



Executive Summary

State of the World's Forests

This document summarizes the main areas of factual information and presents some of the important policy issues facing the international community in relation to UNCED follow-up in forestry.



Food and Agriculture Organization
of the United Nations

State of the World's Forests

Policies and sustainable development

Today, achievement of national development goals requires policies that integrate forests in rural development efforts and that balance economic and environmental needs among national, local and international interests. Forests can no longer be viewed as separate in space, narrow in political interest or sectoral in their economic function. They directly affect, and are affected by, local national and international concerns. Development strategies must acknowledge that forest conditions are influenced by patterns of development, shaped and formed by competitive uses.

Governments are searching for pragmatic policy frameworks that deal coherently with both the contributions of forests to development and the institutional and organizational structures required to maximize these contributions.

Taxes, terms of forest concessions, administered prices, controlled transportation of forest goods, land and tree tenure insecurity, tariff and non-tariff barriers to international trade, investment incentives, agricultural sector strategies and macro-economics policies all affect economic motivations as well as the management and conservation of temperate and tropical forests.

If public policies are to be redirected to achieve efficient and sustainable management of forest resources, then changes are required. The economic valuation of current policies plays an important role in determining the appropriate policy responses. Faced with insufficient economic data estimates, orders of magnitude and indicators of the direction of change have to be the guides to policy.

Trade and the environment

Countries with forest industries may use restrictive trade policies to protect their own forest-based industries, to stimulate value-added processing or to reduce the log content of timber product exports.

Over the past four decades, international trade negotiations such as the Uruguay Round have attempted to reduce trade restrictions on a wide range of goods and services including forest products.

Trade liberalization also raises important questions regarding social distribution of wealth, resources and

income. On the other hand, trade measures are often not the most appropriate means for addressing concerns about deforestation and degradation. Changes in these international flows may have very little influence on the main causes of deforestation and forest degradation in producer countries.

However, trade policies can play a role in encouraging trade-related incentives for sustainable forest management. Such policies should be used in conjunction with and to complement forest sector policies and regulations that improve forest management.

Future directions

There is now wide recognition by governments that sources of wood are found beyond conventional forest jurisdictions and that forest benefits and services go beyond wood. Sustainability, a long tradition in forestry, has evolved radically from focusing on the sustained yield of timber to a much broader concept of managing ecological processes, environmental services and economic and social goods. Critically important issues of equity arise when the interests and welfare of local communities, with limited options and capacity to find alternatives for their subsistence, differ from national or international priorities.

For all these reasons, national governments are challenged to respond both to local people's needs and national and global concerns; to use policies that determine forest conditions in ways that help improve opportunities for people and communities; and to understand better how interactions among sectoral policies and macro-policies influence people's use of forests, and the consequences of such use on national development.

People's participation

Recent experiences at the local level, particularly in community forestry programmes, provide lessons in new forms of local governance aimed at addressing the interests of people who depend on the forest. Community forestry attempts to account for diverse situations by strengthening local stakes in management by directly influencing the use of

individual forests through formal and informal agreements between the government and local groups.

Because access to political power and economic opportunities are not uniform within a community, some groups fair poorly under arrangements intended to benefit local users as a whole. This is especially true for women who are often responsible for collecting fodder, fuelwood and food items from the forest. It is most effective for women to decide on their own priorities and to negotiate with competing interest groups.

Capacity development

The development of local and national capacity in forestry requires human resources with improved skills and capacities to formulate and implement policies, strategies and programmes; and improved institutional arrangement for economic development.

All countries need to improve the capacity of all major groups with an interest and a role to play in the conservation and management of forests and in meeting the growing demands for forest goods and services. Countries need also to strengthen their ability to respond to their obligations to the international community.

International dimensions

Evolving global interests in forest conditions (for carbon storage, biodiversity, wilderness, etc.) are increasing the level of international involvement in forest governance. Chapter 11 of Agenda 21 highlights a number of programme areas. The responsibility for implementing UNCED agreements rests with national governments—the commitment made by NGOs, local communities and private sector groups in each country will determine the rate of progress.

FAO has identified several lines of action:

- international dialogue and collaboration among governments, multilateral institutions, NGOs and the commercial private sector;
- promotion of agreement on criteria and indicators of progress toward sustainable forest management;
- enhancing information on forests and strengthening support for forest resource assessment; and
- intensifying international support for capacity-building, strengthening public institutions and technology transfer.

Forests, economic development and the environment

The economic contribution of forests has been expressed up to now by the value of wood energy and solid wood and fibre products. The annual value of fuelwood and wood-based forest products to the global economy is estimated to be more than US\$400 000 million, or about 2 percent of GDP. The real value of the forestry sector's contribution has increased over the last 3 decades at an average annual rate of 2.5 percent.

About one-quarter of global timber production enters into international trade. Exports have currently reached about \$98 000 million, representing about 3 percent of world merchandise trade.

The outlook for forestry development is increasing demand for products and services and, at the same time, intensifying competition for the use of forest land.

Forests are recognized as an integral part of national economies, providing a wide range of production inputs, environmental goods, food, fuel, medicines, household equipment, building material and raw materials for industrial processing. However, these multiple benefits and services are valued differently by different people. Environmental values have not generally been taken into real account.

Countries are interested in their entire forest system and how they contribute collectively to national development as sources of goods and services, as forms of insurance against environmental risk and as economic and social assets.

Forest resources

Extensive and reliable quantitative and qualitative knowledge about forests and ecosystems is indispensable for today's foresters, policy-makers and scientists. This information is required to develop appropriate strategies and programmes to conserve and manage this important renewable natural resource.

FAO's most recent resource assessment describes the state of forests in 1990 and assesses changes during the 1980s. The 1990 assessment estimates world forest area to be 3 442 million ha: 27 percent of the earth's area with total above-ground woody biomass at 440 500 million oven dry tonnes. These estimates suggest that 70 percent of the world's woody forest biomass is located in the tropical zone.

Deforestation and degradation are major tropical forest issues. For the 1980–90 period, the annual estimated loss in natural forest area is 12.1 million ha,

a decline of 0.8 percent per year in tropical and 0.5 percent in non-tropical developing countries.

The 68 million ha of plantation in developing countries provide a growing proportion of their commercial wood consumption needs.

Developed countries have 41 percent of the world's forest, but account for 76 percent of the industrial roundwood production. On the other hand, the developing countries account for 87 percent of the fuelwood and charcoal use.

Over the past 50 years, forest management in most developed countries has aimed at improving industrial roundwood producing capacity. Data from an assessment carried out by the World Conservation Monitoring Centre suggest that nearly 15 percent of the tropics is under conservation management or protection. This quantitative information must be tempered by the fact that inadequate legislation, weak

institutional support, inadequate or non-existent management and insufficient funding are common.

The future

Actions within the forestry sector alone cannot secure sustainable conservation and a wise use of forests. Success in the implementation of UNCED follow-up activities requires the promotion of follow-up actions in other sectors that influence forestry. Redirecting public policies to achieve efficient and sustainable forest management requires significant changes. However, UNCED's consensus on forest principles represents a commitment of responsibilities beyond national boundaries. The formidable challenge ahead is to turn these principles into practice. The contributions of forest to national development will depend on how well this challenge is met.

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Food and Agriculture Organization of the United Nations

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Introduction

Forests are complex ecosystems capable of providing a wide range of economic, social and environmental benefits. Forests provide products and services which contribute directly to the well-being of people everywhere and are vital to our economies, our environment and our daily lives. While forests and woodlands are now recognized as essential for human life, their benefits and services are valued differently by different people and different groups.

Moreover, the numerous roles that forests are expected to play in local, national and global development continue to change over time. These shifting and sometimes conflicting expectations create difficult policy challenges related to both the forest sector and national development.

Concern about forestry's evolving roles was the subject of intense debate at the United Nations Conference on Environment and Development (UNCED) in June 1992. UNCED highlighted forestry development and environmental issues by developing a set of 'forest principles', devoting a chapter of its programme of action, Agenda 21, to combating deforestation (Chapter 11) and focusing on the importance of non-wood functions of forests in the biological diversity and climate change conventions.

A number of countries have launched specific international initiatives to follow up on UNCED forestry recommendations. This broad consensus on principles of sustainable forest management represents the first-ever commitment of responsibilities beyond national boundaries. Turning these principles into practice, however, presents a more formidable task.

At its 12th Session in March 1995, the Committee on Forestry plans to review progress in the implementation of Agenda 21 and to discuss the major forestry issues to be considered by the Commission on Sustainable Development at its third

session in April 1995. The purpose of this statement on the state of the world's forests is to summarize the main areas of factual information and present some of the important policy issues facing the international community.

This presentation brings together information from the *Global Forest Resources Assessment 1990*, the *FAO Yearbook of Forest Products*, the 1994 *State of Food and Agriculture special chapter*, 'Forest Development and Policy Dilemmas', the Forestry Chapter of *Agriculture Towards 2010* and *The Challenge of Sustainable Forest Management*. These FAO reports analyse the state of forest resources and the role of forests in sustainable development, and provide background information for FAO's report to the Secretariat of the Commission on Sustainable Development. This statement on the state of the world's forests presents a synthesis of this background information. It also includes two regional reviews, Europe and Latin America and the Caribbean, which were prepared in the context of recent FAO regional forestry meetings. Reviews of forestry in other regions will be included in future editions.

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Part 1

Evolution of forest policies and future directions



Evolving forest policies

In the past, the need to generate revenue and foreign exchange for national economic development motivated governments to design centralized and sectoral policies to influence how forest resources were used. Policy-makers regarded forests as distant reserves to be managed as sources of public revenue, treated as reservoirs of new land for cultivation or protected as nature reserves. Over time, however, society's shifting and sometimes conflicting expectations created more difficult policy challenges related to both the forest sector and national development. The perspectives and demands of politically diverse groups are still proliferating, placing a significant strain on current institutions and policies.

Today, national development strategies require policies that integrate forests in rural development efforts and that balance economic and environmental needs among national, local and international interests. Forests are no longer viewed as being separate in space, narrow in political interest or sectoral in their economic function. They directly affect, and are affected by, local national and international concerns. Development strategies must acknowledge that forest conditions are a consequence of development, shaped and formed by competitive uses.

Important changes in our approach to forest policies began in the 1970s, when growing awareness of how local communities depend on forests, and of the importance of small-scale forest industries, prompted efforts to strengthen local participation in forest management, programmes and activities. New types of cooperative activities emerged between local communities and national governments, including community forestry, farm forestry and joint forest management. These activities highlighted the role of forests in broader rural development and, at the same time, eroded confidence in exclusive state control.

The importance of forests to local communities led governments, NGOs and donors to consider a variety of rights, obligations, incentives and supports that would motivate people to invest in growing and managing forests. Countries throughout the world paid greater attention to local interests in forests and the capacity of communities to manage them alongside national interests. They explored new organizations, structures, rules and tenurial forms to enhance the productivity of forests, protect environmental qualities and empower rural communities to use forest resources for economic and social needs. As these various interests and objectives were not necessarily compatible, they gradually expanded rather than resolved contentious forest issues.

By the 1980s, countries began to recognize that forests have a global role in the stability of the biosphere, in the maintenance of biodiversity and in the protection of threatened indigenous and traditional cultures. This expanded role placed additional pressures on national governments. While in the 1970s they were compelled to develop better means to work with local communities, governments of the 1980s were expected to act as intermediaries between international interests in forests and local actions and demands for forest resources. Forestry policy-makers searched for ways to balance growing international expectations with the dispersed, diverse activities and needs of households and local communities.

In the 1990s, forests are a primary focus of policy debates about sustainable development. Despite its message of harmony, the concept of sustainability raises tensions between market-driven economic growth, social pressures for a more equitable distribution of economic opportunities and the need to maintain environmental productivity, ecological services and biological diversity to fulfil future

economic and social aspirations. The forces behind these pressures are unlikely to meet their goals without some compromise.

Forest resources are also in the forefront of national policy debates about how to restructure economic and political systems as well as how such structural changes can be made consistent with national interests in local action, social and sectoral distribution, international obligations and sovereignty. Today's governments are searching for pragmatic policy frameworks that deal coherently with both the contributions of forests to development and the institutional and organizational structures required to make better use of these contributions.

Forest policies and sustainable development

Developing effective forestry strategies and policies to promote sustainable development involves an array of difficult choices. For example, while we know that forest clearing for crops and pasture, overcutting for fuelwood, uncontrolled commercial logging for timber and expanding infrastructure all contribute to deforestation and degradation, the fundamental problem facing policy-makers is how to address the underlying causes. These include poverty, hunger, access to land, a lack of jobs and income-generating opportunities, and growing economic demands for forest goods and services.

Ironically, some government policies frequently exacerbate these underlying causes, producing intense and lasting impacts on forest resources. A growing body of literature now demonstrates convincingly that taxes, terms of forest concessions, administered prices, controlled transportation of forest goods, land and tree tenure insecurity, tariff and non-tariff barriers to international trade, investment incentives, agricultural sector strategies and macro-economics policies all affect economic motivations as well as the management and conservation of temperate and tropical forests. In many cases, these policies directly encourage or unintentionally subsidize deforestation and degradation.

Countries are seeking more appropriate economic policies, regulatory mechanisms, financial incentives, organizational structures and tenurial arrangements to promote sustainable forestry practices. In many

countries, the search for policies takes place alongside a wider examination of the role of government as regulator of the market place, as landowner and as forest manager. This examination is prompted partly by governments' own need to optimize resource efficiency, and partly by public concerns with government performance and, in particular, with the performance of forest services and their policies.

The overall policy impacts on the economy, society and environment depend not so much on the effect of policies on one forest, but their net effects across these diverse settings. The resulting forest conditions reflect the consequences of policies that created and modified the motives for cutting and growing trees in different places and at different times. For example:

- Relative market prices between agricultural and wood products and between fossil and forest fuels influence the growth of farm forestry and rates of natural forest depletion.
- The development of market infrastructure influences price structures and relationships.
- Changes in the labour force, non-farm employment opportunities and the expansion and intensification of agriculture are all fundamental forces affecting how forests change.
- Income and its distribution between and within urban and rural populations affect the availability of resources for, and spatial distribution of, investment in trees.
- The capital value of trees as growing stock and as protection against avoidable costs in soil and aquatic productivity is of growing importance to macro-economic considerations of the national roles of forests.
- Trade policies and international environmental agreements alter property rights and tenure systems.

Thus, the use, development and conditions of forests are fundamental consequences of the wider configuration of national policy and economic development. National development is constantly creating incentives and capacities both to exploit and to enhance forest resources. Economic growth and social conditions tend to shift the location and composition of forest resources. On a national scale, the nature of this relationship depends on a country's

particular economic, demographic and political circumstances.

Forests in national policy

Many governments tend to deal with forests through programmes and projects rather than as elements of a national system. Forests are nonetheless analogous to other systems of national interest such as infrastructure, education, finance, transportation and energy. Policies chosen to express and serve these interests influence the aggregate quality, composition, distribution and use of a country's forests.

Forests are living systems which evolve over time with or without human intervention. These changing forest formations create a kaleidoscopic movement of trees and land uses over space. Understanding the reasons behind these changes provides the basis for predicting the direction and consequences of future changes. Understanding how national policies affect forests provides the basis for achieving desired types of forest formations, including the aggregate contributions they provide, and the required trade-offs with other national objectives. But while the overall economic implications of national policy models are reasonably well understood, aggregate forest landscape formations have been ignored.

Forests and the resources devoted to growing, maintaining and protecting them depend on combinations of many different policies: environmental, energy, land, commodity, trade, industrial and agricultural policies; price, wage, income and investment policies; and the terms of international agreements. The analytical task is to relate policy combinations to forest consequences in diverse conditions and to identify those that are likely to serve local, national and international interests in the best way.

An important step towards understanding how overall policy choices affect forest resources was taken in the 1980s, as development strategies shifted from project-based assistance to policy-oriented programmes. During this period, policy analysts turned their attention to the impacts of intersectoral policy linkages on the forestry sector. They recognized the inability of traditional forestry strategies to slow the accelerating pace of deforestation and forest

degradation and realized that the roots of forest degradation and depletion often lay outside the forestry sector.¹ In the industrial countries, the effects of pollution (acid rain) on temperate forests highlighted this problem. In the developing countries, population growth, land tenure systems and agricultural sector policies were seen as underlying causes of deforestation.

Indeed, specialized direct policies have proved to be remarkably ineffective without an appropriate macro or intersectoral policy context allowing them to work properly. How these policy linkages are defined and interpreted depends on whether forest issues are: viewed from a national (macro) or a forest unit (micro) perspective; evaluated using development-oriented or resource-oriented concepts of capital, space and location; and analysed with macro-economic or micro-economic methods (therefore establishing macro or micro sets of policy priorities).

The ongoing research on the efficiency and sustainability implications of these linkages may be consolidated in four key areas: i) market failures and incentive structures; ii) policy failures; iii) forest sector policies; and iv) impacts of timber trade policies on forest use and the environment.

Market failures and incentive structures

When public goods, including public environmental goods and externalities are present, incentive structures may lead to market failure. The market does not confront users with the full social costs of their actions. For example, markets that fail to reflect environmental values fully (e.g. the additional costs of managing forests sustainably) can lead to excessive environmental degradation. Some form of public or collective action involving regulation (command and control), market-based incentives or institutional measures is required if market failures are to be corrected.

Forests may be affected in several ways. For example, the market prices of widely traded timber products typically do not reflect the environmental costs of their production. Market prices fail to

¹ M.R. de Montalembert. 1992. Intersectoral policy linkages affecting the forestry sector. In H. Gregerson, P. Oram and J. Soears, eds. *Priorities for forestry and agroforestry policy research*. Washington, D.C., IFPRI.

account for indirect use values (e.g. watershed protection or nutrient cycling) as well as future use and non-use values (e.g. option value or existence value), which may be lost or degraded by the production or consumption of forest products. Many environmental benefits are public goods and thus have no market price.

If all goods and services, including environmental services, provided by forests could be bought and sold in efficient markets, the trade-offs among forest functions and between forest and non-forest uses of land would be determined by the public's willingness to buy different services. If the public preferred the services of an intact forest over timber, the private landowner would be paid more to preserve the forest than to harvest it. Since it is not possible to restrict environmental benefits to those who pay for them, no market for these services exists and most landowners undervalue and thus underinvest in environmental forest functions.

In these cases, private and social costs and benefits diverge. Logging companies, for example, may disregard the impact of their activities on wildlife and landscape. The resulting loss of value for hunting or tourism falls outside the private cost and benefit calculations of the timber firm. When external costs are consistently ignored throughout an industry, prevailing market prices will tend to fall below the socially optimal level. Ideal policies would induce landowners to weigh the social costs and benefits of their land-use decisions equally with the private costs and benefits. Policies that attempt to induce this behaviour include taxing landowners to cover the social costs they impose on society or subsidizing landowners to prevent them from imposing the damages.

Property rights also shape the system of incentives and disincentives for forest use. The structure of property rights defines the rules, rights and duties within which users of the forest operate. Economic policy-makers place great importance on property rights systems because they govern the efficiency of resource use throughout the economy as well as the distribution of income.

