue for government.

Most tropical countries have other social and economic priorities that need to be addressed. Public funds to support the establishment of forest plantations are therefore limited and direct investments from the private sector are expected to increase. At present, only a few countries are continuing to encourage private investments in forest plantations through subsidy schemes (Boxes 6.03 and 6.04).

On the other hand, in most ITTO producer countries, the private sector claims that existing financing mechanisms are neither sufficient nor appropriate. Interest rates are considered too high and grace and repayment periods too short.

6) Competition for land

In general, large land areas are required for the establishment of industrial forest plantations. To supply an industrial plant efficiently it is always desirable for land to be a single contiguous tract of land or in a few adjacent parcels. Moreover, it is preferable that the land used for forest plantations is close to basic amenities and an existing road network within economic range of a processing mill or market.

Worldwide, the public scrutiny of land ownership and land use has become increasingly intense. In most tropical countries, especially those with large populations, industrial forest plantations compete for land with agriculture and cattle-raising. The strong competition for land affects land prices and constitutes a barrier to forest business.

Other constraints to industrial forest plantation development in the tropics include:

- a lack of monitoring of ongoing forest plantation programs (private or public);
- uncommitted and uncoordinated policy actions and measures, including a lack of strategic and long-term planning;
- the environmental and ecological impacts of forest plantations (positive and negative);
- a lack of criteria for selecting tree species for forest plantation establishment;

Box 6.4 Capital subsidies for plantation development in China

To ensure that China's pulp producers have adequate supplies of wood fibre, the government has promoted the development of industrial tree plantations. With the adoption of China's Tenth Five-Year Development Plan, the State Forest Administration (SFA) prioritized the establishment of a fast-growing, high-yielding (FGHY) plantation base as one of six core initiatives in the National Forest Protection Program. The central aim of the FGHY initiative is to expand the country's commercial wood supply to support domestic forest industries, especially new capacity for wood pulp production.

According to the SFA's strategic plan, the government has budgeted RMB71.8 billion – US$8.6 billion – to finance the development of 13.3 million hectares of FGHY plantations during the period 2001–2015. Some 5.8 million hectares, or approximately 45% of the targeted area, are intended to be used for pulpwood.

The program covers four priority geographic regions: the south coastal region; the lower and middle reaches of the Yangtze River; the lower and middle reaches of the Yellow River; and Northeast China/Inner Mongolia. In aggregate terms, the largest area allocated to pulpwood plantation development is in Northeast China/Inner Mongolia, where 2.4 million hectares of plantations are planned. The areas planned for pulpwood relative to the total area allocated for FGHY plantations are substantially larger in the South Coastal and Yellow River regions than they are in the other two regions.

The government has structured the FGHY program around 99 priority projects that are eligible for subsidized financing (SFA 2002a). Thirty-nine of these projects involve the development of pulpwood plantations. These will be subsidized through loan interest subsidies, discounted loans from state banks, and extended repayment periods.

Source: Barr and Cossalter (2004).

- the inadequate quality of planting material; and
- the illegal logging and trade of forest products.

FAO is in the process of developing a code of best practices for planted forests that will address these issues as well as other management issues and social aspects (FAO 2005).

Opportunities

The study identified a number of likely developments in the tropical industrial forest plantation sector at the regional and, to some extent, country levels. These are described below.

- The industrial forest plantation area will increase rapidly in the next few years as a way of ensuring there is an adequate wood supply for the global forest industry. Plantation rates will be high in some Asia-Pacific countries, notably China, India, Indonesia and Malaysia, where government incentives (subsidies, grants, tax concessions, differential fees, cost-sharing arrangements, and others) are available. In Latin America and the Caribbean the area of industrial forest plantations will also increase, but at a slower pace. In Africa, industrial forest plantations will not increase significantly in the next few years due to less favorable conditions for forest investments there;
- As a result of extensive industrial forest plantations and substantial increases in forest productivity, forest plantations could push the global industrial wood supply and demand balance towards a surplus in the medium and long terms (Mery et al. 2005 and FAO 2003). The wood supply surplus will be concentrated in the Asia-Pacific region and, to a lesser extent, Latin America and the Caribbean (but less so in Brazil, where significant investments are being made in industrial processing capacity). There will also be surplus timber stocks in some temperate countries (eg Russia). There are strong reasons to expect a significant expansion in forest plantation area in all three tropical regions. In almost all tropical countries the perception is that, for a number of reasons, the supply of timber from natural forests will gradually decrease and production costs will increase.

  Future timber supply from plantations will also depend on forest productivity and timber quality. In most countries, the replacement of timber from natural forests with timber from plantations will require domestic investments in technology and the availability of considerable financial resources. The importance of sourcing wood from sustainably managed forests will continue to increase. In this context, wood from plantations will play an important role.
- Even though the tropical forest plantation estate is expected to continue to expand, its rate of expansion will be lower than in recent decades. Land availability, environmental concerns, production costs, returns on investment and several other factors will divert efforts towards increasing the productivity of existing plantations (eg through high-yielding clones) rather than increasing the area. This will occur mainly in the Asia-Pacific region, since forest productivity is lower than in Latin America (especially Brazil). The expansion of plantation area will depend on the willingness of the public sector and international investors to make funds available, which is limited at present. In most tropical countries the development of innovative financing mechanisms will play an important role. The CDM and other mechanisms for payments for environmental services are likely to play an increasing role. Access to these funding sources for forest plantations is very limited at the moment but could increase.
- In many poor tropical countries, particularly in Africa, forest plantation programs will increasingly be linked to poverty alleviation, community development, and the recovery of degraded land. These programs are likely to grow, contributing to an increase in plantation area.
- In Latin America and the Caribbean and some Asia-Pacific countries, the lack of large contiguous land areas and environmental restrictions on land use will mean that the expansion of the area of industrial plantations will occur mainly on small and medium-sized properties. The involvement of communities and participatory approaches in general will continue to gain importance in tropical countries, particularly in Latin America.
- The expansion of the industrial forest plantation estate in the tropics will continue to be constrained by competition for land with the agricultural and livestock-raising sectors.
- Governments in most tropical African and Latin American countries have limited financial resources to invest in forest plantation programs, which

require comparatively long-term investments. Short-term social and economic concerns are usually given higher priority.