Macro-economic policies

Macro-economic policies and public investment decisions may distort market prices of traded forest

products and services. Economic policy interventions at various levels can alter the profitability of forest-based activities *vis-à-vis* other domestic sectors and their competitiveness relative to foreign producers. For instance, exchange rate devaluations and the level of debt-service ratios influence forest resource use in a variety of ways. An overvalued exchange rate lowers the price of tradable goods relative to non-tradable goods. In this case, a real devaluation would remove economic distortions and provide enhanced incentives to domestic production of tradable goods (including forest products) relative to non-tradable goods. This may encourage forest harvesting and increase deforestation rates through the expansion of wood production for international markets. More generally, macroeconomic policies can affect underlying demand and supply conditions, having an inevitable impact on the forest industry and forest resources.

The impacts of macro-economic performance and policies on the forest sector are difficult to assess; few studies have attempted to examine the macro-economic linkages to temperate deforestation, and studies of tropical deforestation often produce conflicting conclusions.²

Public investment often has direct effects on forest-based activities, particularly where transport infrastructure and public services are extended to previously inaccessible forested areas. This type of investment may be an important subsidy for the logging and wood processing industry, because it reduces the costs of gaining access to forest resources. Likewise, it represents a subsidy for consumers, as it brings forest products to market less expensively. Public investment in remote forested areas also acts as an impetus to human migration and agricultural expansion, which is the major cause of forest clearing in many countries.

² See, for example, A.D. Capistrano, 1990. *Macroeconomic influences on tropical forest depletion: a cross country analysis*. University of Florida (Ph.D. dissertation); A.D. Capistrano and C.F. Kiker, 1990. *Global economic influences on tropical closed broadleaved forest depletion, 1967-1985*. Food Resources Economics Department, University of Florida; and J. Kahn and J. McDonald, 1990. *Third World debt and tropical deforestation*. Department of Economics, New York, SUNY-Binghamton.

Forest sector policies

Examples of policies that aim directly at forest management include tax credits or subsidies for forest conversion, forestation and wood production. Forestry is also affected by policies that alter incentives and impede competition in downstream industries or related sectors, such as wood processing and construction.

In the past several years, a great deal of applied research has focused on the economic linkages between forest policies and deforestation.³ Many studies conclude that forest pricing and management policies often distort costs in two ways. First, the prices for timber products or the products derived from converted forest land do not incorporate the lost economic values, such as foregone timber rentals, foregone non-wood forest products, forest protection and ecological functions or the loss of biodiversity. Second, the direct costs of harvesting and converting tropical forests are often subsidized (or distorted in other ways), thus encouraging overuse and waste.

An important role of policy analysis is to determine whether the benefits of incorporating these foregone values into decisions affecting forest use balance the costs of reduced timber production, trade, jobs and income (as well as the costs of implementing such policies). The next step is to correct the distortional domestic government policies and market failures that drive a wedge between private and social rates of forest use. Economically efficient policies internalize the ecological costs of forest use in production decisions.

Policies that permit imperfect competition in the forest industry can have important effects. Barriers to entry can prevent the most efficient firms from operating, thus leading the industry as a whole to extract more timber than necessary to provide a given supply of products. Inefficiencies in the processing

sector are particularly damaging in this respect, as they tend to increase the raw material requirements and, consequently, timber exploitation through poor log conversion rates and overexpanded capacity. Imperfect competition may also lead to the failure to adopt technologies and management practices designed to improve forest harvesting activities that minimize environmental degradation.

Forestry policies may lead to management inefficiencies in a number of ways by affecting the level of privately and socially efficient harvests; by influencing alternative royalty, contract and concession arrangements and their implications for trespass, high-grading and other environmental losses; and by altering the level of rent distribution. Designing forestry policies to reduce the inefficiencies of existing management practices and to control excessive degradation through logging activities is a complex process requiring careful attention to harvesting incentives. More often than not, policies actually create the conditions for short-term harvesting by concessionaires and, in some instances, even subsidize commercial harvesting at inefficient levels.

All these domestic market and policy failures have important implications for sustainable forest management. If public policies are to be redirected to achieve efficient and sustainable management of forest resources, then changes are required. The economic valuation of current policies plays an important role in determining the appropriate policy responses. Often, however, insufficient economic data and information exist to allow a precise estimation of the economic costs arising from domestic market and policy failures. Although in most cases cost estimates as orders of magnitude and indicators of the direction of change are sufficient for policy analysis, in many cases we are not even at this stage of 'optimal ignorance'.

Forests, trade and the environment

The environmental impacts of international trade are among the most divisive issues facing national policy-makers. Some environmental and advocacy groups interested in the trade environment debate argue that further trade liberalization will increase the demand for tropical timber. Not surprisingly, these groups tend to distrust regional and global trade agreements

³ For recent comparative reviews of how public policies affect deforestation, see: E.B. Barbier, J. Burgess, J. Bishop, B. Aylward and C. Bann, 1993, *The economic linkages between the international trade in tropical timber and the sustainable management of tropical forests*. Final Report for the ITTO; W.F. Hyde, D.H. Newman and R.A. Sedjo, 1991, *Forest economics and policy analysis: an overview*. World Bank Discussion Paper 134, Washington, D.C., World Bank; and R. Repetto and M. Gillis, eds, 1988, *Public policies and the misuse of forest resources*. Cambridge, Massachusetts, Cambridge University Press.

aimed at removing trade barriers. A number of interest groups advocate more restrictive trade measures in multilateral negotiations to control excessive forest depletion, encourage sustainable timber management and raise compensatory financing for timber-producing countries that lose revenues and incur costs by changing their forest policy.

Important concerns in the trade and environmental debate include: i) logging of old-growth forests in some regions of the world to service the trade; ii) the impacts of market, policy and trade distortions on the incentives for timber trade; and iii) the inability of many countries to make a sustainable transition from dependence on primary to second-growth forests and to match domestic processing capacity with the availability of timber stocks.

Trade policies and forest resource use

Countries with forest industries may use restrictive trade policies to protect their own forest-based industries, to stimulate value-added processing or to reduce the log content of timber product exports. Trade barriers include tariffs, quotas and other controls that limit the type and volume of forest products traded relative to what would be traded in a free market. Tariffs and quotas on imported forest products provide protection for domestic forest industries. Subsidies and product standard rules are used to discriminate against imported forest products. Taxes and bans on log exports are intended to promote value-added processing and restrict harvesting.

Over the past four decades, international trade negotiations have attempted to reduce trade restrictions on a wide range of goods and services including forest products. Fora such as GATT provide a means for reaching agreements on trade rules, settling disputes and reducing trade barriers.

Trade liberalization also raises important questions regarding social distribution of wealth, resources and income. More open markets tend to concentrate wealth and redistribute it to economically efficient groups at the expense of less advantaged and less efficient segments of society. These shifts require public interventions to adjust for imperfect competition and market failures. How to sustain productive distribution and regulate conflicts over forest resources is a fundamental question in the new world of liberalized

trade, and nations are only beginning to confront the complexity of these problems.

The various studies to date imply that, to take advantage of trade-expanding strategies, countries need to address existing policy failures and the incentive structure underlying deforestation by, for example, internalizing externalities, improving access to farmland, increasing agricultural productivity, expanding employment opportunities and providing increased tenure security for common and private property.⁴

On the other hand, trade measures are often not the most appropriate means for addressing concerns about deforestation and degradation, for several reasons. First, substantial distortions may already exist in the timber trade, the environmental effects of which are not well known. Further interventions to achieve environmental objectives may add to these uncertainties and prove to have unintended and even counterproductive effects.

Second, market and policy failures have a significant impact on forest management. Domestic environmental policies can have substantial effects on timber production, trade and prices. Trade interventions, on the other hand, address these problems only indirectly at best. Trade measures imposed unilaterally by importing countries would have little influence on domestic policies within producer countries.

Finally, trade measures have their most direct impact on cross-border product flows and prices. As noted above, changes in these international flows may have very little influence on the main causes of deforestation and forest degradation in producer countries. Even for forestry operations, there may be little effective control on how these trickle-down effects influence economic incentives at the level of the timber stand.

However, trade policies can play a role in encouraging trade-related incentives for sustainable forest management. Such policies should be used in conjunction with and to complement forest sector policies and regulations that improve forest management. Certainly, other sectoral and macro-economic policies that influence the pattern of deforestation and forest land use must also be addressed.

⁴ FAO, 1994. Forest development and policy dilemmas. In *The State of Food and Agriculture*. Rome.

Forests and future directions

In the past, national governments treated forests as bounded stocks of wood that could be enhanced, maintained or converted to improve national welfare. These earlier approaches made use of centralized ministries and sectoral policies to generate revenue and foreign exchange. Today, governments are recognizing that sources of wood are found beyond conventional forest jurisdictions and that forest benefits and services go beyond wood.

This broader view of what forests are and what they contribute requires national strategies and policies to integrate forests in rural development efforts and balance economic and environmental needs among local, national and international interests. At the same time, these sometimes conflicting expectations create difficult policy challenges in dealing with both the forest sector and national development.

Evolving concepts and shifting priorities are also placing additional strains on national capacity to manage individual forest units. For instance, sustainability in forestry has evolved from focusing on sustained yield of timber to a much broader concept of managing ecological processes, environmental services and economic and social goods. Like the concept of sustainable development, incorporating this broad range of values into sustainable forestry management is appealing, but difficult in practice. The approach to sustainability depends on the perspective adopted.

In addressing the wide spectrum of priorities between local and global perspectives and responding to interest groups which may have competing objectives, trade-offs are inevitable. Critically important issues of equity arise when the interests and welfare of local communities, with limited options and capacity to find alternatives for their subsistence, differ from national or international priorities.

Consulting and compensating those who are poorly served by the priorities selected is essential; the public must be involved in setting priorities.

For all these reasons, national governments are challenged to mesh people's needs with national and global interests; to use policies that determine forest conditions in ways that help improve opportunities for people and communities; and to understand better how interactions among sectoral policies and macro-policies influence people's use of forests, and the consequences of such use on national development.

Developments in community forestry

Recent experiences at the local level, in community forestry programmes, provide lessons in new forms of local governance aimed at addressing the interests of people who depend on the forest. There is now a need and an opportunity to invest these lessons in arrangements that also capture the intersectoral and macro policy relations that determine what people do with forest resources

Until the early 1970s, central governments tended to blame rural communities for forest destruction; local communities overharvested fuelwood, allowed livestock to overgraze and illegally converted land to crop agriculture. Local needs increasingly conflicted with national needs and, during much of this period, governments responded by nationalizing forests, restricting local access, curtailing community rights and introducing police authority. Over time, this authoritarian approach displaced community-centred cultures, broke up well-established common property resource traditions and resulted in increased forest destruction.⁵

State control meant keeping people away from forests. Agriculture and forestry were considered separate and, to some extent, mutually exclusive

land-use activities. However, it became evident that the expansion of state control and curtailing of community rights ignored fundamental linkages between the forests, agriculture and people as integral components of the rural ecosystem. Food security, income, nutrition, employment, energy sources and overall well-being of rural families were linked to the forests.

The new approach that emerged attempted to integrate forestry and communities into a single framework of policy and action, especially in areas with endemic poverty and severe forest depletion. The re-orientation of policies and programmes aimed to support forestry for people and encourage rural populations to participate in forestry and conservation efforts. Community forestry is the well-known umbrella term for these participatory activities, which include farm forestry, social forestry, joint forest management and extractive reserves. There are subtle distinctions among programmes, but all involve a form of forestry that is based on local interests and depends on community participation.

Community forestry attempts to account for diverse situations by strengthening local stakes in management. Nonetheless, community programmes and activities must operate in the context of national-level approaches that involve uniform policy structures. For instance, macro and sectoral policies affect local-level forest use by influencing such factors as: i) the level of competition for non-forest land uses (agricultural, grazing and industrial uses and the relative prices for their products); ii) ease of access to forest products (unguarded public forests, low-cost agricultural wood, commercial fuels and other fodder sources); and iii) access to markets and availability of services. Community forestry activities attempt to work within this policy context by directly influencing the use of individual forests through formal and informal agreements between the government and local groups.

Community forestry experiences from around the world illustrate diversity in: the products harvested;

the organization of local users; the politics surrounding access; the initial conditions; and contractual arrangements. The variety of products, services and interested parties makes it difficult to classify cases and policies into successes and failures. However, it is evident that different types of users can cooperate and manage programmes, plant trees and restore forests.

On the other hand, as a result of top-down planning, many projects more accurately reflect planner's perceptions of people's needs rather than local people's ideas of their own needs. A recent FAO review of community forestry identifies several patterns that differ from what had been assumed or intended by the planners. Other studies question community forestry achievements and some of its aims. Criticisms include the following: people did not participate to the expected level; the extensive practice of monoculture has been ecologically destructive in some cases; many fuelwood plantations produced industrial and commercial timber rather than relieving fuelwood shortages; and a weak commitment to gender equity (many programmes treated the household as a unit) has worsened rather than strengthened women's economic position and productivity.

The experience with community forestry offers some important lessons.⁶ First, just as different branches of the government often support conflicting uses for forests (such as agricultural expansion, timber production, watershed production, government revenue or local economic development), community interests differ and conflict among activities, users, user groups and communities. Because access to political power and economic opportunities are not uniform within a community, it is not surprising that some groups fare poorly under arrangements intended to benefit local users as a whole. This is especially true for women who are often responsible for collecting fodder, fuelwood and food items from the forest. In these cases, women are penalized by forest management policies designed to promote forest growth by reducing access to forest

⁵ M. Sarin. 1993. *From conflict to collaboration: local institutions in joint forest management*. Joint Forest Management Working Paper No. 14. New Delhi, Ford Foundation.

⁶ J.E.M. Arnold. In FAO, 1992. *Community forestry: ten years in review*. FAO Community Forestry Note No. 7. Rome.

products. Addressing these concerns through national policies is feasible but may inhibit local initiatives. It is more effective for women to decide on their own priorities and negotiate these with competing interest groups.

Second, the more successful examples from around the world point to the need to lay out explicit contracts where the returns to the parties are roughly proportional to the respective levels of investment and risk. Arrangements whereby the state government tries to collect most of the benefits create local opposition. On the other hand, arrangements with large subsidies for local users often attract considerable attention from politically powerful individuals. Even if the usurpation of rural resources can be controlled, highly subsidized projects are financially unsustainable and are rarely replicated.

Capacity development

Community forestry successes underline the advantages of strengthening the capacities of local groups and NGOs involved in forestry activities. Capacity development is needed for individual participation, communal management, co-management with government forest services or joint ventures with private sector groups. Local and provincial groups need expanded education, skill training and funding for national forest services.

Developing local and national capacity in forestry requires human resources with improved skills and capacities to formulate and implement policies, strategies and programmes; and improved institutional arrangement for economic development.

Evidence suggests that all countries need to improve their capacity to manage the growing demands on forest resources and increasing obligations to the international community. While it may be more urgent in some developing countries and those undergoing the transition from a centrally planned to a market-oriented economy, it is also necessary in the industrial countries. Although encouraging examples of organizational reforms and adjustments exist on a limited scale, every country faces challenges to achieve the kind of balance between development and the environment agreed to at UNCED.

FAO identifies six specific areas that require special attention to capacity-building:⁷

- the ability to collect, analyse and use sectoral information for policy formulation, planning, priority-setting and programming;
- the capacity for dialogue and cooperation among sectors, institutions and the increased range of interest groups whose development strategies and programmes need to follow approaches to sustainability that are complementary to those for forestry;
- the capacity to promote sustained participation by rural communities and to provide them with adequate support, including extension;
- the capacity to identify, prepare, negotiate and secure funding for projects and programmes based on the demonstrable value of forest contributions;
- the capacity to adapt policies, laws, tenures, institutions and attitudes as well as to transform skills for effectiveness, especially in former centrally planned countries undergoing market-oriented reforms; and
- research and technological development and research extension on the broad range of technical, socio-economic and policy issues relevant to forestry development.

The international dimensions

Evolving global interests in forest conditions (for carbon storage, biodiversity, wilderness, etc.) are increasing the level of international involvement in forest governance. International funding for forestry from ODA increased from \$400 million per year in the mid-1980s to more than \$1 300 million in the early 1990s. During the last decade, a variety of new international arrangements emerged, including: debt-for-nature swaps and subsidized plantation programmes; tradable permits, quotas and quasi-market schemes for carbon storage; scientific, political, technical assistance and financial programmes to expand resource availability and increase national investments through capital and technology transfers; and freer trade and market liberalization.

⁷ FAO. 1994. *The road from Rio: moving forward in forestry*. Rome.

UNCED devoted considerable attention to the world's forests. The conference drew up a non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests, known as the 'forest principles'. Chapter 11 of Agenda 21 focuses on deforestation, and forestry is an important element in other chapters dealing with desertification and drought, sustainable mountain development and the conservation of biodiversity.

The forest principles can be considered as a code of good stewardship applicable to all forests. They respect national sovereignty over forests and request all countries to adopt sustainable patterns of production and consumption. They also point out the multiple functions and uses of forests and the need for a balanced view of the issues and opportunities for their conservation and development.

Chapter 11 of Agenda 21 highlights four programme areas: sustaining the multiple roles and functions of all types of forests; strengthening capacities for planning assessments and systematic observations of forestry and related programmes, projects and activities; promoting efficient resource utilization and evaluation techniques that incorporate the entire range of values provided by forests, forest lands and woodlands; and enhancing, protecting, conserving and managing degraded areas. The UNCED Secretariat estimated the total annual cost of these programmes to be \$30 000 million.

The responsibility for implementing UNCED agreements rests with national governments, while the commitments made by NGOs, local communities and private sector groups in each country will determine the rate of progress.

FAO has identified several levels of action:

- Stimulate international dialogue among governments, NGOs and the commercial private sector (as main interest groups), to secure early agreement on pressing issues which currently are the subject of divergent positions. Examples include, reaching agreement on common attributes of sustainable forest management, setting clear targets for implementing the forest principles and forestry elements of Agenda 21; reaching agreement on priorities in UNCED follow-up;

proposing modalities for cooperation among the interest groups.

- Promote agreement on a harmonized system of criteria and indicators for assessment of progress toward sustainable forest management, taking account of the different capacities of member countries and their sovereign rights over their forest resources.
- Enhance information on forests and appeal to the donor community to: (a) support the capacity of concerned international institutions active in forest resources assessment; (b) fund programmes for capacity building in member countries for forest resources assessment; and (c) support ongoing international work on development of methodologies for valuation of forest goods and services to provide more sound justification for public and political support for sustainable management of forests.
- Promote collaboration among multilateral lending institutions active in forestry, donor agencies, member governments of main beneficiary countries, NGOs and the private sector in order to study existing and new mechanisms for enhancing funding flows for forestry, with particular emphasis on private sector and domestic resources, including sectoral revenues.
- Through broad consultations among all interest groups, chart a way forward towards trade in forest products from all types of forests, based on sustainably managed forests and the application of criteria and indicators.
- Intensify international support for: (a) capacity-building both for governments and other groups active in forestry; (b) strengthening the public institutions charged with responsibility for safeguarding forests and improving their visibility and stature so as to be better able to influence policy and attract the degree of resources and political support essential for pursuing sustainable forest management; and (c) technology transfer and development, including efforts to marry modern science with indigenous knowledge and practice.

In the future, the trade-offs between international obligations and national interests and government readiness to negotiate international dimensions of forests (in terms of both commodity trade and

environmental services) will further influence policy choices, national development and forest conditions.

Actions within the forestry sector alone cannot secure sustainable conservation and a wise use of forests. Success in the implementation of UNCED follow-up activities requires the promotion of follow-up actions in other sectors that influence forestry. Redirecting public policies to achieve efficient and sustainable forest management requires significant changes. However, UNCED's consensus on forest principles represents the first-ever commitment of responsibilities beyond national boundaries. The formidable challenge ahead is to turn these principles into practice. The contributions of forests to national development will depend on how well this challenge is met.

Part 2

Forests, economic
development and the
environment



Forest products and services

Forests are recognized as an integral part of national economies, providing a wide range of production inputs, environmental goods, food, fuel, medicines, household equipment, building material and raw materials for industrial processing. Forests support agriculture by providing materials for farm implements, harvesting and transportation equipment, crop storage containers and dryers as well as fuel for crop processing. However, these multiple benefits and services are valued differently by different people. Moreover, local, national and international interests also differ. For a number of reasons, the roles that forests are expected to play in local, national and global development change dramatically over time.

Roads, commerce and agrarian populations have penetrated and settled on much of the world's forest land; few forest areas remain disconnected from national interests. Forest areas have undergone 'agrification', involving the use of forests and trees in farming systems and the formation of agricultural mosaics within forest systems. Forests are increasingly managed for their range of products and services, their ability to support rural well-being and their capacity to promote industrial opportunities. Forests provide large, albeit different, ranges of goods and services for virtually all patterns of human settlement and livelihood. They are not just contiguous blocks of timber, but are active parts of life everywhere.

Economic development strategies increasingly recognize the capital values of forests in national policies and programmes that modify forest stocks, qualities and distributions. Forests are now widely acknowledged as both *productive capital stocks* and as components of *public infrastructural systems*. As ecological analogues of industrial capacity and physical infrastructure, forests are entering the central equations of macro-economic growth, often with new

definitions of what the forest is and does.

Conventional national accounting systems overstate sustainable income in two ways. First, the accounts disregard depreciation of forest and other natural capital. Second, the costs of mitigating or offsetting the side-effects of resource depletion (e.g. anti-sedimentation measures in a deforested watershed) are not subtracted from national income.⁸ This conveys the wrong message: that income gained from depleting forest resources can continue forever.⁹

Advances in national accounting make it possible to incorporate explicitly the capital value of forest resources as *productive stocks*, and to assess the effects of changes in them on national productive capacity. Some countries are establishing new accounting systems that measure the depreciation of forest resources due to cutting in excess of their reproductive capacity and their appreciation due to reforestation, regeneration and growth. For instance, the French system shows trade-offs between the economic, ecological and social functions of natural resources. This system, known as the 'natural patrimony accounts', records separate accounts for forests, wildlife, water and soil.

Forest systems provide services that, in their absence, would require capital expenditures or reductions in human well-being. For example, by storing water, regulating flows, protecting channels

⁸ S. El Serafy and E. Lutz. 1989. Environmental and resource accounting: an overview. In Y.J. Ahmad, S. El Serafy and E. Lutz, eds. *Environmental accounting for sustainable development*. Washington, D.C., World Bank.

⁹ C.A. Meyer. 1993. Environmental and natural resource accounting: where to begin? *Issues in development* (November). Washington, D.C., Center for International Development and Environment.

and cleansing impurities, forests form a structure of hydrological services akin to structures for transportation and communication. Recent economic methods make it possible to account for these infrastructural services on a national scale.

Forests represent productive assets that are used as a means for attaining national development objectives, including equity, stability, investment and growth. Programmes in community forestry have become central to rural development programmes that seek to build more productive relations between rural communities and publicly-owned natural resources. Community forestry programmes are widely implemented to strengthen investment incentives and encourage civic participation in the growth and use of forests and trees.

Forests have emerged as significant factors in economic and political relations among nations. For example, forests have taken on foreign policy dimensions through their association with issues concerned with trade and the environment. Forest conditions increasingly affect national dependence on international trade and on processing capacity for wood products and production inputs. Trading patterns grow more complex as wood-exporting nations shift emphasis from primary to secondary and tertiary forms of production, increase their purchasing power and diversify their consumption requirements.

Changes in the extent and quality of forests have become the subject of global environmental concerns: changing forest conditions raise concerns over biological diversity and global climate change. These developments create pressure on national governments to consider forests in the realm of international relations. Some nations are already moving towards international agreements that tie matters of economic and environmental trade together in the service of larger, global interests.

For all of these reasons, national forest politics and policies have evolved out of a narrow sectoral prerogative to enter the pluralized mainstream of political interests involving highly diverse groups. The perspectives and demands of these politically diverse groups have proliferated, placing a significant strain on the institutions of forest policy that evolved when forests meant only timber belonging to the state and

were controlled by a small professional cadre. These competing pressures, combined with a wider understanding of the importance and complexity of forests' non-wood services and values, are strongly influencing forestry policy today.

Forests as a source of national development

Individual forest ecosystems provide many protective, scientific and commercial services, ranging from living space and food to climate regulation and genetic resources. At the national level, however, countries are interested in their entire forest system and how they contribute collectively to national development as sources of goods and services, as forms of insurance against excessive risk and as economic and social assets.

Sources of revenue, foreign exchange and financial equity

Forests supply materials for domestic industry, for export and for import substitution in the form of wood, fibre, processed products, energy and a wide variety of medicinal, ornamental and speciality forest products.

Timber typically has been a primary source of capital for forested nations, through the trade of wood for currency, the use of forests as equity for loans and debt relief and the exchange of concessionary rights for physical infrastructure. Canada, Côte d'Ivoire, India, Indonesia, Malaysia, Norway, Sweden, the Russian Federation, Thailand and the United States, among many other countries, have relied on the transformation of forest capital to help build their industrial and agricultural capacities; Laos, Myanmar and Viet Nam appear to be pursuing a similar strategy today.

Beyond this initial stage of forest transformation, some nations attempt to create employment and increase incomes by building industrial capacities to process wood into finished goods. Finland, Germany, Indonesia, Italy, Malaysia, Singapore, Thailand and the United States have followed this path, using wood from both domestic and foreign sources. Thailand derives substantial foreign exchange from trade in furniture, orchids, speciality foods, medicinals and

wildlife. This stage requires more complex market and tenure systems than those that prevailed when timber was the forest's main contribution. Japan's forest industries rely heavily on imports of tropical and temperate hardwood and coniferous logs; the country accounts for 30 percent of global industrial roundwood imports and about 45 percent of all tropical hardwood imports. Although Japan's own forests are capable of providing for industrial production, economic and environmental considerations and high extraction costs mean a preference for imports.¹⁰

Forests also attract recreational users. Since tourism and recreation may require infrastructural investment beyond the requirements of a processing industry, this economic activity usually awaits later stages of industrial and commercial growth.

Thus, nations must make strategic trade-offs between converting forest capital for industrial and commercial activities, providing access to non-timber products, using forests as energy sources, and increasing future income streams from tourists attracted to pristine forests.

Sources of rural income

Rural populations depend on the products of forests as well as on their environmental services. Forests contribute to food security in many ways. In many developing countries, forests are a primary source of energy, protein, oils, medicines and staple foods for a significant proportion of the rural population and, more importantly, for the most vulnerable among them. In general, forests are most important for food during seasonal or periodic famines or shortages of crop-based foods. At least three-quarters of the world's people depend largely on folk medicine. Brazil has recorded at least 3 000 medicinal plants, India more than 2 000 and Malaysia some 1 000.

As sources of income, forests are important in a distributive sense, creating opportunities that cannot be generated on a national scale or through incipient market systems. National accounts typically do not record such in-kind forest incomes, although these are

essential to the well-being of hundreds of millions of people (especially those groups who depend on the forest as their only source of cash income).

Rural populations also use, protect and create forests as sources of agricultural inputs; they depend on tree products to sustain soil fertility and structure, to feed livestock and to maintain desired moisture regimes and water flows.

Such non-monetized production inputs are not recorded in national accounts, although their decline would reduce monetized production, require compensation through augmented monetized inputs of capital and labour or increase pressure to clear forest for cultivation.

At early stages of market participation, rural populations use commercial forest products to generate cash income. For instance, India has extensive commerce in 'minor' forest products which resident communities harvest, process and sell. Examples include silk, cigarette wrappers, food and feed, charcoal, oils, lac and resins, spices and medicines.

Shares of national assets

Forest tenures have become part of broader strategies designed to distribute national assets to achieve a desired mix of economic growth, equity and stability and to conserve environmental opportunities for future generations.

Tenurial patterns have diversified over the past several decades, reflecting the variety of forest functions, growing populations and political expectations, and expanding technical, financial and organizational capacities. To pure *de jure* state ownership, or *de facto* local control, have been added a wide variety of quasi-public structures of land and market control. These include systems of state-local cooperative management, local management structures and private tenures for forest activities on corporate, farm and household scales. Forest distribution therefore involves choices within and among fiscal, educational, industrial, agrarian and stabilization policies.

Ecological systems providing biodiversity

The world's forests are both laboratories for the natural selection of genetic resources of plants and animals and dynamic storage banks for these genes.

¹⁰ F. Nectoux and Y. Kurada: 1989. *Timber from the south seas: an analysis of Japan's timber trade and environmental impact*. Gland, Switzerland, WWF.

Tropical forests are considered to contain more than 50 percent of all the living species on the planet, including a great proportion of higher plants and mammals. For example, there are 50 indigenous tree species in Europe north of the Alps. In Malaysia, an area of forest covering just 50 ha was found to contain 830 tree species and, in Peru, nearly 300 species of trees have been recorded on a single hectare.

Infrastructure

Forests provide infrastructural services without which development opportunities decline. They stabilize streamflow and microclimates, protect land and earth structures such as roads and canals, drain and shade the land, and purify the atmosphere. Urban trees cool towns, conserve energy and absorb pollutants, substituting for more conventional infrastructure which would otherwise be needed. Strategically placed trees can reduce home air-conditioning needs by 10 to 15 percent by providing shade, and can reduce heating requirements by shielding wind.

The economic and social consequences of changes in forests ecosystems are difficult to predict. Changes in the dynamics of river basins, ecological regions or wildlife systems, for example, may reduce or increase different aspects of human well-being; without sufficient knowledge, the unpredictability of the consequences tends to rise with the extent of change. The inundation carrying logs through Thai villages, boulders falling on to Nepalese villages, and habitat-deprived elephants rampaging through Indian villages are recent examples of catastrophes that well-managed forests can prevent.

Although the concept of 'forest as infrastructure' is not yet widely supported, the absence of forests clearly requires constructed infrastructure at the expense of other potential uses of scarce capital.

Sources of energy

Forests supply energy that would otherwise be unavailable or would cost more to obtain. Wood continues to be the primary fuel in most tropical nations and a significant fuel in many others. Wood may substitute for fossil fuels and agricultural biomass, alleviating cost pressures on competing needs for these resources.

Nutritional problems arise where people lack sufficient fuelwood to cook their food adequately and where its substitution with dung reduces the fertility and productivity of their fields. Fossil fuel replacements, whether for energy or fertilizer, can be expensive in foreign exchange or in lost future opportunities for domestic use. Energy policies in nations of South Asia and Africa have placed significant emphasis on fuelwood plantations.

Sources of potentially tradable global services

Forests supply many global benefits: they store carbon; maintain diverse, unique and rare forms of life; store biotic potential; and encompass natural phenomena that have yet to be understood. These global attributes are gaining value rapidly as institutions evolve to protect them and develop means to translate them into tradable forms. The Global Environmental Facility (GEF) was established to finance national provision of such services.

Debt-for-nature swaps, long-term purchases of forest carbon storage for industrial atmospheric emissions, environmental conditions in trade agreements and international contracts for biological prospecting rights are early examples of the gradual development of international trade in global environmental services.

Cultural heritage

In recent years, forests have become more widely recognized as homes of cultures. International concern and appreciation for the value of traditional cultures and their knowledge of nature have contributed to the preservation of forest regimes and increased attention to the needs of forest dwelling communities as a matter of national interest.

The economic contributions of forests

The many conventional economic contributions of forests are well documented, particularly the value of wood energy and solid wood and fibre products. The annual value of fuelwood and wood-based forest products to the global economy is estimated to be more than US\$ 400 000 million, or about 2 percent of GDP (see Table 2 on page 24). In the developing

Table 1
Forest products in the economy, 1991 (US\$ million)

| | production | percent of GDP | imports | exports | percent of trade | consumption | | production | percent of GDP | imports | exports | percent of trade | consumption |
|-----------------------------|----------------|-------------------|----------------|---------------|---------------------|----------------|----------------------------------|----------------|-------------------|---------------|---------------|---------------------|----------------|
| World | 417 665 | 2 | 107 613 | 98 050 | 3 | 427 228 | Swaziland | 132 | 20 | 1 | 75 | 13 | 57 |
| Africa | 24 552 | 6 | 4 333 | 1 562 | 2 | 27 322 | Tanzania, United Republic | 1 427 | — | 13 | 3 | 1 | 1 437 |
| Algeria | 139 | 0 | 348 | 0 | 0 | 487 | Togo | 53 | 3 | 5 | 0 | 0 | 59 |
| Angola | 284 | 4 | 8 | 0 | 0 | 292 | Tunisia | 209 | 1 | 183 | 9 | 0 | 382 |
| Benin | 205 | 11 | 2 | 0 | 0 | 206 | Uganda | 674 | 23 | 2 | 0 | 0 | 676 |
| Botswana | 57 | 2 | 0 | — | — | 57 | Zaire | 1 619 | 21 | 9 | 24 | 3 | 1 604 |
| Burkina Faso | 351 | 11 | 5 | 0 | 0 | 357 | Zambia | 556 | 17 | 6 | 0 | 0 | 562 |
| Burundi | 163 | 15 | 5 | — | — | 169 | Zimbabwe | 421 | 8 | 19 | 8 | 0 | 433 |
| Cameroon | 690 | 6 | 120 | 201 | 15 | 610 | North/Central America | 133 391 | 2 | 16 907 | 29 624 | 5 | 120 674 |
| Central African Republic | 149 | 12 | 0 | 15 | 20 | 134 | Belize | 8 | 2 | 5 | 2 | 1 | 11 |
| Chad | 179 | 15 | 4 | — | — | 183 | Canada | 30 482 | 5 | 1 840 | 16 931 | 13 | 15 391 |
| Congo | 188 | 7 | 2 | 129 | 16 | 62 | Costa Rica | 248 | 5 | 81 | 22 | 1 | 307 |
| Côte d'Ivoire | 698 | 9 | 28 | 278 | 10 | 448 | Cuba | 276 | 1 | 193 | 2 | 0 | 467 |
| Egypt | 280 | 1 | 2 730 | 0 | 0 | 3 010 | Dominican Republic | 41 | 1 | 85 | 0 | 0 | 126 |
| Equatorial Guinea | 39 | 4 | — | 19 | 42 | 20 | El Salvador | 200 | 3 | 22 | 3 | 0 | 219 |
| Ethiopia | 1 703 | — | 4 | 0 | 0 | 1 707 | Guatemala | 323 | 3 | 70 | 19 | 2 | 373 |
| Gabon | 271 | 6 | 6 | 226 | 12 | 52 | Haiti | 216 | 9 | 10 | 0 | 0 | 226 |
| Gambia | 35 | 12 | 0 | — | — | 35 | Honduras | 281 | 9 | 136 | 31 | 3 | 386 |
| Ghana | 729 | 12 | 11 | 93 | 9 | 647 | Jamaica | 14 | 0 | 67 | 0 | 0 | 81 |
| Guinea | 180 | 6 | 1 | 1 | 0 | 180 | Mexico | 3 546 | 1 | 676 | 133 | 0 | 4 089 |
| Guinea-Bissau | 28 | 6 | 0 | 2 | 8 | 26 | Nicaragua | 173 | — | 7 | 3 | 1 | 177 |
| Kenya | 1 508 | 19 | 24 | 4 | 0 | 1 529 | Panama | 103 | 2 | 56 | 1 | 0 | 158 |
| Lesotho | 23 | — | 5 | — | — | 28 | Trinidad and Tobago | 10 | 0 | 54 | 0 | 0 | 64 |
| Liberia | 331 | — | 3 | 78 | 31 | 255 | United States | 97 470 | 2 | 13 467 | 12 478 | 3 | 98 459 |
| Libyan Arab Jamahiriya | 32 | 0 | 52 | — | — | 84 | South America | 23 729 | 3 | 1 110 | 2 633 | 3 | 22 206 |
| Madagascar | 358 | 13 | 3 | 2 | 1 | 359 | Argentina | 1 511 | 2 | 102 | 193 | 2 | 1 420 |
| Malawi | 340 | 15 | 8 | 0 | 0 | 348 | Bolivia | 71 | 2 | 4 | 30 | 4 | 45 |
| Mali | 231 | 9 | 2 | — | — | 233 | Brazil | 16 369 | 4 | 247 | 1 472 | 5 | 15 144 |
| Morocco | 239 | 1 | 239 | 3 | 0 | 475 | Chile | 2 233 | 8 | 77 | 836 | 9 | 1 474 |
| Mozambique | 642 | — | 5 | 1 | 0 | 646 | Colombia | 1 304 | 3 | 129 | 17 | 0 | 1 416 |
| Niger | 203 | 8 | 5 | 0 | 0 | 208 | Ecuador | 691 | 7 | 163 | 26 | 1 | 828 |
| Nigeria | 4 667 | 16 | 98 | 11 | 0 | 4 754 | French Guiana | 8 | 2 | 2 | 4 | 6 | 6 |
| Reunion | 1 | 0 | 55 | — | — | 56 | Guyana | 4 | 1 | 1 | 4 | 1 | 1 |
| Rwanda | 219 | 13 | 6 | — | — | 224 | Paraguay | 341 | 6 | 21 | 28 | 4 | 334 |
| Sao Tome and Principe | 1 | 0 | 0 | 0 | 0 | 1 | Peru | 398 | 1 | 109 | 4 | 0 | 503 |
| Senegal | 217 | 4 | 31 | — | — | 248 | Suriname | 13 | 1 | 3 | 1 | 0 | 15 |
| Sierra Leone | 124 | 14 | 2 | 0 | 0 | 126 | Uruguay | 216 | 3 | 30 | 17 | 1 | 229 |
| Somalia | 276 | — | 1 | 0 | 0 | 277 | Venezuela | 571 | 1 | 221 | 0 | 0 | 792 |
| South Africa | 2 710 | 3 | 232 | 381 | 2 | 2 561 | | | | | | | |
| Sudan | 967 | 13 | 9 | — | — | 976 | | | | | | | |