- The forest outgrower programs promoted by the pulp-and-paper industry are likely to intensify and will help consolidate forestry activities on small rural properties. These partnership programs are important in Latin America, notably Brazil, and will also increase in the Asia-Pacific region.
- The private sector will continue to be the main investor in forest plantations worldwide, particularly in Asia-Pacific and Latin America and the Caribbean. In Africa, development will be influenced by the geopolitical situation in the Congo Basin. Given the region's instability, few foreign private investors seem interested in channelling resources there. Forest plantations in Africa will continue to be mostly linked to international cooperation projects.
- Industrial forest plantations will continue to be the focus of foreign direct investment, mainly in Latin America and the Caribbean and the Asia-Pacific region; many timber investment management organizations have been analyzing opportunities in Brazil, China, Indonesia and Malaysia. In most non-tropical countries, in both the northern and southern hemispheres, plantation productivity is lower than in tropical countries and land is almost always more costly. This encourages investors to seek locations where returns might be higher.
- Many forest-industry companies will gradually divest themselves of their forest assets, which often cover extensive areas. The revenue from the sale of these forest assets will be used to pay debts and to fund industrial development. In this context, timber investment management organizations will play an important role.
- Eucalypts and acacias will continue to be the most important tree species used in forest plantations for pulp and paper. Pines, rubber and teak will increase their role as the preferred tree species for the production of sawn timber, plywood and veneer.
- Stakeholders will succeed in developing broadly shared views on how best to deal with the environmental and social issues associated with the establishment and management of industrial plantations. In locations where pressure for land is high, however, conflicts over large-scale industrial plantations are likely to continue.

7 ELEMENTS OF AN ITTO STRATEGY FOR PLANTATION DEVELOPMENT

Linking industrial forest plantation development constraints to ITTO objectives and actions

This chapter reviews ITTO's stated goals and action plan relevant to industrial plantation development and sets out the possible ways in which ITTO can further assist tropical producer members to overcome the constraints facing the sector.

General aspects

Table 7.1 lists five constraints to industrial forest plantation development in the tropics relevant to ITTO's cross-cutting actions (as set out in the Organization's Yokohama Action Plan). Table 7.2 lists nine constraints relevant to the goals and actions set out in the Yokohama Action Plan, also taking into account the *ITTO Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests*. Together, the tables indicate the high degree of relevance of plantation development to ITTO's mandate.

Table 7.1 Key limiting factors related to ITTO cross-cutting actions

Key issues limiting forest plantation development	ITTO cross-cutting actions	Cross-cutting action #
1. Lack of knowledge on current status of tropical plantations	• Encourage and assist producer member countries to identify and address constraints in their implementation of SFM and the sustainable development of the forest industry to enhance the contribution of the forest sector to national objectives	2.a
2. Poor capacity-building development	• Assist human resource development and institutional strengthening by conducting national, regional and international training activities and the provision of fellowships	2.e
3. Lack of (global) information generating/disseminating	• Maintain and expand the tropical timber databases and facilitate access to them • Support the sharing of information, knowledge and technology to improve SFM, product processing, utilization and understanding of the marketplace as related to ITTO's priorities	2.g 2.i
4. Lack of and/or insufficient technology and R&D	• Support the sharing of information, knowledge and technology to improve SFM, product processing, utilization and understanding of the marketplace as related to ITTO's priorities • Support research and development studies and projects to improve understanding of the marketplace, efficient product processing, industrial utilization and better forest management	2.i 2.l
5. Lack of funding/financial mechanisms	• Explore and encourage investment and private-sector joint ventures in the forestry sector, including the re-investment of forest-generated revenues	2.j

Source: ITTO (2002), adapted by STCP.

Table 7.2 Key limiting factors related to ITTO goals and actions for reforestation and forest management