| | production | percent of GDP | imports | exports | percent of trade | consumption |
|------------------------|----------------|-------------------|---------------|---------------|---------------------|----------------|
| Asia | 108 178 | 2 | 26 894 | 12 336 | 2 | 122 736 |
| Afghanistan | 329 | 6 | 1 | - | - | 330 |
| Bangladesh | 1 257 | 6 | 33 | 0 | 0 | 1 290 |
| Bhutan | 63 | 22 | 0 | 10 | 11 | 53 |
| Brunei Darussalam | 21 | 2 | 17 | 0 | 0 | 39 |
| Cambodia | 288 | - | 0 | 18 | 43 | 270 |
| China | 29 316 | 8 | 3 904 | 829 | 1 | 32 392 |
| Cyprus | 7 | 0 | 85 | 0 | 0 | 92 |
| Hong Kong | 151 | 0 | 1 936 | 861 | 1 | 1 226 |
| India | 15 227 | 5 | 399 | 39 | 0 | 15 587 |
| Indonesia | 11 869 | 10 | 295 | 3 601 | 12 | 8 563 |
| Iran, Islamic Republic | 723 | 1 | 467 | 0 | 0 | 1 190 |
| Iraq | 19 | 0 | 117 | - | - | 136 |
| Israel | 162 | 0 | 405 | 26 | 0 | 541 |
| Japan | 27 184 | 1 | 12 453 | 2 139 | - | 37 497 |
| Jordan | 13 | 0 | 56 | 9 | 1 | 60 |
| Korea, DPR | 275 | 1 | 5 | 1 | 0 | 279 |
| Korea, Republic | 4 279 | 2 | 2 612 | 506 | 1 | 6 385 |
| Laos | 173 | 15 | 1 | 16 | 21 | 158 |
| Lebanon | 71 | 3 | 41 | 0 | 0 | 112 |
| Malaysia | 4 683 | 10 | 499 | 3 120 | 9 | 2 061 |
| Mongolia | 143 | 5 | 1 | 0 | 0 | 144 |
| Myanmar | 933 | 8 | 5 | 148 | 35 | 790 |
| Nepal | 802 | - | 4 | 0 | 0 | 806 |
| Pakistan | 1 408 | 3 | 153 | 0 | 0 | 1 561 |
| Philippines | 1 890 | 4 | 161 | 94 | 1 | 1 956 |
| Singapore | 266 | 1 | 964 | 643 | 1 | 597 |
| Sri Lanka | 375 | 4 | 76 | 0 | 0 | 451 |
| Syrian Arab Republic | 12 | 0 | 53 | 0 | 0 | 65 |
| Thailand | 2 613 | 3 | 1 210 | 136 | 0 | 3 687 |
| Turkey | 2 274 | 2 | 385 | 48 | 0 | 2 612 |
| Viet Nam | 1 348 | 9 | 13 | 93 | 5 | 1 267 |
| Europe | 83 934 | 1 | 55 965 | 47 567 | 3 | 92 331 |
| Albania | 174 | 4 | 2 | 1 | 0 | 175 |
| Austria | 4 239 | 2 | 1 558 | 3 285 | 8 | 2 512 |
| Belgium/Luxembourg | 1 817 | 1 | 3 451 | 1 926 | 2 | 3 342 |
| Bulgaria | 578 | 3 | 101 | 45 | 1 | 634 |

| | production | percent of GDP | imports | exports | percent of trade | consumption |
|-----------------------------------|----------------|-------------------|---------------|---------------|---------------------|----------------|
| Former Czechoslovakia | 2 308 | 7 | 106 | 427 | 4 | 1 987 |
| Denmark | 584 | 0 | 1 766 | 417 | 1 | 1 933 |
| Finland | 8 959 | 7 | 512 | 8 238 | 36 | 1 233 |
| France | 9 328 | 1 | 6 152 | 3 842 | 2 | 11 638 |
| Germany | 16 703 | - | 12 567 | 6 819 | 2 | 22 451 |
| Greece | 447 | 1 | 999 | 100 | 1 | 1 346 |
| Hungary | 662 | 2 | 339 | 135 | 1 | 865 |
| Ireland | 185 | 0 | 467 | 136 | 1 | 516 |
| Italy | 4 942 | 0 | 6 166 | 1 818 | 1 | 9 289 |
| Netherlands | 2 201 | 1 | 4 399 | 2 433 | 2 | 4 167 |
| Norway | 2 400 | 2 | 708 | 1 517 | 4 | 1 592 |
| Poland | 2 338 | 4 | 127 | 250 | 2 | 2 214 |
| Portugal | 1 972 | 3 | 738 | 1 209 | 7 | 1 501 |
| Romania | 1 570 | 5 | 80 | 171 | 4 | 1 479 |
| Spain | 4 372 | 1 | 2 784 | 1 120 | 2 | 6 036 |
| Sweden | 10 756 | 4 | 1 168 | 9 873 | 18 | 2 051 |
| Switzerland | 1 570 | 1 | 2 136 | 1 283 | 2 | 2 423 |
| United Kingdom | 4 222 | 0 | 8 853 | 1 727 | 1 | 11 348 |
| Former Yugoslavia, SFR | 1 609 | 2 | 689 | 795 | 7 | 1 503 |
| Oceania | 5 395 | 2 | 1 477 | 1 553 | 3 | 5 319 |
| Australia | 2 980 | 1 | 1 216 | 471 | 1 | 3 724 |
| Fiji | 41 | 3 | 16 | 48 | 13 | 10 |
| New Caledonia | 1 | 0 | 10 | - | - | 11 |
| New Zealand | 1 971 | 5 | 212 | 885 | 10 | 1 298 |
| Papua New Guinea | 361 | 11 | 5 | 114 | 7 | 253 |
| Samoa | 7 | 4 | 1 | 0 | 0 | 8 |
| Solomon Islands | 32 | 16 | 1 | 35 | 42 | 2 |
| Vanuatu | 3 | 2 | 0 | 1 | 5 | 2 |
| Yemen | 12 | - | 10 | 0 | 0 | 22 |
| Former USSR | 38 485 | 2 | 927 | 2 773 | 4 | 36 639 |
| TOTAL DEVELOPED COUNTRIES | 285 377 | 1 | 86 716 | 83 652 | 4 | 288 441 |
| TOTAL DEVELOPING COUNTRIES | 132 289 | 4 | 20 897 | 14 398 | 2 | 138 787 |

Table 2
Annual value of fuelwood and wood-based products to the global economy (US\$ '000 million)

| | forestry | industry | total | GDP* (percent) |
|----------------------|----------|----------|-------|----------------|
| developing countries | 70 | 63 | 133 | 4.1 |
| developed countries | 26 | 259 | 285 | 1.4 |
| world | 96 | 322 | 418 | 1.8 |

* gross domestic product (percent)

countries, fuelwood accounts for US\$70 000 million and forest industry products for US\$ 63 000 million. Estimates for the developed countries are US\$26 000 million for fuelwood and US\$259 000 million for wood products.

The real value of the forestry sector's contribution has increased over the last 3 decades at an average annual rate of 2.5 percent. Growth of the value of energy from the forest in developing countries has averaged 2.5 percent while the value of wood in energy has declined in developed countries. The forest industry has averaged 3 percent growth world wide, but at a rate of 6 percent for developing countries.

No comparable global estimate is available for non-wood services and benefits of forests, but some country estimates do exist. An FAO study of non-wood forest product use in Greece, Italy, Morocco, Spain, Tunisia and the coastal zones of France and Algeria indicate that Mediterranean trade in cork, resin, mastic gum, honey, mushrooms, wild fruit and wild game, added to the value of trees used in livestock production, had an estimated value of more than US\$1 000 million in 1992.¹¹ The export of rattan by Southeast Asian countries is approximately \$300 million per year, and exports of gum arabic by Sudan is around US\$70 million per year.

FAO estimates that the forestry sector provides subsistence and wage employment equivalent to 60 million work years world-wide, 80 percent of

which is in developing countries.¹² Much of this is in fuelwood and charcoal related activities. An estimated 3 000 million people depend on fuelwood as their main source of household energy, consuming more than one-half of the world's wood production. In many urban areas of developing countries, families may spend 20 to 30 percent of their income on fuelwood and charcoal.¹³ In 1992, global wood consumption included 1 870 million m³ of fuelwood and 1 600 million m³ of industrial roundwood.

Global per caput consumption of forest products has increased by nearly 1 percent per year over the past three decades. Between 1961 and 1991, the value of global wood consumption more than doubled in real terms, growing by an average of 2.7 percent per year. During the same period, global roundwood production increased by 75 percent, fuelwood nearly doubled and industrial roundwood increased by 50 percent. Among processed products, sawnwood increased by 20 percent, wood panels by 600 percent and paper by 350 percent. Three countries, Canada, the Russian Federation and the United States, account for more than one-half of all the world's industrial roundwood production.

These substantial increases in the volume of wood-based products have been achieved with a relatively small increase in industrial roundwood production. This is explained by improved efficiency in sawnwood and plywood production, the recovery of wood residues for the manufacture of other wood-based panels and in paper manufacture, and increased recycling of used paper in paper manufacture. In addition, wood residues make important contributions as a fuel source, improving energy efficiency in many wood industries.

The developed countries consume most of the world's sawnwood and wood-based panels (300 m³ per 1 000 people per year for housing and furniture) and paper (150 tonnes per 1 000 people per year for communications, packaging and hygiene). Average annual developing country consumption of

¹¹ FAO. 1993. *More than wood*. FAO Forestry Topics Report No. 4. Rome.

¹² FAO. *Agriculture towards 2010*. (in press).

¹³ R. Rowe, N.P. Sharma and J. Browder. 1992. Deforestation problems, causes, and concerns. In Sharma, ed. 1992. *Managing the world's forests: looking for balance between conservation and development*. Dubuque, Iowa.

sawnwood and wood-based panels is 30 m³ per 1 000 people and consumption of paper is 12 tonnes per 1 000 people.

In developing countries, 80 percent of wood is consumed as fuel. Fuelwood accounts for 58 percent of energy use in Africa, 15 percent in Latin America and 11 percent in Asia. In more than 40 countries and in many of the least-developed countries, wood is the source of more than 70 percent of national energy consumption. Wood supplies the basic energy needs in communities where people lack access to, or cannot afford, alternative fuels; where wood supply is scarce, twigs and leaves may be used.

World trade patterns in forest products

About one-quarter of global timber production enters into international trade. Exports have currently reached about \$98 000 million, representing about 3 percent of world merchandise trade (see Table 3). Trade in wood-based products is growing more rapidly than production. The developed countries dominate trade flows, accounting for more than 80 percent of total trade. Moreover, trade is concentrated in a handful of countries: the top five importers, United States, Germany, Japan, United Kingdom and Italy, accounted for 50 percent of world imports; the top five exporters, Canada, United States, Sweden, Finland and Germany, accounted for more than 50 percent of world exports. Brazil, Indonesia and Malaysia account for 10 percent of world exports and 50 percent of developing country exports.

Table 3
Value of exports of wood-based products
(US\$ '000 million)

| | total | trade* (percent) |
|----------------------|-------|------------------|
| developing countries | 14 | 1.9 |
| developed countries | 84 | 3.5 |
| world | 98 | 3.1 |

* merchandise trade (percent)

For several major exporters, forest products are an important component of their external trade; in the case of Cambodia, the Central African Republic, Equatorial Guinea, Finland, Laos, Liberia, Myanmar and the Solomon Islands, timber products exceed 20 percent of total exports; in the case of Canada, Cameroon, Congo, Côte d'Ivoire, Gabon, Fiji, Finland, Indonesia, Malaysia, New Zealand, Swaziland and Sweden, they exceed 10 percent. Canada exports almost 50 percent of its production.

Other countries are heavily dependent on imports. This is particularly the case with paper; some 80 developing countries depend on paper imports for more than half of their supply. Even the United States, which is the world's largest producer and second largest exporter of forest products, is also the largest importer of forest products.

An important trade feature among the developing countries has been the increase in manufactured products as a share of their total exports. In 1961, 54 percent of export value was unprocessed roundwood while, by 1992, this proportion had dropped to 20 percent of a much larger total.

While tropical timber accounts for only a small portion of world trade and of total timber production, it is significant in a number of countries. In Malaysia, the export of sawnwood and wood-based panels accounted for more than 60 percent of production in 1991 and 1992. Indonesia exports more than 80 percent of its wood-based panels and plywood. Other countries with high export shares include the Congo, Côte d'Ivoire, Gabon, Ghana, Liberia and Papua New Guinea.

Around 80 percent of industrial roundwood from tropical countries is imported by four Asian countries—China, Japan, Thailand and the Republic of Korea. Japan is the single largest importer, accounting for 45 percent of imports in 1992.

The outlook for the forestry sector in the economy

The outlook for forestry development is increasing demand for products and services and, at the same time, intensifying competition for the use of forest land. As a source of energy, forests will continue to play a major role for many developing countries,

although the overall growth of their total energy consumption will be much faster than the growth of wood used for energy. The annual growth in fuelwood and charcoal consumption in the developing countries is expected to be approximately 1.6 percent from 1990 through 2010 (see Table 4).

The world's industrial roundwood consumption is projected to grow by about 2.5 percent during the period 1990–2010: a 3.8 percent growth rate in developing countries and 2 percent in the developed countries.

Table 4
Current and projected consumption of forest products (1990–2010)

| | 1990 | | | growth (1990–2010) | | | 2010 | | |
|------------------------|--------------------------------------|-----------|------------|--------------------|-----------|------------|--------------------------------------|-----------|------------|
| | *m ³ or †tonnes (million) | | | percent | | | *m ³ or †tonnes (million) | | |
| | world | developed | developing | world | developed | developing | world | developed | developing |
| fuelwood and charcoal* | 1 800 | 240 | 1 560 | 1.4 | 0.8 | 1.6 | 2 400 | 280 | 2 120 |
| industrial roundwood* | 1 650 | 1 270 | 380 | 2.5 | 2.0 | 3.8 | 2 700 | 1 900 | 800 |
| sawnwood* | 485 | 373 | 112 | 2.5 | 1.5 | 4.1 | 790 | 500 | 250 |
| panels† | 125 | 108 | 17 | 4.6 | 4.3 | 6.5 | 310 | 250 | 60 |
| paper† | 238 | 196 | 42 | 3.1 | 2.3 | 5.8 | 440 | 310 | 130 |

The state of forest resources

Extensive and reliable quantitative and qualitative knowledge about forests and ecosystems are indispensable for today's foresters, policy-makers and scientists. This information is required to develop appropriate strategies and programmes to conserve and manage this important renewable natural resource. It is also the only way to monitor global trends in forest cover and the supply of goods and services forests provide.

FAO's first forest assessment, the 1947 World Forest Inventory, focused on industrial wood production capacity. Over time, new concerns emerged and the need to evaluate forests for their many other values became more apparent. Subsequent FAO global forest assessments continued to cover industrial wood production capacity but also attempted to capture information about fuelwood resources (1970s) and tropical deforestation (1980s). FAO's most recent resource assessment describes the state of forests in 1990 and assesses changes during the 1980s, including forest fragmentation, logging intensity, biomass conditions and plantations (1990s).¹⁴

The 1990 assessment estimates world forest area to be 3 442 million ha: 27 percent of the earth's area or 0.64 ha per caput. FAO's definition of forests

includes ecological systems with a minimum of 10 percent crown coverage of trees. In addition to areas classified as forests, 1 700 million ha contain woody vegetation, shrubs, scrub and forest fallow. These woodlands often have forest characteristics but do not meet the minimum tree cover definition of open or closed forests.

The quantity of biomass provides a broad indication of the forest's potential for wood fibre supply (for products and energy use) and its significance in the carbon cycle. Existing estimates of woody biomass are still rough and are only indicative. The knowledge base is improving quickly, however. Current estimates place total above-ground woody biomass at 440 500 million oven dry tonnes. These estimates suggest that 70 percent of the world's woody forest biomass is located in the tropical zone, highlighting the important role tropical forests play in carbon storage. Brazil accounts for 25 percent of the woody biomass with 16 percent of the world's forest area, while the former USSR accounts for 12 percent of the woody biomass with 22 percent of the forests.

The regional distribution of world forest cover is presented in Table 5 on page 28. Three countries and the former USSR account for more than 50 percent of the world's forest area: the former USSR (22 percent), Brazil (16 percent), Canada (7 percent) and the United States (6 percent). Latin America and the Caribbean is the most forested region with 48 percent of its land area covered with natural forests and plantations. Africa and the developing countries of Asia have a much lower relative forest cover (18–19 percent). In Europe and North America, forest cover is about the world average, while it is higher in the former USSR (35 percent), highest in Japan (64 percent) and lowest in Australia (5 percent).

Per caput forest area varies greatly between regions ranging from more than 2 ha in tropical Latin

¹⁴ Results have been published in the following publications: *The Forest Resources of The Temperate Zones*. The UN ECE/FAO 1990 Forest Resource Assessment, Volume 1 General Forest resource Information, and Volume 2 Benefits and Functions of the Forests; *Forest Resources Assessment 1990—Tropical Countries*. FAO Forestry Paper No. 112; *Forest Resources Assessment 1990—Non-Tropical Developing Countries* (Mediterranean Region). FO/MISC/94/3; *Forest Resources Assessment 1990—Country briefs* (tropical countries); and *Forest Resources Assessment 1990—Global synthesis*. FAO Forestry Paper No. – (in preparation)

Table 5
Total forest area related to land area and population

| region | land (million ha) | forest (million ha) | forest cover as a percentage of total land | forest (ha/cap) | other wooded land (million ha) | forest and other wooded land (million ha) |
|--|----------------------|------------------------|--|--------------------|--------------------------------------|---|
| Europe | 550 | 149 | 27 | 0.26 | 46 | 195 |
| former USSR | 2 139 | 755 | 35 | 2.15 | 187 | 941 |
| North America | 1 835 | 457 | 25 | 1.65 | 293 | 749 |
| Pacific (developed) | 818 | 71 | 8 | 0.51 | 106 | 178 |
| Africa | 2 964 | 545 | 18 | 0.85 | 591 | 1 137 |
| <i>tropical</i> | 2 237 | 529 | 24 | 1.09 | 554 | 1 083 |
| <i>non-tropical</i> | 727 | 16 | 2 | 0.10 | 38 | 52 |
| Asia and the Pacific region | 2 613 | 497 | 19 | 0.17 | 163 | 660 |
| <i>tropical</i> | 901 | 338 | 38 | 0.21 | 115 | 453 |
| <i>non-tropical</i> | 1 712 | 159 | 9 | 0.11 | 48 | 207 |
| Latin America and the Caribbean countries | 2 016 | 967 | 48 | 2.16 | 292 | 1 260 |
| <i>tropical</i> | 1 650 | 924 | 26 | 2.31 | 267 | 1 191 |
| <i>non-tropical</i> | 366 | 43 | 12 | 0.89 | 25 | 68 |
| developing countries | | | | | | |
| <i>tropical</i> | 4 788 | 1 791 | 37 | 0.73 | 935 | 2 726 |
| <i>non-tropical</i> | 2 806 | 218 | 7 | 0.13 | 111 | 329 |
| total developed | 5 342 | 1 432 | 27 | 1.07 | 631 | 2 064 |
| total developing | 7 594 | 2 009 | 26 | 0.50 | 1 047 | 3 056 |
| grand total | 2 936 | 3 442 | 27 | 0.64 | 1 678 | 5 120 |

Figure 1
Forest and other wooded land (components, 1980-90)

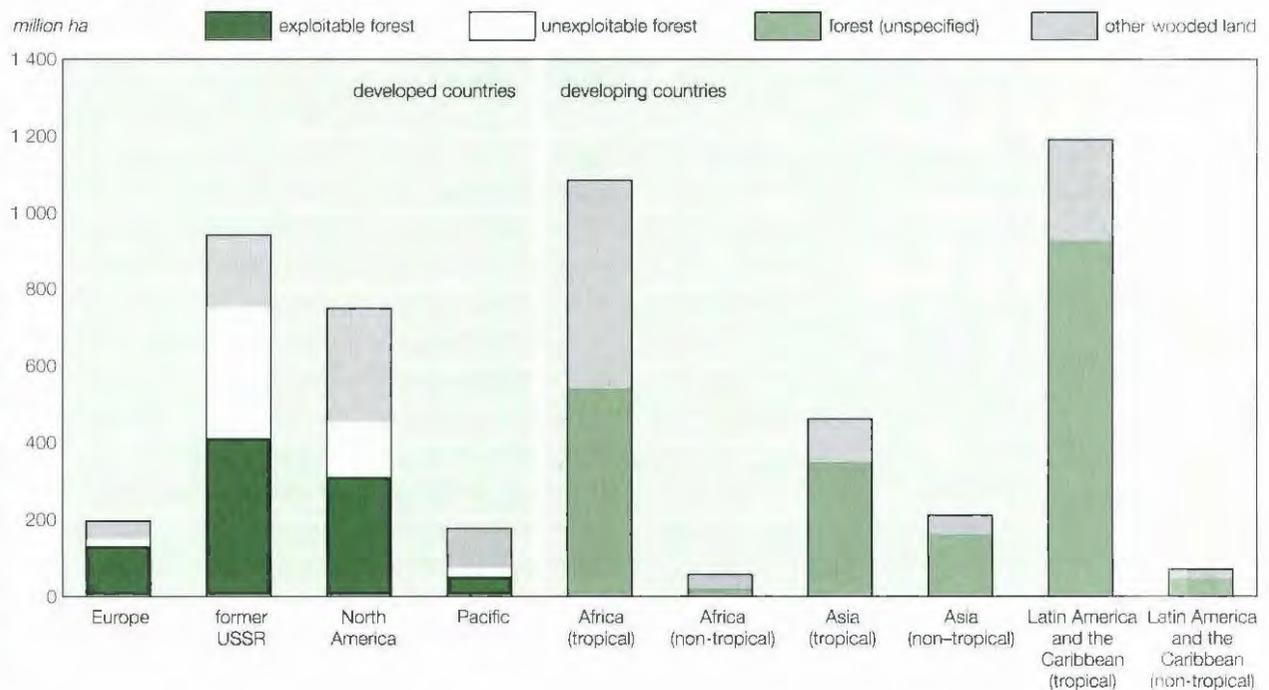


Table 6
Forest cover state and change by ecological zone for tropical countries

| ecological zone | land (million ha) | natural forest (million ha) | natural forest cover as a percentage of total land | deforestation 1980-1990 percent/year |
|---------------------------------|----------------------|--------------------------------|--|--|
| wet | 935 | 715 | 77 | 0.6 |
| moist deciduous | 1 294 | 591 | 46 | 1.0 |
| dry and very dry | 1 241 | 238 | 19 | 0.9 |
| hill and mountain zone | 719 | 203 | 28 | 1.1 |
| desert | 589 | 8 | 1 | 1.0 |
| total tropical countries | 4 778 | 1 756 * | 37 | 0.8 |

* excludes some small tropical countries

America and the Caribbean, to around 0.15 ha in non-tropical developing countries and in the developing countries of Asia and the Pacific. Some countries in the tropical wet zone (French Guyana, Gabon, Guyana and Suriname) have more than 15 ha per caput.

Forests in the tropical zone

The tropical zone contains 1 790 million ha of forests: 37 percent of the land area and 0.73 ha per caput. The tropical zone may be divided into six ecofloristic zones: the tropical rain forests, the moist deciduous forests, the dry zone, the very dry zone, the desert zone and the hill and mountain forests. About three-quarters of the tropical forest is in the tropical rainforest and the moist deciduous forest zones. Dry lowland formations and upland formations each constitute about 12 to 13 percent of the total tropical zone forest.

Table 6 shows that 77 percent of the land area in the wet zone is still covered with natural forest. The corresponding percentages are 46 in the moist deciduous, 19 in the dry and very dry and 29 in the hill and mountain forest zones. The entire wet zone (commonly referred to as the tropical rain forest zone) and the moist zone are assumed to have been completely forested. In the heterogeneous hill and mountain zone, it is assumed that the original forest cover was slightly less. A corresponding estimate for the dry and very dry zone is difficult to make.

Deforestation and degradation are major tropical forest issues. For the 1980-90 period, the annual estimated loss in natural forest area is 13.1 million ha (0.8 percent in tropical and 0.5 percent in non-

tropical developing countries). The rates, causes and effects of deforestation differ greatly between countries and regions. These differences are due to population density and growth rates, the extent and quality of forest resources, levels and rates of development, the structure of property rights and cultural systems. In the assessment of the tropical forest resources, a high correlation has been found between the change in the forest area and the change in population density. According to the model used, the process of population/forest interaction resembles a biological growth process where deforestation is observed to increase relatively slowly at initial stages of increases in population density, much faster at intermediate stages and slowly in the final stages.

The exact nature of the relationship varies between ecological zones. The lowest annual deforestation rate is observed in the wet zone. Deforestation rates are much higher in the moist, dry and hill and mountain zones. These zones have more favourable conditions for agriculture and high population pressure.

Recent estimates suggest that nearly two-thirds of tropical deforestation worldwide is due to farmers clearing land for agriculture.¹⁵ The largest losses of forest area are taking place in the tropical moist deciduous forests, the zone best suited for human settlement and agriculture. In the decade 1980 to 1990, an estimated 61 million ha were deforested, more than

¹⁵ R. Rowe, N.P. Sharma and J. Browder. 1992. Deforestation: problems, causes, and concerns. In Sharma, ed. 1992. *Managing the world's forests: looking for balance between conservation and development*. Dubuque, Iowa.

10 percent. The proportion of moist deciduous area still forested is 46 percent (only 29 percent in Asia). In contrast, 76 percent of the world's rain forest zone is still covered in forest. During the past decade, the total area of rain forest cut was 46 million ha.

Forests in the temperate zone

The FAO/ECE Forest Resources Assessment 1990 is studying changes in forest area in the industrial countries. While the data are incomplete, the emerging picture demonstrates a net gain in area of forest and other wooded land in Europe of nearly 2 million ha during the 1980s; small increases in New Zealand and Australia, and a net decrease of 3.2 million ha in the United States. The former USSR reported a net increase in forest and other wooded land of 22.6 million ha between 1978 and 1988, principally as a result of natural regeneration and planting and sowing on agricultural and other non-forest land, e.g. for shelterbelts. There is, however, an element of uncertainty in this figure as other sources report an increase in the area of forest of 21.7 million ha, partially offset by a decrease in other wooded land of 11.1 million ha.

In practically all the developed countries, fellings have remained below net annual increment and, in some cases, by a substantial margin. In the exploitable forests, in which most of the fellings occur, 1990 fellings reached only 74 percent of the increment. The corresponding regional figures are 80 percent in North America; 74 percent in the former USSR; 71 percent in Europe and perhaps no more than 50 percent in the developed countries of the Pacific region. The lower rates are not a new development: the evidence suggests that the increment in Europe has exceeded fellings for at least 40 years, maybe much longer. This data also confirms reports of a long-term build-up of growing stocks and woody biomass in most developed countries.

The temperate zone includes two basic ecological formations: mixed temperate forest and boreal forest. The mixed temperate forests comprise coniferous and broad-leaved species, including both deciduous and evergreens. The boreal forests extend between the Arctic tundra and the temperate zones in a circumpolar belt and consist of mainly coniferous species. The

boreal forests are vast; they cover 920 million ha—27 percent of the earth's forest area—and contain more than 70 percent of its coniferous forests.

Public concern about quality of temperate forests and how they are managed and used is widespread and growing.¹⁶ Concerns include forest quality, health, and the ability of current forest policies and of management practices in the various categories of ownership to balance forest quality with competing demands for timber, jobs, wildlife conservation, water resources, landscape and recreational benefits.

Forest plantations

Forest plantations are established for a variety of reasons including the production of industrial roundwood, fuelwood and poles, and for soil conservation and shelters. Plantations cannot provide the full range of goods and services supplied by a natural forest. They are tree crops, analogous to agricultural crops, with a simplified ecology of one or, at most, a few species usually chosen for their yield and ease of management. The primary purpose of most plantations is to produce wood or other products quickly and cheaply. Their role, which is a highly valuable one, complements national or global forestry management strategies.

The available data on plantation areas suggest that the 68 million ha in developing countries provide a growing proportion of their commercial wood consumption needs (see Table 7). An additional 14 million ha of rubber, coconut and oil palm plantations are not included in the area of forest plantations. The latter are mainly in Asia and the wood obtained from them is increasingly important. In the temperate and boreal zone, many forests are managed in a manner that makes the distinction between planted forest and naturally regenerated forest of little significance. Thus the following discussion relates mainly to forest plantation in developing countries.

Plantations can be highly productive. The increment of timber from a tropical plantation may

¹⁶ A.V. Korotkov and T.J. Peck, 1993. *Forest resources in the industrialized countries: an ECE/FAO assessment* Unasylva, 44(174).

Table 7
Forest cover state and change for developing countries

| region | 1990 | | annual change, 1980–1990 | | | |
|--|--------------------------------|---------------------------------|--------------------------------|--|---------------------------------|-------------------------------|
| | natural forest (million ha) | net plantations (million ha) | natural forest (million ha) | natural forest cover as a percentage of total land | net plantations (million ha) | total forest* (million ha) |
| Africa | 541 | 4.4 | -4.2 | -0.8 | 0.23 | -4.0 |
| <i>tropical</i> | 528 | 2.1 | -4.1 | -0.7 | 0.13 | -4.0 |
| <i>non-tropical</i> | 13 | 2.2 | -0.1 | -1.0 | 0.10 | 0 |
| Asia and the Pacific region | 441 | 56.2 | -4.4 | -0.9 | 3.40 | -1.0 |
| <i>tropical</i> | 315 | 22.6 | -3.9 | -1.2 | 2.11 | -1.8 |
| <i>non-tropical</i> | 126 | 33.6 | -0.4 | -0.3 | 1.28 | -0.8 |
| Latin America and the Caribbean countries | 960 | 7.7 | -7.7 | -0.8 | 0.41 | -7.3 |
| <i>tropical</i> | 918 | 6.0 | -7.4 | -0.8 | 0.37 | -7.0 |
| <i>non-tropical</i> | 42 | 1.7 | -0.3 | -0.6 | 0.05 | -0.3 |
| total tropical | 1 761 | 30.7 | -15.4 | -0.8 | -2.61 | -12.7 |
| total non-tropical | 181 | 37.9 | -0.9 | -0.5 | -1.37 | 0.5 |
| total developing | 1 941 | 68.6 | -16.3 | -0.8 | 4.10 | -12.1* |

* Table 10 (see pages 35–38) shows net annual change in area of forest and other wooded land totalling -10.2 million ha for developing countries.

be 30 m³ per hectare compared with 2 to 8 m³ per hectare from a managed natural forest. Annual yields of up to 70 m³ per hectare have been attained in Brazil from clones of hybrids of eucalyptus species. Such exceptional figures must, of course, be treated with caution. Experience shows that the yields assumed at the planning stage of many plantations are overestimated.¹⁷ A recent review of tropical plantations concluded that planning is generally poor, particularly for vital issues such as matching species and site. The study also noted that plantation projects are often designed in haste, with scant attention paid to important issues because of time and financial constraints.¹⁸ However, tree plantations that are well planned and managed can be highly productive and are ideal for supporting the large-scale wood industries required to satisfy future demands for wood and wood fibre.

¹⁷ FAO. 1993. *The challenge of sustainable forest management. What future for the world's forest?* Rome.

¹⁸ D. Panley. 1992. *Assessment of tropical forest plantation resources.* Umea, Uppsala, Swedish University of Agricultural Sciences.

Developing countries in the Asia and Pacific region have the largest share with 79 percent. The remainder is distributed between Latin America and Caribbean countries (13 percent) and African countries (8 percent). Six countries account for 85 percent of the developing countries plantations: China (31.8 million ha), India (13.2 million ha), Indonesia (6.4 million ha), Brazil (4.9 million ha), and Viet Nam and the Democratic People's Republic of Korea with 1.5 million ha each.

An overall average survival rate of about 70 percent has been calculated based on 56 plantation inventories in 18 developing countries. Applying this survival rate to the reported plantation area in developing countries yields a net total plantation area of 60 million ha for 1990. It must be noted, however, that the results of these plantations inventories may not be typical of all plantations; some plantations have survival rates of 30 percent or less due to poor maintenance or protection.

About 50 percent of the reported plantations have been established during the 1980s—60 percent in tropical and 35 percent in non-tropical developing countries. The average reported annual increase in

plantation area in the tropics during the decade 1980-90 was about 4.1 million ha, or a net increase in plantation area of 2.9 million ha.

Among the main species planted are eucalypts, pines, teak and acacias. While pines and teak are planted mostly for industrial purposes, eucalypts are planted for both industrial and non-industrial purposes and various acacia species are important for fuelwood, fodder and gum arabic production.

Cultivating trees with agricultural crops and growing woodlots outside gazetted forests gained considerable momentum in the 1980s. In order to estimate the planted area outside the traditional forests, many countries have fixed national criteria to convert seedlings raised in the nurseries and distributed or planted, into area. It is difficult to make estimates at global level for these forms of tree planting.

In the developing countries, further development of plantation forestry is constrained by the shortage of land. With expanding farming populations using all the unforested land for food production, the areas available for plantations are becoming increasingly restricted. The experience of the past two decades demonstrates that degraded or waste land may be the only resource available to the landless poor. There are, however, large areas where the natural forest has been badly degraded or abandoned farmland where

soil fertility has been lost through exhaustive agricultural use, which could be used for plantations.

Forest management for wood production

Developed countries have 41 percent of the world's forest, but account for 76 percent of the industrial roundwood production. On the other hand, the developing countries account for 87 percent of the fuelwood and charcoal use. Over the past 50 years, forest management in most developed countries has aimed at improving industrial roundwood producing capacity. Harvesting levels, total annual growth, growing stocks and biomass have increased substantially as a result. To a large extent, the developed countries have achieved these results through the replacement of poorly stocked and slow growing forests and intensive silvicultural practices.

Table 8 provides information on trends in harvesting intensity and harvested areas by region. In addition to the total area harvested, information is presented on the estimated areas of previously unlogged and previously logged forests. All three regions exhibit a slow but steady increase in the share of harvesting operations that occur in secondary forest. This effect is due partly to the fact that less primary forest remains each year and partly from the fact that changing market conditions

Table 8
Estimated harvesting intensities and areas of broadleaved forest harvested annually in the three major regions of the tropics

| period | Africa | | | Asia and the Pacific | | | Latin America and the Caribbean | | | all tropical countries | | |
|--------|---------------------------|---|------------------|---------------------------|---|------------------|---------------------------------|---|------------------|---------------------------|---|------------------|
| | average harvest intensity | area of forest harvested annually (thousand ha) | | average harvest intensity | area of forest harvested annually (thousand ha) | | average harvest intensity | area of forest harvested annually (thousand ha) | | average harvest intensity | area of forest harvested annually (thousand ha) | |
| | | primary forest | secondary forest | | primary forest | secondary forest | | primary forest | secondary forest | | primary forest | secondary forest |
| 61-65 | 14 | 394 | 91 | 42 | 510 | 78 | 7 | 1 247 | 57 | 17 | 2 152 | 226 |
| 66-70 | 14 | 506 | 137 | 43 | 750 | 135 | 8 | 1 260 | 76 | 20 | 2 516 | 348 |
| 71-75 | 14 | 593 | 166 | 35 | 1 343 | 221 | 8 | 1 485 | 119 | 20 | 3 422 | 505 |
| 76-80 | 14 | 612 | 215 | 33 | 1 732 | 319 | 8 | 2 011 | 183 | 19 | 4 356 | 717 |
| 81-85 | 14 | 634 | 239 | 32 | 1 718 | 369 | 8 | 2 297 | 251 | 18 | 4 648 | 859 |
| 86-90 | 13 | 723 | 248 | 33 | 1 861 | 453 | 8 | 2 287 | 320 | 19 | 4 871 | 1 020 |

Table 9
Number and extent of conservation areas in the forestry, wildlife and other sectors

| region | forestry | wildlife | others | all sectors | |
|------------------------------------|----------------------|----------------------|----------------------|----------------------|---|
| | area (million ha) | area (million ha) | area (million ha) | area (million ha) | conservation area as a percentage of total land |
| Africa | 25.9 | 197.7 | 0.6 | 224.2 | 10.0 |
| Asia and the Pacific | 70.5 | 55.6 | 0.8 | 126.9 | 14.2 |
| Latin America and the Caribbean | 116.5 | 118.4 | 120.7 | 355.6 | 21.5 |
| total | 212.9 | 371.7 | 122.1 | 706.7 | 14.8 |

Source: Assessing the Conservation Status of the World's Tropical Forest. WCMC contribution to the FAO FRA 1990 Project

increasingly improve the economic opportunities for relogging areas that were harvested two or more decades ago. This is especially true of the increase in market acceptability of 'lesser known' tree species. Although the increase is seldom dramatic, it is relatively steady and, over a period of decades, the effect is significant.

Regional differences in the annual area harvested and the stocking density of commercial species are significant. For example, even though the *volume* of non-coniferous sawlogs and veneer logs produced annually in the Asia and Pacific region during 1986–90 was 3.7 times the comparable volume produced in the Latin America and Caribbean region, the estimated total area harvested in tropical Asia is 89 percent of that in tropical America. This is due to the fact that the average commercial timber harvest volume per unit area in the Asia and Pacific region during 1986–90 is estimated to be about 33 m³/ha compared to an average of only about 8 m³/ha in the Latin America and Caribbean region.

Forest management for conservation

Conservation areas are lands managed through legal or customary regimes to protect and maintain biological diversity and natural and associated cultural resources.¹⁹ Table 9 summarises the findings

of an assessment carried out by the World Conservation Monitoring Centre (WCMC). The data in this assessment suggest that nearly 15 percent of the tropics is under conservation management or protection.