Key issues limiting forest plantation development	Linkage with ITTO goals and actions for reforestation and forest management Goals/actions Goal 1: Support activities to secure the tropical timber resource base	Action #
1. Climate for forest investment: – law enforcement	• Support the effective enforcement of forest laws and regulations that ensure SFM and secure the production base	1.1
2. Low price of illegal products	• Review the current situation regarding any undocumented forestry activities relating to the objectives of the Organization	1.2
3. Innovative incentive mechanisms and legislative framework, including market-based instruments for expanding forest plantations: – lack of incentive mechanisms – complexity of legislation	• Develop innovative mechanisms and relevant legislative frameworks, including incentives and market-based instruments, to secure and expand, where appropriate, the forest resource base	1.7b
4. Restrictions related to land-use: – land-use planning (forest vocation land[1]) – tenure (property rights) – competition with other activities	• Secure the forest resource base through the implementation of forest policy, legislation and associated strategies, revised and updated where appropriate, which address: – land-use planning which defines forests appropriate for production and provides sufficient representation through protected, reserved and conservation areas to ensure biodiversity conservation and watershed protection – tenure rights, taking into account traditional ownership and/or use – national guidelines and regulations for forest utilization which ensure local stakeholder rights and secure conservation and environmental services	1.7c
	Goal 2: Promote sustainable management of tropical forest resources	
5. Cost and complexity of forest certification to some stakeholders	• Assist members, as appropriate, to build capacity to engage in voluntary certification to enhance market acceptance of tropical timber and tropical timber products	2.9
6. Lack of information on forest plantations (especially sustainable production capacity for policy definition and investors)	• Encourage members and assist them, where appropriate, to implement forest inventories and determine the sustainable yield capacity of each forest management unit through the application of appropriate resource assessment methods and incorporate these into forest management plans	2.10a
7. Community's forest plantations are not established for the markets	• Establish and manage forests for multiple uses in close cooperation with local forest owners and communities living in forest areas	2.10g
8. Loss of planted forest areas due to fire in some regions	• Undertake measures for the prevention and management of fire relating to tropical timber-producing forests	2.10g
9. Lack of knowledge in silviculture and forest management	• Strengthen training institutions and intensify training of forestry personnel and other stakeholders in silviculture, reduced impact logging and resource assessment, and in the management of both natural forests and timber plantations	2.10l

[1] *As defined in Nascimento (2005); see Chapter 6.*
Sources: ITTO (2002), adapted by STCP.

Recommended strategies and actions for ITTO

Strategic country-level actions supported by ITTO

- ITTO should assist governments to:

  Development/improvement of forest policies and legislation

  1) Create enabling policies and enhance political commitment to forest plantation development; undertake land-use planning; combat illegal logging and illegal timber trade; create adequate incentive mechanisms and a conducive investment climate; secure property rights for forest landowners and producers; and promote institutional development, considering that:
     - in countries with a competitive advantage in industrial plantations, forest policies and national strategies should include industrial plantations as a major area of intervention, targeting both the meeting of domestic needs and the development of export-oriented production. This would require strategic planning supported by analytical studies as well as adequate mechanisms in land allocation and tenure, training and extension, research and development and financing incentives
     - in less competitive countries, institutional capabilities will need to be upgraded to integrate forest plantations within the national planning system. This will require analytical studies to clarify the role of forest plantations, including their contributions to economic growth, poverty alleviation, and environment conservation.
  2) Reduce transaction costs by simplifying the administrative procedures for the establishment of plantation projects and the harvesting of plantation timber (eg by revising forest laws, establishing clearing-house mechanisms, and other actions).
  3) Develop innovative incentives and financing mechanisms for forest plantations, including those under the CDM, other carbon financing initiatives, and avoided deforestation. Options include payments for other environmental services and special forest plantation trust funds and securities.
  4) Revise the legal framework related to land and natural resource use by identifying bottlenecks that prevent the adequate implementation of forest plantation programs. Legal reforms would also help to remove restrictive aspects of current laws and the judiciary system linked to the risks faced by long-term investments.

  Definition and allocation of land for forest plantations

  5) Identify priority zones for forest plantations (land and resource macro-zoning).
  6) Support forest plantation programs by enhancing national capacities for land-use planning and the allocation of forest plantation areas in accordance with best practice.

  Capacity-building

  7) Promote and support research and development through concerted action among national governmental and private-sector institutions.
  8) Develop ways of communicating relevant information and findings from research on plantation forests to stakeholders, including through specialist publications.
  9) Build up human resource capacity through programs for improving plantation-related skills (professional, technical and vocational).
  10) Improve the national services – such as extension, advisory and technical assistance – needed for the establishment and expansion of industrial forest plantations.

- ITTO should assist organizations of smallholders and communities to:

  11) Facilitate interactions between government, the private sector and NGOs through capacity-building in negotiation and conflict-resolution skills.
  12) Disseminate information about the importance of forest plantations and their impacts on the conservation of natural forests.
  13) Support the organization of smallholders and communities interested in plantation development.
  14) Build the capacity of stakeholders to participate in plantation development by convening workshops and providing specialized training courses.

- ITTO should assist the private sector to:

15) Support the adoption, by private-sector organizations, of proper planning, including in regard to financial aspects and risk assessment, taking into account the importance of land-use planning, tenure rights and national guidelines and regulations for forest utilization.

16) Disseminate to private-sector organizations up-to-date information on the application of relevant international standards and best practices codes.

17) Disseminate information related to the role of forest plantations in climate change mitigation, soil and water conservation, and biodiversity conservation, and their direct contributions to economic and social development.

18) Facilitate cooperation between the corporate sector, communities and smallholders through appropriate types of partnerships and outgrower schemes.

19) Through national and international fora, facilitate the active exchange of technical and scientific information related to forest plantations.

20) Support innovative technologies that improve environmental performance (eg reduced-impact logging).

Strategic actions to be implemented by ITTO

ITTO should:

Information base on timber plantations

21) Improve existing ITTO forest databases by including adequate information on industrial plantations. This will involve providing support to producer member countries to develop their systems. ITTO should also disseminate information through its Market Information Service and other ITTO communication vehicles.

22) Collect the information (eg through national and regional forest inventories, etc) on forest plantation resources – such as planted area, tree species, distribution and sustainable production capacity – necessary for decision-making to promote forest planting and timber utilization.

23) Share information, knowledge and technology through cooperation with countries and other organizations (eg disseminate technical information on plantation forests, including forest planting methods and management, based on the lessons learned from successful and unsuccessful plantation experiences).

24) Communicate information at the national and international levels through national workshops, seminars and other events, and publications using various media (printed and electronic).

International and regional forums and seminars

25) Organize international and regional forums to exchange experiences in financing mechanisms and the development of strategies for forest plantations in the tropics, taking into account recent developments in the United Nations Framework Convention on Climatic Change, the CDM, etc. ITTO should provide specific forums for small and medium-sized investors related to potential forest development ventures, especially in emerging and developing economies where access to financial resources is often restricted to large corporations.

Policy development to improve the investment climate for forest plantations

26) Support the implementation of national programs to improve the business climate for sustainable forest investment.

27) Develop national strategies to improve the attractiveness of plantation investment (domestic/foreign).

28) Promote regional initiatives for engaging national institutions and professional, public and civil-society organizations in the identification of forest development projects that can be presented to investment institutions and international development cooperation and aid agencies. This could be done, for example, by coordinating the provision of assistance with regional entities such as *Corporación Andina de Fomento*, multilateral and regional development financing organizations, and others.

Human resource development and institutional strengthening

29) Support the development of human resources in topics such as:

- the management of genetic material
- nursery measures
- species-specific silviculture
- appropriate harvesting technologies
- fire management
- pest and disease control.

30) Promote the transfer of technology among national research institutions by facilitating dialogue and funding fellowships for specific training and the investigation of technical issues such as species selection, seed supply, nursery operations, plantation establishment and management, and other aspects.

31) Develop guidelines for the participatory formulation of plantation projects to be used by stakeholders in producer member countries in order to facilitate access to resources and technical assistance.

Guidance on the establishment and sustainable management of planted tropical forests

32) Review the *ITTO Guidelines for the establishment and sustainable management of planted tropical forests*.

Other strategic actions

Although, in general, ITTO actions do not target government decisions directly associated with extra-sectoral factors (ie supra- and inter-sectoral factors), given ITTO's intergovernmental nature there are a number of actions it can take to address them. ITTO should:

Macroeconomic policies (supra-sectoral)

33) *International trade*: Continue to undertake actions related to market constraints, including on tariff and non-tariff trade barriers and policies that address illegal logging and trade.

34) *Government transparency*: Contribute to international efforts that might, in the long run, result in the adoption of improved planning practices and a higher degree of participation by civil society. A lack of transparency can have a detrimental effect on the development of the forest plantation sector.

35) *Fiscal benefits in the economic environments of tropical countries*: Support analytical work to assist governments in adjusting their fiscal policies, such as by improving taxation efficiency in the forest sector.

Other related economic sectors (inter-sectoral)

36) Carry out analytical studies on the economic instruments applied in agriculture to clarify their impact on the rehabilitation of marginal lands through forest plantations, and on land values.

37) Review experiences in other sectors related to technical education and training and financing mechanisms and determine their applicability to forest plantation development.

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ANNEX 1 LIST OF CONTACTS

	Region :	**Asia-Pacific**		
No.	**Country**	**Institution**	**Contact person**	**Profile**
1	Indonesia	Association of Indonesian Forest Concession Holders	Nanang Roffandi Ahmad - President Commissioner	Society
2	Indonesia	Bank Mandiri	Bamban Setiawan - Managing Director	Financial
3	Indonesia	CIFOR	Christopher M. Barr - Senior Policy Scientist	Government
4	Indonesia	Forest Plantation Development	Bambang Tri Hartono - Deputy Director	Government
5	Indonesia	Indonesian Ekolabel Institute	Aditya Bayunanda - Project Management Manager	Government
6	Indonesia	Riau Andalan	Irsan Syarief - President Director	Company
7	Indonesia	Sinar Mas Group	Aris Adhianto - Director	Company
8	Indonesia	WWF	Nurcahyo Adi - Trade Coordinator	Government
9	Malaysia	Forestry Dept of Peninsular Malaysia	Mohmed Rasid Ibrahim - Deputy Director	Organization
10	Malaysia	Malaysian Timber Council	Azelan Ashak - Assisitant Director of Strategic Planning	Company
11	Malaysia	Malaysian Timber Industry Board	Hajjah Mahani Mohd Yusoff - Deputy Director Strategic Planning	Company
12	Malaysia	Ministry of Plantation Industries and Commodities	Wan Abdul Hadi Wan Mohd Shafie - Assistant Secretary	Organization
13	Thailand	Associate Dean	Nikhom Laemsak	Society
14	Thailand	FAO Regional Forestry Commission	Patrick Durst - Senior Forestry Officer	Organization
15	Thailand	National Consultant to the ITTO Mission	Sittichai Ungphakorn	Organization
16	Thailand	National Parks Office	Narong Mahannop	Organization
17	Thailand	Office of Reforestation Promotion	Thongchai Pratoosuwan - Director	Organization
18	Thailand	Kasetsart University	Suree Bhumibhamon - Associate Professor	University
19	Thailand	Siam Forestry Co Ltd – Paper and Packaging	Poramate Larnroongroj - Managing Director	Company
20	Thailand	Sustainable Forest Management	Chittiwat Silapat, Director	Organization
21	Thailand	Thailand Environment Institute	Chamniern Paul Vorratnchaiphan - Director of Grassroots Action Program	Organization
22	Thailand	Thailand Tree Farm Association	Reungchai Pousajja	Society
	Region :	**Latin America & Caribbean**		
No.	**Country**	**Institution**	**Contact person**	**Profile**
23	Ecuador	AceroVegetal	Jorge Manzur - Gerente Geral	Company
24	Ecuador	Asociacion Ecuatoriana de Productores de Teca y Maderas Tropicales	Rodolfo Arámbulo - Presidente	Society
25	Ecuador	Banco Interamericano de Desarrollo	Steven W. Stone - Espec. en Recursos Naturales	Financial
26	Ecuador	Corpei	Valeria Escudero - Subgerente del Promoción de Exportación	Organization
27	Ecuador	Eucapacific Proyecto Forestal	Guillermo Rodrigues - Director	Company
28	Ecuador	FAO Ecuador	Iván Ángulo Chacon - Representante de la FAO em Ecuador	Organization
29	Ecuador	Ministerio de Agricultura y Ganadería	Ramón del Salto - Fomento Agroproductivo	Government
30	Ecuador	Ministerio del Ambiente del Ecuador	Germán Espinoza - Dirección Forestal	Government
31	Peru	Asociación de Exportadores de Peru (ADEX)	-	Society
32	Peru	Asociación para la Investigación y Desarrollo Integral (AIDER)	-	Society
33	Peru	Maderera Bozovich	Renato Dedini	Company
34	Peru	Maderera Vulcano	-	Company
35	Peru	Ministerio de Agricultura (INRENA)	Marco Romero	Government