This quantitative information must be tempered by a realistic appraisal of on-the-ground management effectiveness and the threats to existing sites. Throughout the tropics there tends to be inadequate legislation and ineffective application of the legal measures that do exist. Weak institutional support, inadequate or non-existent management and insufficient funding are common. Consequently, there is a tendency towards 'paper parks' whose existence is largely theoretical and is not reflected by substantive and durable conservation reserves on the ground. Furthermore, those sites that do exist are under increasing pressure from competing land uses.

Despite the seemingly encouraging picture that emerges from the data, it is often impossible to know whether or not a conservation area network is representative, particularly in terms of biological diversity. A survey conducted by WCMC shows that out of 8 715 conservation areas only 5 percent are known to have been inventoried for one or more taxonomic groups. Conservation areas have frequently been established with little or no regard to ecological criteria for their selection. Continuing and growing pressure on land throughout the tropics, particularly in densely populated Asian nations, has forced the selection of conservation areas to be made on pragmatic and not necessarily scientific grounds.

¹⁹ This definition was agreed upon at the IV World Congress on National Parks and Protected Areas, Caracas, 10–12 February 1992.

Figure 2
Wood harvesting in 1990 (related to total forest area)

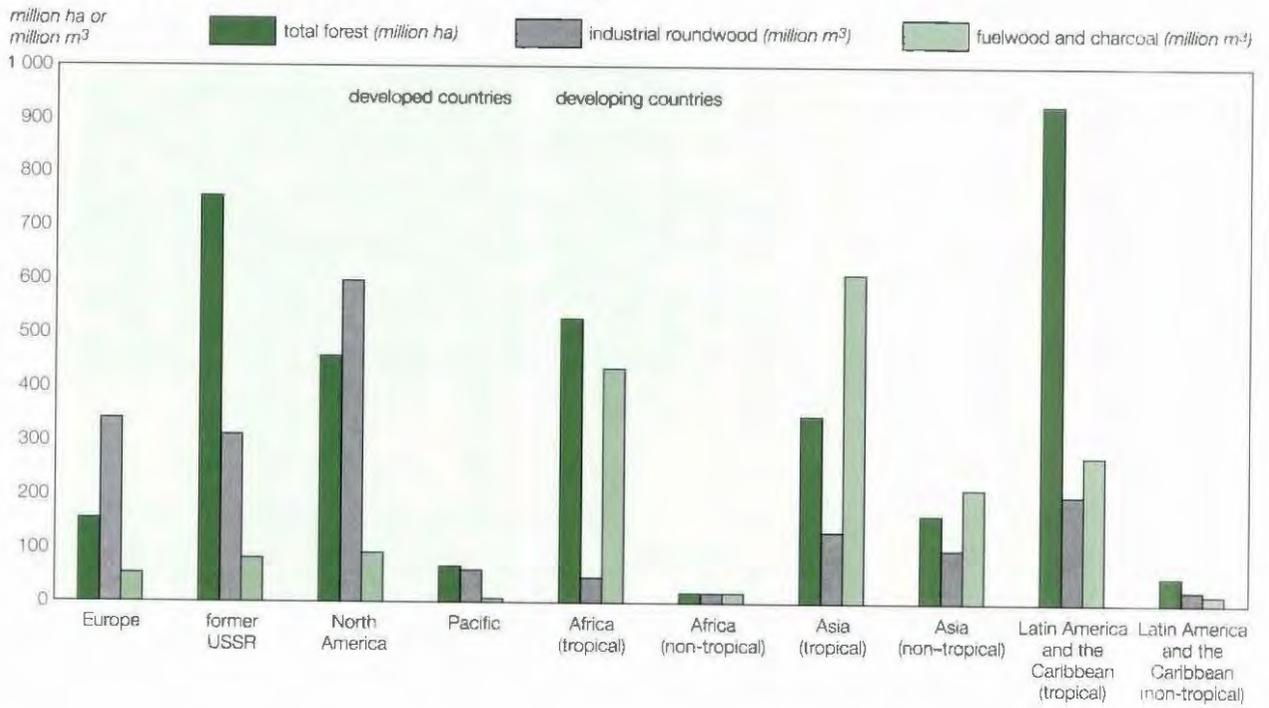


Table 10
Forest and wooded land coverage by country

a) Africa

| country | forest and other wooded land | | | forest area | | | other wooded land | |
|--------------------------------------|------------------------------|--|-----------------------------|---|-----------|--------------------------------|-----------------------------|----------------|
| | total area (thousand ha) | annual change (thousand ha) (percent) | total area (thousand ha) | forest area as a percentage of total land | ha/cap | biomass (million tonnes) | total area (thousand ha) | |
| Burkina Faso | 13 813 | | 4 436 | 16 | 0.49 | 349 | 9 377 | |
| Cape Verde | 78 | | 16 | 4 | 0.04 | 1 | 62 | |
| Chad | 32 450 | | 11 438 | 9 | 2.01 | 718 | 21 012 | |
| Gambia | 286 | | 98 | 10 | 0.11 | 10 | 188 | |
| Guinea-Bissau | 2 162 | | 2 022 | 72 | 2.13 | 167 | 140 | |
| Mali | 28 791 | | 12 158 | 10 | 1.30 | 750 | 16 633 | |
| Mauritania | 4 536 | | 556 | 1 | 0.27 | 35 | 3 980 | |
| Niger | 10 442 | | 2 562 | 2 | 0.36 | 82 | 7 880 | |
| Senegal | 13 400 | | 7 656 | 40 | 1.04 | 517 | 5 744 | |
| West Sahelian Africa | 105 956 | -297.2 | -0.28 | 40 941 | 8 | 0.96 | 2 628 | 65 015 |
| Djibouti | 1 320 | | 22 | 1 | 0.05 | 2 | 1 298 | |
| former P. D. R. of Ethiopia | 41 991 | | 14 354 | 13 | 0.31 | 2 039 | 27 637 | |
| Kenya | 16 815 | | 1 305 | 2 | 0.05 | 113 | 15 511 | |
| Somalia | 15 945 | | 758 | 1 | 0.10 | 77 | 15 187 | |
| Sudan | 68 955 | | 43 179 | 18 | 1.71 | 2 648 | 25 776 | |
| Uganda | 16 023 | | 6 366 | 32 | 0.35 | 377 | 9 657 | |
| East Sahelian Africa | 161 048 | -642.2 | -0.39 | 65 983 | 13 | 0.54 | 5 254 | 95 065 |
| Benin | 11 497 | | 4 961 | 45 | 1.05 | 198 | 6 536 | |
| Côte d'Ivoire | 18 952 | | 10 967 | 34 | 0.87 | 870 | 7 985 | |
| Ghana | 18 013 | | 9 608 | 42 | 0.64 | 817 | 8 405 | |
| Guinea | 17 484 | | 6 696 | 27 | 0.97 | 559 | 10 788 | |
| Liberia | 6 632 | | 4 639 | 48 | 1.82 | 1 049 | 1 993 | |
| Nigeria | 65 654 | | 15 785 | 17 | 0.14 | 1 616 | 49 869 | |
| Sierra Leone | 6 969 | | 1 895 | 26 | 0.46 | 200 | 5 074 | |
| Togo | 4 566 | | 1 370 | 25 | 0.40 | 99 | 3 196 | |
| West Africa | 149 765 | -85.4 | -0.06 | 55 919 | 27 | 0.35 | 5 409 | 93 845 |
| Cameroon | 35 905 | | 20 366 | 44 | 1.96 | 2 951 | 15 539 | |
| Central African Republic | 46 754 | | 30 568 | 49 | 10.49 | 3 809 | 16 185 | |
| Congo | 25 285 | | 19 902 | 58 | 9.98 | 5 466 | 5 383 | |
| Equatorial Guinea | 2 719 | | 1 829 | 65 | 5.35 | 480 | 890 | |
| Gabon | 19 966 | | 18 256 | 71 | 15.59 | 5 118 | 1 710 | |
| Zaire | 166 076 | | 113 317 | 50 | 3.15 | 28 523 | 52 759 | |
| Central Africa | 296 704 | -571.2 | -0.19 | 204 238 | 51 | 3.87 | 46 349 | 92 486 |
| Angola | 77 197 | | 23 194 | 19 | 2.31 | 1 625 | 54 004 | |
| Botswana | 26 561 | | 14 262 | 25 | 11.10 | 546 | 12 299 | |
| Burundi | 1 315 | | 325 | 13 | 0.06 | 16 | 989 | |
| Malawi | 3 724 | | 3 612 | 38 | 0.43 | 486 | 112 | |
| Mozambique | 55 881 | | 17 357 | 22 | 1.11 | 1 384 | 38 524 | |
| Namibia | 26 296 | | 12 569 | 15 | 9.45 | 481 | 13 727 | |
| Rwanda | 945 | | 252 | 10 | 0.03 | 27 | 694 | |
| United Republic of Tanzania | 68 497 | | 33 709 | 38 | 1.23 | 1 445 | 34 788 | |
| Zambia | 60 337 | | 32 349 | 44 | 3.83 | 2 273 | 27 988 | |
| Zimbabwe | 26 144 | | 8 981 | 23 | 0.92 | 540 | 17 163 | |
| Tropical South Africa | 346 895 | -735.8 | 0.21 | 146 609 | 26 | 1.54 | 8 824 | 200 287 |
| Comoros | 41 | | 11 | 5 | 0.02 | 16 | 30 | |
| Madagascar | 23 225 | | 15 999 | 28 | 1.34 | 1 680 | 7 226 | |
| Mauritius | 44 | | 12 | 6 | 0.01 | 1 | 32 | |
| Reunion | 135 | | 100 | 40 | 0.17 | 22 | 35 | |
| Saint Helena | 9 | | 1 | 5 | 0.23 | 0 | 8 | |
| Seychelles | 3 | | 3 | 12 | 0.05 | 18 | 0 | |
| Insular Africa | 23 457 | -89.4 | -0.38 | 16 127 | 27 | 1.13 | 1 737 | 7 331 |
| Tropical Africa | 1 083 826 | -2 421.2 | -0.22 | 529 818 | 24 | 1.09 | 70 201 | 554 008 |
| Algeria | 3 945 | | 2 039 | 1 | 0.08 | 197 | 1 906 | |
| Egypt | 34 | | 34 | 0 | 0.00 | 0 | 0 | |
| Libya Arab Jamahiriya | 846 | | 400 | 0 | 0.09 | 13 | 446 | |
| Morocco | 5 744 | | 3 864 | 5 | 0.15 | 432 | 1 880 | |
| Tunisia | 569 | | 569 | 4 | 0.07 | 3 | 0 | |
| North Africa | 11 137 | -73.1 | -0.68 | 6 905 | 1 | 0.06 | 671 | 4232 |
| Lesotho | 23 | | 7 | 0 | 0.00 | 0 | 16 | |
| South Africa | 41 543 | | 8 208 | 7 | 0.22 | 1 427 | 33 335 | |
| Swaziland | 146 | | 146 | 8 | 0.19 | 7 | 0 | |
| Non-tropical South Africa | 41 712 | -333.5 | -0.78 | 8 361 | 7 | 0.21 | 1 434 | 33 351 |
| Non-tropical Africa | 52 850 | -406.6 | -0.76 | 15 267 | 2 | 0.10 | 2 105 | 37 583 |
| TOTAL AFRICA | 1 136 675 | -2 827.8 | -0.25 | 545 084 | 18 | 0.85 | 72 306 | 591 591 |

Table 10 (continued)

Forest and wooded land coverage by country**b) Asia and the Pacific region**

| country | forest and other wooded land | | | forest area | | | other wooded land | |
|-----------------------------------|------------------------------|--------------------------------|--------------|-----------------------------|---|-------------|--------------------------------|-----------------------------|
| | total area (thousand ha) | annual change (thousand ha) | (percent) | total area (thousand ha) | forest area as a percentage of total land | ha/cap | biomass (million tonnes) | total area (thousand ha) |
| Bangladesh | 1 472 | | | 1 004 | 8 | 0.01 | 104 | 468 |
| Bhutan | 3 168 | | | 2 813 | 60 | 1.97 | 508 | 355 |
| India | 82 648 | | | 64 959 | 22 | 0.08 | 4 806 | 17 689 |
| Nepal | 5 751 | | | 5 079 | 37 | 0.27 | 549 | 672 |
| Pakistan | 3 128 | | | 2 023 | 3 | 0.02 | 203 | 1 105 |
| Sri Lanka | 3 997 | | | 1 885 | 29 | 0.11 | 198 | 2 113 |
| South Asia | 100 163 | 596.3 | 0.64 | 77 762 | 19 | 0.07 | 6 368 | 22 402 |
| Cambodia | 13 724 | | | 12 170 | 69 | 1.48 | 2 163 | 1 554 |
| Laos | 21 436 | | | 13 177 | 57 | 3.24 | 2 544 | 8 259 |
| Myanmar | 49 774 | | | 29 091 | 44 | 0.70 | 6 259 | 20 683 |
| Thailand | 14 968 | | | 13 264 | 26 | 0.24 | 1 585 | 1 704 |
| Viet Nam | 23 499 | | | 9 782 | 30 | 0.15 | 1 524 | 13 717 |
| Continental S. E. Asia | 123 400 | -1 087.3 | -0.85 | 77 484 | 41 | 0.44 | 14 075 | 45 916 |
| Brunei Darussalam | 458 | | | 458 | 87 | 1.72 | 138 | n.a. |
| Indonesia | 145 108 | | | 115 674 | 64 | 0.64 | 22 261 | 29 434 |
| Malaysia | 22 248 | | | 17 664 | 54 | 1.02 | 4 591 | 4 584 |
| Philippines | 13 640 | | | 8 034 | 27 | 0.13 | 1 848 | 5 606 |
| Singapore | 4 | | | 4 | 7 | 0.00 | 1 | 0 |
| Insular S. E. Asia | 181 458 | -1 509.2 | -0.81 | 141 834 | 58 | 0.54 | 28 837 | 39 624 |
| Papua New Guinea | 42 115 | | | 36 030 | 80 | 8.98 | 6 890 | 6 085 |
| American Samoa | 14 | | | 0 | 0 | 0.00 | 0 | 14 |
| Fiji | 859 | | | 853 | 47 | 1.18 | 160 | 6 |
| French Polynesia | 115 | | | 0 | 0 | 0.00 | 0 | 115 |
| Guam | 10 | | | 0 | 0 | 0.00 | 0 | 10 |
| Kiribati | 2 | | | 0 | 0 | 0.00 | 0 | 2 |
| New Caledonia | 1 289 | | | 710 | 39 | 4.22 | 138 | 579 |
| Niue | 6 | | | 0 | 0 | 0.00 | 0 | 6 |
| Pacific Islands | 40 | | | 0 | 0 | 0.00 | 0 | 40 |
| Samoa | 164 | | | 133 | 47 | 0.84 | 27 | 31 |
| Soloman Islands | 2 456 | | | 2 410 | 86 | 7.53 | 481 | 45 |
| Tonga | 8 | | | 0 | 0 | 0.00 | 0 | 8 |
| Vanuatu | 809 | | | 809 | 66 | 5.39 | 173 | 0 |
| Pacific | 47 886 | -44.7 | -0.09 | 40 945 | 76 | 6.75 | 7 870 | 6 941 |
| Tropical Asia | 452 907 | -2 044.9 | -0.45 | 338 025 | 38 | 0.21 | 57 149 | 114 883 |
| Afghanistan | 2 614 | | | 1 199 | 2 | 0.07 | 13 | 1 415 |
| Bahrain | 0 | | | 0 | 0 | 0.00 | 0 | 0 |
| Iran | 11 437 | | | 1 737 | 1 | 0.03 | 332 | 9 700 |
| Iraq | 192 | | | 83 | 0 | 0.00 | 5 | 109 |
| Jordan | 173 | | | 51 | 1 | 0.02 | 3 | 122 |
| Kuwait | 5 | | | 5 | 0 | 0.00 | 0 | 0 |
| Lebanon | 144 | | | 78 | 8 | 0.03 | 7 | 66 |
| Oman | 0 | | | 0 | 0 | 0.00 | 0 | 0 |
| Qatar | 0 | | | 0 | 0 | 0.00 | 0 | 0 |
| Saudi Arabia | 902 | | | 202 | 0 | 0.01 | 4 | 700 |
| Syrian Arab Republic | 484 | | | 245 | 1 | 0.02 | 5 | 239 |
| United Arab Emirates | 60 | | | 60 | 1 | 0.04 | 0 | 0 |
| Yemen | 1 921 | | | 9 | 0 | 0.00 | 0 | 1 912 |
| Middle East | 17 931 | 164.7 | 0.97 | 3 668 | 1 | 0.03 | 369 | 14 263 |
| China | 162 029 | | | 133 799 | 14 | 0.12 | 16 009 | 28 230 |
| Dem. People's Rep. of Korea | 7 370 | | | 6 170 | 51 | 0.28 | 423 | 1 200 |
| Republic of Korea | 6 291 | | | 6 291 | 64 | 0.15 | 755 | 0 |
| Mongolia | 13 741 | | | 9 406 | 6 | 4.29 | 564 | 4 335 |
| Temperate Asia | 189 431 | 539.0 | 0.33 | 155 666 | 13 | 0.13 | 17 751 | 33 765 |
| Non-tropical Asia | 207 362 | 703.8 | 0.39 | 159 334 | 9 | 0.12 | 18 120 | 48 028 |
| TOTAL ASIA AND PACIFIC | 660 269 | -1 341.1 | -0.21 | 497 359 | 19 | 0.17 | 75 269 | 162 911 |

Table 10 (continued)