36	Peru	Tropical Forest Consultants	Eduardo Rios - Manager	Company
37	Venezuela	Compañía Nacional de Reforestación	Guillermo Banchs Hernández - Presidente	Company
38	Venezuela	Corporación Andina de Fomento	Maria Teresa Szauer - Directora Desarrollo Sustenible	Financial
39	Venezuela	Fundación Instituto Forestal Latinoamericano	Manuel Briceño - Presidente	Organization
40	Venezuela	Instituto de Investigaciones para el Desarrollo Forestal	Ernesto Arends - Coordinador	Organization
41	Venezuela	Ministerio del Ambiente y de los Recursos Naturales	Renzo Silva - Director General Recurso Forestal	Government
42	Venezuela	Pizano SA	Miguel Rodríguez - Director Forestal	Company
43	Venezuela	Smurfit Cartón de Venezuela	León Rosales	Company
44	Venezuela	Terranova de Venezuela	Enrique Carrera - Director Forestal	Company
	Region :	**Africa**		
No.	**Country**	**Institution**	**Contact person**	**Profile**
45	Cameroon	ANAFOR - Agence Nationale D'appui au Développement Forestier (National Agency of Support to Forest Development)	Narcisse Lambert Mbarga	Government
46	Congo (Brazzaville)	Ministère de L'economie Forestière Charge de la Pêche et des Ressources Halieutiques (Ministry of Forest Economy, Fisheries and Water Resources)	Dominique Nsosso	Government
47	Babon	Ministère de L'economie Forestière, des Eaux, de la Peche et des Parcs Nationaux (Ministry of Forest Economy, Water, Fisheries and National Parks)	Sylvain Nze Nguema	Government
48	Ghana	African Development Bank	Manager	Financial
49	Ghana	Asuo Bosomadu Timber and Sawmills Ltd	-	Company
50	Ghana	Care International, Ghana	Fiona Percy	Organization
51	Ghana	Danish International Development Agency	Officer in Charge	Financial
52	Ghana	Department for International Development	Country Director	Financial
53	Ghana	Environmental Protection Agency	Executive Director	Government
54	Ghana	Environmental Protection Association of Ghana	John Kwadwo Owusu - Project Manager	Society
55	Ghana	Forest Plantation Development Centre	Project Manager	Government
56	Ghana	Forest Services Division	Executive Director	Government
57	Ghana	Forestry Ghana	-	Company
58	Ghana	Forestry Research Institute of Ghana	Director	Government
59	Ghana	Friends of the Earth, Ghana	Theo Anderson - Director	Organization
60	Ghana	Furniture and Wood Workers Association of Ghana	President	Society
61	Ghana	Ghana Association for the Conservation of Nature (GACON)	Joseph Mmwaura	Society
62	Ghana	Ghana Timber Association	-	Society
63	Ghana	Ghana Timber Millers Organization	-	Organization
64	Ghana	Green Earth Organization (GEO)	George Ahadzi	Organization
65	Ghana	Ministry of Lands, Forestry and Mines	Technical Director (Forestry)	Government
66	Ghana	Netherlands Development Organisation (SNV)	Paul Van Hoof	Organization
67	Ghana	Resource Management Support Center	Director	Government
68	Ghana	Ricerca E Cooperazione	Country Representative	Organization
69	Ghana	Samartex Timber and Plywood Co.	-	Company
70	Ghana	Social Security and National Insurance Trust	Managing Director	Financial
71	Ghana	Subri Industrial Plantation Limited	Director	Government
72	Ghana	Swiss Lumber Company Ltd	-	Company
73	Ghana	Technoserve Ghana	Human Resources Manager	Organization
74	Ghana	Timber Industry Development Division	Executive Director	Government
75	Ghana	The World Bank	Edward Dwumfour	Financial

ANNEX 2 MODEL QUESTIONNAIRES

2.1 QUESTIONNAIRE TO CERTIFICATION BODIES

QUESTIONNAIRE – ITTO STUDIES ON INDUSTRIAL FOREST PLANTATIONS

Please respond short answers to the following questions related to ***industrial forest plantations*** *in your country, as applied to your organisation.*

1. Certified forest area:

   Year: _____

Country	CERTIFIED AREA		
	Planted Forest Area (ha)	Native Forest Area (ha)	TOTAL Area (ha)

2. Impacts of forest certification and the chain of custody in **the competitiveness and trade** of products from tropical plantations.

3. Is there any channel of distribution for this type of product in your country or a specific niche of market.

4. **Costs of certification of planted forests** comparatively with natural forests under different conditions (companies, communities, small landowner, etc).

5. Which other costs are applied to maintain the forest certification and/or chain of custody, besides the cost to certifier?

6. To which extent is certification a barrier to the international trade (planted and natural forest products)?

7. Is there a "premium" price paid for certified wood in the domestic and international market? If so, please give example (5).

8. What is your knowledge about successful cases of tropical forest products from certified planted forests?

9. **Trends and perspectives** of forest certification from forest plantations in the tropics;

10. Main restrictions or incentives to forest certification.

11. Recommendations for change (including actions to ITTO in the promotion or assistance regarding industrial forest plantation in the tropics)?
    - Strategies that ITTO could adopt to assist producer countries to promote private sector investment in commercial plantation development that supports sustainable forest development?

12. Other relevant aspects?

2.2 QUESTIONNAIRE TO PRIVATE COMPANIES AND INVESTORS

QUESTIONNAIRE – ITTO STUDIES ON INDUSTRIAL FOREST PLANTATIONS

Please respond short answers to the following questions related to ***industrial forest plantations*** *in your country, as applied to your organisation.*

PRODUCTION AND TRADE

- **Production and Trade of Tropical Timber Products from plantation sources?**
- Major companies based on forest plantation (raw material + products), location within the country, major species and forest products;
- Market and trade of plantation timber:

Please check, correct or fill in, as appropriate, the following table indicating the **reference year:**

YEAR [1]: _____. Perception of Volume or Share (%)

Products	Unit[2]	Domestic Market				International Market			
		Production		Consumption		Exports		Imports	
		Plantation	Non-Plantation	Plantation	Non-Plantation	Plantation	Non-Plantation	Plantation	Non-Plantation
Logs									
Sawnwood									
Veneer sheets									
Plywood									
Others									
Combi-Plywood									
Reconstituted wood panel									
Pulp									
Paper									
Charcoal									
TOTAL									

[1] Year: 2004 (preferably 2005), if available please also provide statistics over the period 1995-2004;
[2] Unit: (i) volume (m^3 or ton); (ii) value (USD); (iii) proportion of total plantation/non-plantation timber (%).

- Main Direction of trade of plantation and non-plantation timber: 2004 (preferably 2005);
- Growth rates of production, consumption, exports and imports: 1995-2004;
- Market trends;
- Distribution channels: from forest to market;

- **Comparison of the structure of the industry based on plantation timber x based on natural forest timber**

INDUSTRIES	Plantation Timber	Natural Forest Timber
Comparison		
Relative Importance and Perspectives		
Technology applied		
Constrains in supply / using plantation logs		
Others issues relevant		

- **End-uses of tropical timber products in your country?**
- **Main issues related to domestic and international markets of tropical plantation timber?**
- **Market competitiveness of tropical plantation timber/products compared to non-tropical timber in the international and domestic markets?**
- **Market Competition (Tropical Plantation Timber):**
  - Main competitors (countries) for relevant products;
  - Main markets for plantation timber;
  - Perception on competing products in the market.
  - Barriers and constraints to entry in the plantation industry/trade:
  - Market barriers faced by industry using plantation timber (e.g: forest certification, product quality certification, standards, legal aspects, others);
  - Main constrains in marketing plantation timber products;
  - Views on future developments (products, market share, and other aspects);

INCENTIVE MECHANISMS FOR FOREST PLANTATIONS

- **Perceptions of the climate for investing in industrial plantations?**
- **Perception of the profitability of industrial forest plantation development?**
  - What do you think it now is or is likely to be?
  - To what extent does your perception of profitability govern their investment thinking? (or, alternatively What factors govern your investment thinking?)
  - What extent and by what means do financial considerations influence investment in tropical industrial plantations? (or How much influence do NPV style calculations have in practice on investment decisions re industrial plantations?)
- **Analysis of successes and failures of the existing financial incentive mechanisms?**
- **What in your view constitutes success or failure of a plantation programme/ mechanism?**
- **How have existing mechanisms contributed to the successes or to the failures?**

- **What are the key factors in the successes and failures of the existing commercial plantations?**
- **Industry perspective of the existing incentives (disincentives) for industrial forest plantations?**
- **What is the role of the government towards industrial forest plantations? What is your perception (comments) on trends and perspectives of national actions and policies towards industrial forest plantations?**

  Role of government:

  Trends:

  Perspectives:

- **Total investments in industrial forest plantations (over the past ten years)?**
- **To what extent carbon sequestration in general or carbon credits trading in particular is or is becoming a factor in encouraging investment in forest plantations by developed countries or polluting industries?**
- **What extent does or could carbon sequestration or crediting and trading influence private sector investment in tropical industrial plantations?**

GOVERNMENT ACTIONS/POLICIES TOWARDS FOREST PLANTATIONS

- **Appraisal of the impact of Forest Certification in the marketability of tropical timber products?**
  - Certified tropical plantation forest area under different certification schemes:
  - Impacts on the Competitiveness/Marketability of Products from Tropical Plantations:
  - Trends and perspectives:
  - What are the relative costs of securing certification? (under different certification schemes and stakeholders - forest companies, communities, small landowners).
  - Any other comments

RECOMMENDATIONS FOR ITTO

- **Recommendations for change (including actions to ITTO in the promotion or assistance regarding industrial forest plantation in the tropics)?**
- **Strategies that ITTO could adopt to assist producer countries to promote private sector investment in commercial plantation development that supports sustainable forest development?**
- **Other relevant aspects?**
- **Common constraints to commercial plantation development?**