Forest and wooded land coverage by country**c) Latin America and the Caribbean**

| country | forest and other wooded land | | | forest area | | | other wooded land | |
|---|------------------------------|--|-----------------------------|---|-----------|--------------------------------|-----------------------------|----------------|
| | total area (thousand ha) | annual change (thousand ha) (percent) | total area (thousand ha) | forest area as a percentage of total land | ha/cap | biomass (million tonnes) | total area (thousand ha) | |
| Costa Rica | 1 569 | | 1 456 | 29 | 0.48 | 262 | 113 | |
| El Salvador | 890 | | 127 | 6 | 0.02 | 12 | 763 | |
| Guatemala | 9 465 | | 4 253 | 39 | 0.46 | 725 | 5 212 | |
| Honduras | 6 054 | | 4 608 | 41 | 0.90 | 527 | 1 446 | |
| Mexico | 129 057 | | 48 695 | 26 | 0.55 | 3 174 | 80 362 | |
| Nicaragua | 7 732 | | 6 027 | 51 | 1.56 | 1 088 | 1 705 | |
| Panama | 3 266 | | 3 123 | 41 | 1.29 | 695 | 143 | |
| Central America | 158 033 | -825.5 | -0.51 | 68 289 | 29 | 0.58 | 6 483 | 89 745 |
| Barbados | 5 | | 0 | 0 | 0.00 | 0 | 5 | |
| Bermuda | 1 | | 0 | 0 | 0.00 | 0 | 1 | |
| British Virgin Islands | 5 | | 3 | 20 | 0.19 | 0 | 2 | |
| Cayman Islands | 6 | | 0 | 0 | 0.00 | 0 | 6 | |
| Montserrat | 4 | | 3 | 25 | 0.23 | 0 | 1 | |
| Netherlands Antilles | 7 | | 0 | 0 | 0.00 | 0 | 7 | |
| St. Pierre & Miquelon | 1 | | 0 | 0 | 0.00 | 0 | 1 | |
| United States Virgin Islands | 14 | | 14 | 41 | 0.13 | 1 | 0 | |
| Antigua and Barbuda | 26 | | 10 | 23 | 0.13 | 1 | 16 | |
| Bahamas | 186 | | 186 | 19 | 0.72 | 22 | 0 | |
| Belize | 2 117 | | 1 998 | 88 | 10.98 | 255 | 119 | |
| Cuba | 3 262 | | 1 960 | 18 | 0.19 | 209 | 1 302 | |
| Dominica | 50 | | 44 | 59 | 0.54 | 5 | 6 | |
| Dominican Republic | 1 530 | | 1 084 | 22 | 0.15 | 106 | 446 | |
| French Guyana | 8 318 | | 7 997 | 91 | 86.92 | 2 500 | 321 | |
| Grenada | 11 | | 6 | 18 | 0.07 | 1 | 5 | |
| Guadeloupe | 93 | | 93 | 55 | 0.27 | 11 | 0 | |
| Guyana | 18 756 | | 18 424 | 94 | 17.72 | 4 571 | 331 | |
| Haiti | 139 | | 31 | 1 | 0.00 | 2 | 108 | |
| Jamaica | 652 | | 254 | 23 | 0.10 | 43 | 399 | |
| Martinique | 71 | | 43 | 41 | 0.13 | 5 | 28 | |
| Puerto Rico | 336 | | 324 | 37 | 0.09 | 38 | 12 | |
| St. Kitts and Nevis | 24 | | 13 | 36 | 0.25 | 2 | 11 | |
| St. Lucia | 34 | | 5 | 8 | 0.03 | 1 | 29 | |
| St. Vincent | 12 | | 11 | 28 | 0.09 | 1 | 1 | |
| Suriname | 15 094 | | 14 776 | 95 | 36.67 | 3 831 | 317 | |
| Trinidad and Tobago | 235 | | 168 | 33 | 0.13 | 33 | 68 | |
| Caribbean | 50 989 | -48.8 | -0.10 | 47 447 | 69 | 1.35 | 11 640 | 3 543 |
| Bolivia | 57 977 | | 49 345 | 46 | 6.75 | 7 376 | 8 632 | |
| Brazil | 671 921 | | 566 007 | 67 | 3.76 | 106 053 | 105 914 | |
| Colombia | 63 231 | | 54 190 | 52 | 1.70 | 10 515 | 9 041 | |
| Ecuador | 15 576 | | 12 007 | 43 | 1.11 | 2 355 | 3 569 | |
| Paraguay | 19 256 | | 12 868 | 32 | 3.01 | 796 | 6 388 | |
| Peru | 84 844 | | 68 090 | 53 | 3.05 | 16 014 | 16 754 | |
| Venezuela | 69 436 | | 45 943 | 52 | 2.33 | 8 615 | 23 493 | |
| Tropical South America | 982 242 | -4 793.2 | -0.48 | 808 450 | 60 | 3.28 | 151 723 | 173 792 |
| Tropical Latin America & Caribbean | 1 191 265 | -5 667.5 | -0.47 | 924 186 | 56 | 2.31 | 169 847 | 267 079 |
| Argentina | 50 936 | | 34 436 | 13 | 1.07 | 8 540 | 16 500 | |
| Chile | 16 583 | | 8 033 | 11 | 0.61 | 1 776 | 8 550 | |
| Uruguay | 933 | | 813 | 5 | 0.26 | 145 | 120 | |
| Non-tropical South America | 68 453 | -397.7 | -0.55 | 43 283 | 12 | 0.89 | 10 460 | 25 170 |
| TOTAL LATIN AMERICA AND CARIBBEAN | 1 259 718 | -6 047.2 | -0.47 | 967 469 | 48 | 2.16 | 180 307 | 292 249 |

Table 10 (continued)

Forest and wooded land coverage by country

d) Developed countries

| country | forest and other wooded land | | | forest area | | | other wooded land | |
|----------------------------------|------------------------------|--------------------------------|--------------|-----------------------------|---|-------------|--------------------------------|-----------------------------|
| | total area (thousand ha) | annual change (thousand ha) | (percent) | total area (thousand ha) | forest area as a percentage of total land | ha/cap | biomass (million tonnes) | total area (thousand ha) |
| Finland | 23 373 | 5.5 | | 20 112 | 66 | 4.03 | 945 | 3 261 |
| Norway | 9 565 | n.a. | | 8 697 | 28 | 2.05 | 313 | 868 |
| Sweden | 28 015 | 0 | | 24 437 | 60 | 2.85 | 1 393 | 3 578 |
| Nordics | 60 953 | 5.5 | 0.02 | 53 246 | 52 | 2.99 | 2 651 | 7 707 |
| Belgium | 620 | 1.9 | | 620 | 20 | 0.06 | 53 | 0 |
| Denmark | 466 | 1.0 | | 466 | 11 | 0.09 | 38 | 0 |
| Iceland | 123 | n.a. | | 0 | 0 | 0.00 | 0 | 123 |
| Ireland | 429 | 4.8 | | 396 | 6 | 0.11 | 13 | 33 |
| Netherlands | 334 | 1.0 | | 334 | 10 | 0.02 | 32 | 0 |
| United Kingdom | 2 380 | 24.2 | | 2 207 | 9 | 0.04 | 124 | 173 |
| North Western Europe | 4 352 | 32.9 | 0.81 | 4 023 | 8 | 0.04 | 260 | 329 |
| Austria | 3 877 | 14.2 | | 3 877 | 47 | 0.50 | 485 | 0 |
| former Czechoslovakia | 4 491 | 2.0 | | 4 491 | 36 | 0.29 | 660 | 0 |
| France | 14 154 | 8.0 | | 13 110 | 24 | 0.23 | 1 219 | 1 044 |
| Germany | 10 735 | 46.9 | | 10 490 | 30 | 0.13 | 1 584 | 245 |
| Luxembourg | 88 | 0.1 | | 85 | 33 | 0.23 | 8 | 3 |
| Poland | 8 672 | 5.0 | | 86 872 | 28 | 0.23 | 937 | 0 |
| Switzerland | 1 186 | 6.6 | | 1 130 | 28 | 0.17 | 199 | 56 |
| Central Eastern Europe | 43 203 | 82.8 | 0.19 | 41 855 | 29 | 0.20 | 5 091 | 1 348 |
| Albania | 1 449 | 0.1 | | 1 046 | 38 | 0.32 | 48 | 403 |
| Bulgaria | 3 683 | 7.8 | | 3 386 | 31 | 0.38 | 207 | 298 |
| Cyprus | 280 | 0.2 | | 140 | 15 | 0.20 | 4 | 140 |
| Greece | 6 032 | 0.9 | | 2 512 | 19 | 0.25 | 85 | 3 520 |
| Hungary | 1 675 | 8.2 | | 1 675 | 18 | 0.16 | 186 | 0 |
| Israel | 124 | n.a. | | 102 | 5 | 0.02 | 6 | 22 |
| Italy | 8 550 | n.a. | | 6 750 | 22 | 0.12 | 547 | 1 800 |
| Romania | 6 265 | 0.2 | | 6 190 | 27 | 0.27 | 681 | 75 |
| Turkey | 20 199 | 3.1 | | 8 856 | 11 | 0.15 | 558 | 11 343 |
| former S. F. R. of Yugoslavia | 9 454 | 34.5 | | 8 371 | 33 | 0.35 | 862 | 1 083 |
| South East Europe | 57 711 | 55.0 | 0.11 | 39 028 | 20 | 0.19 | 3 184 | 18 683 |
| Portugal | 3 102 | 13.8 | | 2 755 | 32 | 0.26 | 124 | 347 |
| Spain | 25 622 | 0.9 | | 8 388 | 17 | 0.22 | 554 | 17 234 |
| Iberia | 28 724 | 14.7 | 0.05 | 11 143 | 19 | 0.23 | 678 | 17 581 |
| Europe | 194 943 | 190.8 | 0.13 | 148 295 | 27 | 0.26 | 11 864 | 45 648 |
| Belarus | 6 256 | 27.3 | | 6 016 | 29 | 0.59 | 499 | 240 |
| Other former USSR | 926 035 | n.a. | | 739 729 | 36 | 2.56 | 50 302 | 186 306 |
| Ukraine | 9 239 | 24.0 | | 9 213 | 16 | 0.18 | 848 | 26 |
| Former USSR | 941 530 | 51.3 | 0.01 | 754 958 | 35 | 2.15 | 51 648 | 186 572 |
| Canada | 453 300 | 0 | | 247 164 | 27 | 9.32 | 25 458 | 206 136 |
| USA | 295 989 | -316.5 | | 209 573 | 23 | 0.84 | 19 490 | 86 416 |
| North America | 749 289 | -316.5 | -0.11 | 456 737 | 25 | 1.65 | 44 948 | 292 552 |
| Australia | 145 613 | 0.6 | | 39 837 | 5 | 2.33 | 2 430 | 105 776 |
| Japan | 24 718 | -4.8 | | 24 158 | 66 | 0.20 | 1 498 | 560 |
| New Zealand | 7 472 | n.a. | | 7 472 | 28 | 2.23 | 209 | 0 |
| Oceania | 177 803 | -4.2 | | 71 467 | 9 | 0.50 | 4 137 | 106 336 |
| TOTAL DEVELOPED COUNTRIES | 2 063 565 | -78.6 | -0.01 | 1 432 457 | 27 | 1.07 | 112 598 | 631 108 |

Summary

| | | | | | | | | |
|----------------------|------------------|------------------|--------------|------------------|-----------|-------------|----------------|------------------|
| Developing countries | 3 056 662 | -10 216.1 | -0.33 | 2 009 912 | 26 | 0.50 | 327 882 | 1 046 751 |
| Developed countries | 2 063 565 | -78.6 | -0.01 | 1 432 457 | 27 | 1.07 | 112 598 | 631 108 |
| GRAND TOTALS | 5 120 227 | -10 294.7 | -0.20 | 3 442 368 | 27 | 0.64 | 440 479 | 1 677 859 |

Annex 1 : definitions

Developed countries

Forest: land with tree crown cover (stand density) of more than about 20 percent of the area. Continuous forest with trees usually growing to more than about 7 m in height and able to produce wood. This includes both closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground, and open forest formations with a continuous grass layer in which tree synusia cover at least 10 percent of the ground.

Other wooded land: land which has some forestry characteristics but is not forest as defined above. It includes open woodland and scrub, shrub and brushland (see below), whether or not used for pasture or range. It excludes land occupied by 'trees outside the forest'.

Open woodland: land with tree crown cover (stand density) of about 5–20 percent of the area.

Scrub, shrub and brushland: land with scrub, shrub or stunted trees, where the main woody elements are shrubs (usually more than 50 cm and less than 7 m in height), covering more than about 20 percent of the area, not primarily used for agricultural or other non-forestry purposes, such as grazing of domestic animals.

Exploitable forest: forest and other wooded land on which there are no legal, economic or technical restrictions on wood production. It includes areas where, although there are no such restrictions, harvesting is not currently taking place, for example, areas included in long term utilization plans or intentions.

Developing countries

Forest: ecosystem with a minimum of 10 percent crown cover of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices. The term *forest* is further subdivided, according to its origin, into two categories:

- i) **Natural forests:** a subset of forests composed of tree species known to be indigenous to the area.
- ii) **Plantation forests:**
 - established artificially by afforestation on lands which previously did not carry forest within living memory;
 - established artificially by reforestation of land which carried forest before, and involving the replacement of the indigenous species by a new and essentially different species or genetic variety.

Deforestation: change of forest with depletion of tree crown cover to less than 10 percent. Changes within the forest class (from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity, are termed forest degradation. Degradation is not reflected in the estimates.

Other wooded land includes the following:

- i) **Forest fallow,** consisting of all complexes of woody vegetation deriving from the clearing of natural forest for shifting agriculture. It consists of a mosaic of various succession phases and includes patches of uncleared forests and agriculture fields which cannot be realistically segregated and accounted for area-wise, especially from satellite imagery. Forest fallow is an intermediate class between forest and non-forest land uses. Part of the area which is not under cultivation may have the appearance of a secondary forest. Even the part currently under cultivation sometimes has the appearance of forest, due to presence of tree cover. Accurate separation between forest and forest fallow may not always be possible.
- ii) **Shrubs,** referring to vegetation types where the dominant woody elements are shrubs with more than 50 cm and less than 5 metres height on maturity. The height limits for trees and shrubs should be interpreted with flexibility, particularly where the minimum tree and maximum shrub heights, which may vary between 5 and 7 metres approximately.

Annex 2:

European forests and forestry

Prepared at the request of the Executive Committee of the FAO European Forestry Commission to provide better information on the European dimension of world forestry.

The European region is covered with temperate or boreal forests, over 30 percent of its area. This forest cover is largely of human creation, through the heavy reforestation of the last 150 years following the extensive exploitation of forests over previous centuries in this densely populated continent.

The concept of sustainable management, in earlier times conceived mainly as sustainable yield of wood, found its origin in Europe several generations ago. More recently, the combination of environmental threats and pressing urban demands for varied forest amenities, have led foresters in most countries to elaborate policies which put wood production and forest management within a framework that ensures the long term fulfilment of environmental sustainability and the supply of the whole range of goods and services which society requires.

In many countries, the implementation of such policies depends on the operations of a multitude of private forest owners, often managing small areas of forest, who control nearly half of the forest area. Legal, regulatory, economic or educational instruments, incentives and deterrents have been put in place to bring profit-seeking behaviour into harmony with societal objectives, alongside management practices directly applied by public sector foresters. Such policies have to be seen within an overall trend of declining state intervention and subsidization. These broad traits of the European forest and policies are more systematically documented in the following text.

The debate about sustainable management of forests, and particularly on the reconciliation of economic, environmental and social functions, has gained worldwide scope and is of the highest importance for the future of the forest sector and for the formulation of policies. Every country and every region has its particular ecological, climatic, economic, institutional, even cultural characteristics, which give a specific nature to this common concern and call for approaches tailored to each case. In this context, Europe—taken here in its narrow extension, as large parts of Russia have very different conditions from those prevailing in the majority of other European countries—can be distinguished from the other forest regions in the world by a few features widely shared among its members.

History

Forest is the climax ecosystem in most parts of Europe²⁰ and in prehistoric times, over 80 percent of the continent was covered by forest. The advance of agriculture over many centuries, and the rapid changes of the industrial revolution, reduced the forest area to less than a quarter in the nineteenth century. However, in European conditions, the forest proved resilient, returning when human pressure eased; from the mid-nineteenth century, or earlier in some cases, Europeans became aware of the importance of forests and the necessity of preserving, expanding and managing them sustainably.

²⁰ For the purposes of this note, Europe includes the Nordic countries, the 12 countries of the European Union, central and southeast Europe and the Balkans, as well as Turkey, and the countries in transition from a centrally planned economy including the Baltic countries, but not the members of the Commonwealth of Independent States (CIS).

Table A1
Europe's forests around 1990

| country | forest and other wooded land (million ha) | change 1980-90 | growing stock | net annual increment (million m ³) | fellings | forest cover (percent) | forest and other wooded land per caput (ha) | growing stock per hectare (m ³) | fellings as a percentage of net annual increment (percent) |
|---|--|----------------|---------------|---|--------------|---------------------------|--|--|---|
| Finland | 23.4 | 0.06 | 1 679 | 69.7 | 55.9 | 77 | 4.68 | 72 | 80 |
| Iceland | 0.1 | n.a. | n.a. | n.a. | 0.0 | 2 | 0.54 | n.a. | n.a. |
| Norway | 9.6 | 0.00 | 571 | 17.6 | 11.8 | 31 | 2.26 | 60 | 67 |
| Sweden | 28.0 | 0.00 | 2 471 | 91.0 | 57.5 | 69 | 3.27 | 88 | 63 |
| Nordic countries | 61.1 | 0.06 | 4 721 | 178.3 | 125.2 | 55 | 3.39 | 77 | 70 |
| Belgium | 0.6 | 0.02 | 90 | 4.5 | 3.3 | 20 | 0.06 | 145 | 75 |
| Denmark | 0.5 | 0.1 | 54 | 3.5 | 2.3 | 11 | 0.09 | 116 | 65 |
| France | 14.2 | 0.08 | 1 742 | 65.9 | 48.0 | 26 | 0.25 | 123 | 73 |
| Germany | 10.7 | 0.47 | 2 674 | 63.1 | 42.7 | 31 | 0.13 | 249 | 68 |
| Greece | 6.0 | 0.01 | 149 | 3.3 | 3.4 | 47 | 0.60 | 25 | 102 |
| Ireland | 0.4 | 0.05 | 30 | 3.5 | 1.6 | 6 | 0.12 | 70 | 45 |
| Italy | 8.6 | n.a. | 743 | 13.6 | 8.0 | 28 | 0.15 | 87 | 59 |
| Luxembourg | 0.1 | 0.00 | 20 | 0.7 | 0.4 | 34 | 0.24 | 230 | 54 |
| Netherlands | 0.3 | 0.01 | 52 | 2.4 | 1.3 | 10 | 0.02 | 156 | 54 |
| Portugal | 3.1 | 0.14 | 167 | 11.3 | 10.9 | 36 | 0.29 | 54 | 96 |
| Spain | 25.6 | 0.01 | 450 | 27.8 | 15.0 | 51 | 0.66 | 18 | 54 |
| United Kingdom | 2.4 | 0.24 | 203 | 11.1 | 8.1 | 10 | 0.04 | 85 | 73 |
| European Union | 72.5 | 1.04 | 6 374 | 210.5 | 144.9 | 31 | 0.21 | 88 | 69 |
| Austria | 3.9 | 0.14 | 953 | 22.0 | 17.3 | 47 | 0.50 | 246 | 79 |
| Switzerland | 1.2 | 0.07 | 360 | 5.8 | 5.3 | 30 | 0.18 | 304 | 91 |
| Central Europe | 5.1 | 0.21 | 1 313 | 27.8 | 22.6 | 41 | 0.35 | 259 | 81 |
| Bulgaria | 3.7 | 0.08 | 405 | 10.6 | 4.8 | 33 | 0.41 | 110 | 45 |
| Czech Republic | 2.6 | 0.02 | 617 | 18.8 | 13.3 | 34 | 0.26 | 234 | 71 |
| Hungary | 1.7 | 0.08 | 229 | 8.2 | 6.1 | 18 | 0.16 | 137 | 74 |
| Poland | 8.7 | 0.05 | 1 380 | 30.5 | 27.3 | 28 | 0.23 | 159 | 90 |
| Romania | 6.3 | 0.00 | 1 202 | 31.6 | 16.0 | 27 | 0.27 | 192 | 50 |
| Slovakia | 2.0 | n.a. | 360 | 9.7 | 5.6 | 41 | 0.38 | 181 | 58 |
| East Europe | 24.9 | 0.23 | 4 193 | 109.5 | 73.1 | 29 | 0.26 | 168 | 67 |
| Albania | 1.4 | 0.00 | 73 | 1.0 | 1.6 | 52 | 0.45 | 50 | 163 |
| Croatia | 2.5 | n.a. | 298 | 8.8 | 6.2 | 44 | 0.51 | 121 | 71 |
| Cyprus | 0.3 | 0.00 | 3 | 0.3 | 0.6 | 31 | 0.4 | 11 | 206 |
| Israel | 0.1 | n.a. | 4 | 0.2 | 0.1 | 6 | 0.03 | 32 | 29 |
| Yugoslavia (excluding Croatia and Slovenia) | 5.9 | 0.35 | 1 056 | 13.6 | 13.4 | 33 | 0.35 | 178 | 98 |
| Slovenia | 1.1 | n.a. | 207 | 5.3 | 2.5 | 53 | 0.54 | 192 | 47 |
| Turkey | 20.2 | 0.03 | 759 | 19.8 | 17.2 | 26 | 0.34 | 38 | 87 |
| South East Europe | 31.5 | 0.38 | 2 400 | 48.9 | 41.5 | 29 | 0.35 | 76 | 85 |
| Estonia | 1.9 | n.a. | 243 | 8.4 | 3.3 | 44 | 1.24 | 127 | 39 |
| Latvia | 2.8 | n.a. | 439 | 8.6 | 6.2 | 44 | 1.03 | 159 | 72 |
| Lithuania | 2.0 | n.a. | 321 | 8.4 | 3.7 | 31 | 0.54 | 164 | 43 |
| Baltic countries | 6.6 | 0.00 | 1 003 | 25.5 | 13.1 | 40 | 0.85 | 151 | 51 |
| TOTAL EUROPE | 201.7 | 1.91 | 20 004 | 600.4 | 420.3 | 36 | 0.35 | 99 | 70 |

Source: FAO/ECE Forest Resource Assessment 1990, supplement on newly constituted countries, estimates for ETTS V

Trends in area, growing stock and harvest

Since the beginning of this century the area of forests in most countries has been expanding steadily. The recorded area of Europe's forests²¹ in 1990 was about 195 million ha, 35 percent of land area and nearly 50 million ha more than in 1950, although the area of 'forests in use' had dropped from 143 to 133 million ha due to an increase in forest reserves and other protected areas. (Note: part of this increase is due to changes in measurement, so the increase is less than 50 million ha.)