2.3 QUESTIONNAIRE TO FINANCING INSTITUTIONS

QUESTIONNAIRE – ITTO STUDIES ON INDUSTRIAL FOREST PLANTATIONS

Please respond short answers to the following questions related to ***industrial forest plantations*** *in your country, as applied to your organisation.*

INCENTIVE MECHANISMS FOR FOREST PLANTATIONS

1. **What the attitude/policy of your organization is regarding lending for, or investing in industrial forest plantations and the reasons for holding that view?**

2. **What mechanisms does your organisation provide or offer for sponsoring or promoting industrial forest plantations?**

3. **What are the other existing financial incentives/mechanisms for the promotion of industrial forest plantations (e.g., subsidies, plantation programs, fiscal incentives, loans, others) in the tropical countries you operate?**

Level	Main Financial Incentives	Institution	Total Annual Amont for Forest Plantation (US$)	Main Features
International				
Federal				
State/Province				
Municipal				
Others				

4. **What do potential or prospective investors think of those mechanisms and their administering bodies?**

5. **Analysis of successes and failures of the existing financial incentive mechanisms?**
   - What in your view constitutes success or failure of a plantation programme?
   - How have existing mechanisms contributed to the successes or to the failures?
   - What are the key factors in the successes and failures of the existing commercial plantations in your country?

6. **Main bottlenecks for the existing mechanisms for the promotion of industrial forest plantations and recommendations for changes?**
   - Main bottlenecks for existing mechanisms:
   - Recommendations for changes of existing mechanisms:

7. **To what extent carbon sequestration in general or carbon credits trading in particular is or is becoming a factor in encouraging investment by developed countries or polluting industries?**

8. **What extent does or could carbon sequestration or crediting and trading influence private sector investment in tropical industrial forest plantations?**

RECOMMENDATIONS FOR ITTO

9. **Recommendations for change (including actions to ITTO in the promotion or assistance regarding industrial forest plantation in the tropics)?**
   - Strategies that ITTO could adopt to assist producer countries to promote private sector investment in commercial plantation development that supports sustainable forest development?

10. **Other relevant aspects?**
    - Common constraints to commercial plantation development?

2.4 QUESTIONNAIRE TO GOVERNMENT INSTITUTIONS

QUESTIONNAIRE – ITTO STUDIES ON INDUSTRIAL FOREST PLANTATIONS

Please respond short answers to the following questions related to ***industrial forest plantations*** *in your country, as applied to your organisation.*

INDUSTRIAL FOREST PLANTATIONS

1. Forest cover and existing commercial tropical plantations in the country?

Please check, correct, or fill in, as appropriate, the following table indicating the reference year:

YEAR: _____

Forests	Area (ha)	MAI [1] (m^3/ha.year)	Main Locations (Region/Provinces)	Observation
Natural Forests (1)				
Industrial Plantation (2)				
- *Eucalyptus*				
- Pine				
- Others				
Non-Industrial Plantation (3)				
TOTAL (1+2+3)				

[1] MAI – Mean Annual Increment (m^3/ha.year) = Forest Productivity (if available).

- Main commercial tropical species:
  - Eucalyptus:
  - Pine:
  - Others (Teak/Acacia/Others):
- Management prescriptions:
- Plantation quality (X): ( )High ( )Medium ( )Low
- Plantation ownership (%): ( )Private ( )Government ( )Community ( )Other
- Comments on Private Sector Plantations:
- Comments on Community Participation Plantations:

GOVERNMENT ACTIONS/POLICIES TOWARDS FOREST PLANTATIONS

2. Government actions and policies towards industrial forest plantations?

- Does discussion on policy measures and issues driving the debate towards forest plantations take place in your country?
- Who arranges it?
- How much notice is taken of it?
- Is there really a debate in your country about industrial forest plantations?

3. Main shortcomings and constraints of the existing policies relating to industrial forest plantations?

4. Legal aspects and framework related to industrial forest plantations (their impact as incentives and disincentives)?

- Main legal aspects:
- Impact of legal aspects as incentives:
- Impact of legal aspects as disincentives:

5. **Existence of a National Forest Program/Policy?**
   - What are the provisions and objectives of the NFP with regard to (industrial and non-industrial) forest plantations?
   - National Forest Program/Policy:
     - Short description:
     - Website:
     - Main results:
     - Effectiveness:

INCENTIVE MECHANISMS FOR FOREST PLANTATIONS

6. **What the attitude/policy of your organization is regarding lending for, or investing in industrial forest plantations and the reasons for holding that view?**

7. **What mechanisms does your organisation provide or offer for sponsoring or promoting industrial forest plantations?**

8. **What are the major existing financial incentives/mechanisms for the promotion of industrial forest plantations (e.g., subsidies, plantation programs, fiscal incentives, loans, others) in your country?**
   - Federal level:
   - State/Provincial level:
   - Municipal level:
   - Any other:

9. **Analysis of successes and failures of the existing financial incentive mechanisms?**
   - What in your view constitutes success or failure of a plantation programme?
   - How have existing mechanisms contributed to the successes or to the failures?
   - What are the key factors in the successes and failures of the existing commercial plantations in your country?

10. **Total investments in industrial forest plantations (over the past ten years)?**

11. **To what extent carbon sequestration in general or carbon credits trading in particular is or is becoming a factor in encouraging investment in forest plantations by developed countries or polluting industries?**

12. **What extent does or could carbon sequestration or crediting and trading influence private sector investment in industrial tropical plantations?**

PRODUCTION AND TRADE

13. **Production and Trade of Tropical Timber Products from plantation sources?**
    - Major companies based on forest plantation (raw material + products), location within the country, major species and forest products;
    - Market and trade of plantation timber:

    Please check, correct or fill in, as appropriate, the following table indicating the reference year:

YEAR [1]: _____. Perception of Volume or Share (%)

Products	Unit[2]	Domestic Market				International Market			
		Production		Consumption		Exports		Imports	
		Plantation	Non-Plantation	Plantation	Non-Plantation	Plantation	Non-Plantation	Plantation	Non-Plantation
Logs									
Sawnwood									
Veneer sheets									
Plywood									
Others									
Combi-Plywood									
Reconstituted wood panel									
Pulp									
Paper									
Charcoal									
TOTAL									

[1] Year: 2004 (preferably 2005), if available please also provide statistics over the period 1995-2004;
[2] Unit: (i) volume (m^3 or ton); (ii) value (USD); (iii) proportion of total plantation/non-plantation timber (%).

- Main Direction of trade of plantation and non-plantation timber: 2004 (preferably 2005);
- Growth rates of production, consumption, exports and imports: 1995-2004;
- Market trends;
- Distribution channels: from forest to market;

14. Comparison of the structure of the industry based on plantation timber x natural forest timber

INDUSTRIES	Plantation Timber	Natural Forest Timber
Comparison		
Relative Importance and Perspectives		
Technology applied		
Constrains in supply / using plantation logs		
Others issues relevant		

15. Main end-uses of tropical timber products in your country?

16. Main issues related to domestic and international markets of tropical plantation timber?

17. Market competitiveness of tropical plantation timber/products compared to non-tropical timber in the international and domestic markets?

18. Market Competition (Tropical Plantation Timber):

- Main competitors (countries) for relevant products;
- Main markets for plantation timber;
- Perception on competing products in the market.
- Barriers and constraints to entry in the plantation industry/trade:
  - Market barriers faced by industry using plantation timber (e.g: forest certification, product quality certification, standards, legal aspects, others);
  - Main constrains in marketing plantation timber products;
- Views on future developments (products, market share, and other aspects);

RECOMMENDATIONS FOR ITTO

19. Recommendations for change (including actions to ITTO in the promotion or assistance regarding industrial forest plantation in the tropics)?

- Strategies that ITTO could adopt to assist producer countries to promote private sector investment in commercial plantation development that supports sustainable forest development?

20. Other relevant aspects?

- Common constraints to commercial plantation development?
- **Perception on risks for investment in industrial forest plantation in your country:**

Please fill in with an "X", as appropriate, the following table indicating the best alternative:

	RISK FOR FOREST INVESTMENT		
FACTORS AFFECTING INDUSTRIAL FOREST INVESTMENTS	LOW	MEDIUM	HIGH
SUPRA (Macroeconomy)			
Growth of GDP			
Exchange Rate			
Interest rate			
Free Trade Agreements			
Political Stability and Government Transparency			
Governance issues [1]			
Fiscal Policy			
INTER SECTOR			
Economic infrastructure			
– Transportation			
– Energy/Utility			
Social infrastructure			
Licenses and permits			
Labor			
– Laws and labor contracts			
– Wages			
– Labor productivity			
– Labor qualification			
Access to credit			
Justice and law enforcement			
Capital gain policy			
Land and resource tenure			
– Land tenure			
– Land market			
– Land use as collateral			
Sectorial policies			
– Environment policies and restrictions			
– Agricultural policies and restrictions			
INTRA-SECTOR			
Forest Resources (availability)			
Subsidies and Financial Mechanisms			
Trade Restrictions (on forest products)			
Markets			
Entrepreneurial Development Service			
Forest Vocation Land (land suitable and available for forest)			
Legal and Institutional Basis			

[1] How effectively government policies and measures are being implemented.

2.5 QUESTIONNAIRE TO CIVIL SOCIETY ORGANIZATIONS

QUESTIONNAIRE – ITTO STUDIES ON INDUSTRIAL FOREST PLANTATIONS

Please respond short answers to the following questions related to ***industrial forest plantations*** *in your country, as applied to your organisation.*

SOCIETAL ASPECTS

1. **What is the view of your organization as for the commercial tropical forest plantations?**

2. **What are in your view the societal needs related to commercial forest plantations?**

ACTIONS/POLICIES TOWARDS FOREST PLANTATIONS

3. **Existence of a National Forest Program/Policy?**
   - What are the provisions and objectives of the NFP with regard to (industrial and non-industrial) forest plantations?
   - National Forest Program/Policy:
     - Short description:
     - Website:
     - Main results:
     - Effectiveness:

INCENTIVE MECHANISMS FOR FOREST PLANTATIONS

4. **Analysis of successes and failures of the existing financial incentive mechanisms?**
   - What in your view constitutes success or failure of a plantation programme/ mechanism?
   - How have existing mechanisms contributed to the successes or to the failures?
   - What are the key factors in the successes and failures of the existing commercial plantations?

PRODUCTION AND TRADE

15. **To your knowledge, how communities have participated and benefited from forest management and forest products trade in your country/ program?**
    - Natural forests (SFM):
    - Plantation forests:

6. **Market competitiveness of tropical plantation timber/products compared to non-tropical timber in the international and domestic markets?**

RECOMMENDATIONS FOR ITTO

7. **Recommendations for change (including actions to ITTO in the promotion or assistance regarding industrial forest plantation in the tropics)?**
   - Strategies that ITTO could adopt to assist producer countries to promote private sector investment in commercial plantation development that supports sustainable forest development?

8. **Other relevant aspects?**
   - Common constraints to commercial plantation development?

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