Since the 1950s, fellings have consistently been below the growth of the forest (net annual increment), enabling European forests to supply ever greater quantities of wood while simultaneously increasing the growing stock of forest capital. Almost all European countries have systems to ensure that forests are not managed in an unsustainable way, at least from the point of view of wood production. Only two countries (Albania and Greece) reported fellings higher than net annual increment in the 1990 Forest Resource Assessment. There have certainly also been changes in the quality of Europe's forests. International efforts are under way to develop the analytical and measurement tools to record this scientifically.

The many functions of Europe's forests

There are now hardly any primary forests (in the sense that they have never been touched by man) in the region. Most European forests are managed to produce a wide range of goods, notably wood, as well as many locally important non-wood goods, and services such as recreation, protection (of soils, watersheds and transport infrastructure in

mountainous regions), and nature conservation. The role of Europe's forests as an important 'carbon sink' is increasingly recognized²². As growth exceeds fellings, there is a net uptake/storage of carbon in the biomass. Human management over the centuries has shaped the forests of Europe, creating forests of great beauty and rich biodiversity (such as the selection forests of central Europe and English ancient woodlands), as well as efficient wood production forests which are often also valuable for the non-wood goods and services they provide.

Ownership

Slightly less than half of Europe's forest land is in private hands. In part these belong to large traditional family holdings, or the forest industries, but in many countries there are thousands, even millions, of owners with very small holdings. In a number of countries, forestry traditions, public support, and cooperative arrangements and extension services, enable these owners to manage their forests intensively and rationally. Elsewhere, some holdings are neglected, especially where the estate has been broken up by successions and owners have left the country for the cities.

Trends in management objectives

Wood

Between 1913 and 1990, total production of wood rose 42 percent, but that of industrial wood by 160 percent, as wood which would earlier have been

Table A2
Roundwood production in Europe* (million m³)

| | 1913 | 1938 | 1950 | 1970 | 1990 |
|-----------------|------------|------------|------------|------------|------------|
| fuelwood | 139 | 127 | 126 | 69 | 58 |
| industrial wood | 119 | 170 | 161 | 268 | 310 |
| total | 258 | 297 | 287 | 337 | 368 |

* excluding the Baltic countries for reasons of comparability over time.

²¹ Including 'other wooded land', but excluding the Baltic countries for reasons of comparability over time.

²² Estimated by Kauppi *et al.* (Kauppi P., Mielikainen K., and Klusela K. *Biomass and carbon budget of European forests, 1971 to 1990*. Science Vol 256, 3 April 1992) at 85–120 million tonnes of carbon a year in stem wood, other biomass and permanent forest products.

used as fuel was 'diverted' for use as raw material. The rise in demand for small-sized wood has been particularly strong in the forest industries, first for pulp, but later also for wood-based panels. For a while, this rising demand for wood of essentially uniform characteristics, the increasing industrialization and mechanization of all parts of the economy, as well as financial pressures, led forest managers in many areas to attach great importance to the efficiency of production of large volumes of wood, sometimes at the expense of the other functions of the forest. However, this coincided with a profound change in society's expectations of what forests should produce: it is now clear that society attaches equal or greater importance to the non-wood goods and services of the forest.

Non wood

Highly efficient, plantation forestry has created forests in some areas which were poor in biodiversity and sometimes visually unattractive. This may be considered a natural consequence of a situation where forest managers' main source of income was wood sales, and the level of public grants and subsidies often also was not affected by the conservation, landscape or recreation value of the forest, giving no incentive to manage for these goals.

One important consequence of this development was a widening difference in perceptions in many countries between foresters and the general public, increasingly prosperous and urban in its attitudes, and very conscious of 'ecological' issues. Reaction to this situation was faster in some countries than others. Most forest administrations have now taken firm steps to correct this tendency, fully recognizing the importance of both wood and non-wood values in their management objectives. A number of countries took the necessary action decades ago. However, it will take decades to remove the visual evidence of past silvicultural misjudgments and in some countries public confidence in the forestry profession and forestry institutions will need to be rebuilt. Considerable research and experimentation is necessary into the management strategies and methods needed to produce the non-wood goods and services in the most effective and efficient way possible.

Threats to European forests

The two threats to European forests which have attracted most public attention are fire and pollution. All over southern Europe, hundreds of thousands of hectares of forests²³ are destroyed by fire every year. In earlier centuries, these forests were managed as part of a stable rural land use system, which has now been destabilized by the multiple changes of the modern world, notably rural depopulation, increase of tourism, loss of economic value of the forests etc. Fire suppression, though important, is not sufficient. Fires are a symptom of deep seated socio-economic and land use problems.

In some areas, most notably a large area in north-central Europe (Poland, Czech Republic, eastern Germany), pollution has caused considerable forest damage even to the extent of making traditional forestry impossible. This is, however, basically a local or regional phenomenon. The more widespread foliage loss apparent in the European-level surveys carried out annually since the early 1980s has more complex causes, of which pollution seems to be only one. Research is being conducted into the complexities of forest ecosystems, notably the effect of site, climate, pollution and their interactions. Nevertheless, significant progress has already been made in many countries in reducing emissions, notably of SO₂.

Although this attracts less public attention, forests in Europe are susceptible to continuing damage due to storms (over 100 million m³ blown down in 1990), insects (e.g. the regular cycle of infestation of Polish forests by the nun moth, *Lymantria monacha*) and diseases.

Countries in transition

The formerly centrally-planned economies of central and eastern Europe, now in transition to a market economy, face radical adjustments in every part of their economy and society, including the forest and forest products sector. Particular forest-linked issues are forest ownership (resritution/privatization),

²³ An average of 0.6 million ha over the last decade, with large year-to-year variations.



support and control of private forest owners, investment in obsolete and polluting forest industries, adaptation of trade patterns, acquisition of marketing and management skills, etc. At present, consumption and production of forest products are at very low levels, although some countries have been able to continue to export roundwood and sawnwood to western markets.

Forestry and agriculture

The reform of agricultural policies in most European countries is releasing many millions of hectares of agricultural land for other uses, including forestry. A major issue facing governments now is to develop effective policies for this which will encourage the establishment of the type of forests required by society, taking into account all factors.

The future

European countries intend to contribute actively to the international effort towards successful progress in the promotion of sustainable forestry practices throughout the world. The two Ministerial Conferences on the protection of forests in Europe, held in 1991 (Strasbourg) and 1993 (Helsinki), preceded and followed the Earth Summit in Rio de Janeiro. They gave birth to a set of resolutions of growing political significance, for which an explicit system of follow-up and monitoring is now being established. Further progress along these lines will take place at the European level. European countries will also participate actively in the initiatives which accompany the UNCED process in the field of forestry, including efforts towards a Convention on Forests which would build on the forest principles adopted in Rio de Janeiro.

Further information can be obtained from:

The Timber Section
UN ECE/FAO Agriculture & Timber Division
Palais des Nations, CH-1211
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Telephone: (41-22) 917 28 74
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Annex 3: an overview of the forestry situation in Latin America and the Caribbean

Historical perspective

Forests originally covered a large portion of the Latin American and Caribbean Region and were modified relatively little by the native inhabitants. The conquest and colonization period marked a breaking point with the incorporation of agriculture and livestock practices that were imposed by the conquerors and which still persist today. The land, which was previously communal, went to the colonizers, and a large portion was subsequently owned by the states that were established after their emancipation from the colonizing Crowns.

The overall land tenure situation in almost all of Latin America and the Caribbean is reflected in the fact that much of the land still belongs to the states who regulate its use. Population growth and the forest colonization process prevail throughout the region and expansion of the agricultural and livestock frontier continues to the detriment of natural forests.

State-owned land is normally protected through legislation, but it is invariably invaded by landless peasants, settlers and small and large companies,

who exploit or eliminate the forest cover. Various land reform systems and settlement processes conducted by governmental agencies have developed systems for transferring the land to local inhabitants, but often with poor results. The greatest part of invaded land with forest potential continues in the hands of the State, without the stage of granting land titles being completed. As a result, deforestation is considered an 'improvement' and land not covered by forests is considered more valuable than forested land. As the land does not belong to the occupant he has no access to credit or to reforestation programmes, and little interest in conservation.

Forest resources

At the beginning of the present decade, there were approximately 1 800 million ha of tropical forests of which Latin America has more than 900 million ha. Of these, approximately 675 million ha are of dense humid forests, of which more than half are located in the Amazon Basin. In addition there are another 100 million ha of secondary forest.

Table A3

Estimations of the land area, forest cover and deforestation rates in tropical Latin America and the Caribbean

| subregion | number of countries | land area | forest cover | | annual deforestation | |
|----------------------------|---------------------|----------------|--------------|--------------|----------------------|----------------|
| | | | 1980 | 1990 | 1981-1990 | |
| | | | million ha | million ha | million ha | annual percent |
| Central America and Mexico | 7 | 239.6 | 79.2 | 68.1 | 1.1 | 1.5 |
| Caribbean | 19 | 69 | 48.3 | 47.1 | 0.1 | 0.3 |
| Tropical South America | 7 | 1 341.6 | 864.6 | 802.9 | 6.2 | 0.7 |
| total/average | 33 | 1 650.2 | 992.1 | 918.1 | 7.4 | 0.7 |

The annual deforestation in Latin America between 1981 and 1990 was 7.4 million ha/year; a rate of 0.7 percent per year for the decade of the 1980s, the highest of any region in the world (see Table A3).

In almost all the countries of the continent, forest resources have continued to be affected by overgrazing, wood extraction, forest fires, mining exploitations and the building of infrastructure such as roads and hydroelectric dams. This has led to wind and water erosion and serious problems of flooding and sedimentation in rivers, among other effects.

Forest management

Many native mixed forests of the region have been degraded due to the exploitation of only a few commercial species, and also to selective extraction, leaving the worst specimens in the forest in a poor sanitary condition and with low commercial value. In addition, damage has been caused by forest fires, insects and fungi.

Although real progress in the management of natural forests in the region is limited, some countries are now modifying legislation and assigning resources to conserve the forests. Increasingly, there is a realization that the survival of natural forests will depend on their use and maintaining the principles of economic and social development on an ecologically sustainable bases. However, the solution to this equation is extremely complex and, in view of the multiple factors involved, has yet to be solved in most of the region.

Despite the problems, there has been progress in forest management. Plans and programmes have been initiated in many countries in the region, and a growing number of projects are in execution. In addition, governments are assigning greater economic resources which are being supplemented by funds from outside the region.

Legislation prohibiting the exploitation of specific resources is being enforced, and moratoriums are being established regarding concessions until more information is available on the use and management of the resource. Recently, some countries have modified their legislation, eliminating incentives to destroy the forests. Regulations have been promulgated suspending permits and grants, and prohibitions have been established that limit hunting

to subsistence of local indigenous communities.

Several countries have continued with watershed management programmes and projects, and multilateral international organizations are increasingly financing projects of this nature. Nearly all of the countries of the region have created systems of protected areas to assist in the conservation of the remaining forest.

There has also been a considerable improvement in the recognition by legislators and policy-makers of the need for nature conservation. The general public also believe that the environment is a factor that warrants consideration, and thanks to modern communications, they rapidly become aware of what is occurring in other places. These factors have a bearing on the existence of a more favourable attitude on the part of individuals, enterprises and industries towards conservation measures.

Forest plantations

Save for a few exceptions, there is an imbalance between deforestation and forestation or reforestation. However, more and more countries in the region are adopting coherent policies for forest plantations, and important progress has been achieved by some countries as a result of adequate incentive policies. Also, the existence of plantations in some areas has considerably reduced the pressure on the natural forest, particularly for production of wood, delaying its exploitation although not eliminating it.

There is a strong correlation between sustained incentive policies for reforestation (with great reductions in plantation, administration and management costs) and the high plantation rates. The amounts invested by the State in these subsidies are more than recovered by the increased industrial activity and by taxes paid on these products and their consumption.

Forest products

Wood production and timber supply is a major economic activity in the region, although not always reflected in the Gross Domestic Product (GDP) due to difficulties in obtaining reliable production and consumption statistics. In addition, the real participation of the forestry sector in national

economies tends to be undervalued, and exploitation of forests outside the legal framework often prevents the availability of real production figures.

The commercial use of mixed natural forests is characterized by the limited number of species employed both for internal consumption and for export. A representative case is that of Brazil: in spite of having the greatest tropical wood potential of the world, its participation in the world market is only somewhat higher than one percent of international trade.

Forest products are of particular importance for rural communities, indigenous populations and peri-urban or urban inhabitants of low economic resources. Fuelwood and charcoal are their principal sources of energy, mainly for cooking and, in colder areas, for heating. Fuelwood is not only important in direct domestic consumption but also in industrial use. Also very important is the production of poles, beams and other round timber for the construction of houses, particularly at the rural level.

There is an imbalance between demand and supply of timber and basic construction products in most of the Latin American and Caribbean region. There is also an increasing expansion in the radius and time of supply to inhabitants of towns, villages or the rural population. Supply and demand is very irregular with greater availability where population densities are lower and particularly critical in the arid and semi-arid zones of the region.

Deficits are being overcome by establishing plantations for energy purposes in zones of greatest demand, and through the use of simple technologies that improve the quality and economy of combustion. However, these efforts are rather isolated and insufficient to cover the growing needs of the population.

Non-wood forest products are significant in the region, but their contribution to the satisfaction of the basic needs of the population—particularly important in the more isolated rural sectors—is often underestimated. The exportation of non-wood forest products is becoming an important source of national income, and is of particular significance for rural communities in providing job opportunities and possibilities of increasing family incomes.

With limited economic resources applied to the promotion of non-wood forest product activities, it is

possible to attract resources directly towards the less favoured communities, thus contributing indirectly to forest conservation, sources of energy and raw material for the elaboration of various handicrafts and products of daily use.

There remains in the region a need to clearly identify 'non-wood forest products', to classify them according to the raw material and the use to which they are destined, to promote dissemination campaigns, to highlight their importance and usefulness for trade, and to exchange information and research material regarding these products among the countries of the region.

Forest industries

Forest industries that use round logs from natural forests as raw material, are facing problems of supply. This, coupled with the small number of species used, protective forest legislation and inappropriate forest management, is creating critical situations with regard to the availability of timber in many areas of the region.

From the technological viewpoint, the industrial equipment available is mostly obsolete (usually between 30 and 50 years old), of low productivity and frequently resulting in products of low quality. This equipment is generally dimensioned to saw logs of large diameter, which are increasingly rare. The most efficient production is achieved in installations equipped with modern technologies, whose supply of raw material comes from plantations and managed natural forests.

Sustainable management methods are being identified to serve as a basis for industrial development, with consequent economic and social development. The ecological management of forests will affect the availability of raw material for the primary processing industry, and places value on the environment, landscape, soil and water conservation, and improvement of air quality, etc.

Forestry institutions

In most Latin American and Caribbean countries, government forestry institutions are undergoing transformation as a result of macroeconomic reforms

introduced by structural adjustment programmes, and the increased social demands on the forestry sector. In addition, changes in national development policies and the greater importance accorded to private initiatives, have contributed to a modification of the role of forestry administrations. Many countries are also decentralizing the management of their forest estate, by strengthening regional agencies and involving the local communities so that they will have a more active role in the sector's local decisions and actions. Several countries have, or are in the process of, establishing national commissions on environment, attached to the Presidency of the Republic, to Ministries of Foreign Affairs or other high level offices also concerned with forestry matters.

Notable changes have been made, or are being made to forestry legislation in many countries of the region. Numerous decrees, laws and regulations are being modernized with the aim of improving protection, management and use of forest resources.

In recent years, important changes have occurred in the planning of forestry development, and in the adoption of policies for the forest sector. Much of these changes result from the UNCED meeting in Rio de Janeiro, Agenda 21, the Convention on Biological Diversity and the Declaration of Forestry Principles, as well as from the impact of the Tropical Forests Action Programme (TFAP) through the National Forestry Action Plans.

Information gathering, analysis, synthesis and formulation of general and specific plans has been carried out in almost all the countries, many within the context of the Tropical Forests Action Programme—thirty-two countries in the region have participated in the TFAP.

The initiative has fostered the formulation of numerous specific projects as well as contributed to redefining and establishing precise and clear strategies for the development of the forestry sector. TFAP as a planning exercise has helped the developing countries to perceive and programme their goals, and permitted an in-depth analysis of the objectives and priorities of the forestry sector by harmonizing criteria and points of view of all related national and local institutions and groups.

Summary

The forest resources of the region are under great pressure, reflecting the social and economic situation. Serious deficiencies persist in their conservation and management. Nevertheless, positive changes are expected as a result of modifications in policies, legislation and actions occurring in recent years. The greater awareness of the population and governments of forestry problems has brought about a general increase in concern for forest management. This in turn has resulted in the allocation of increasing resources for the forestry sector and the establishment of more protected areas.

Although all the countries in the region have declared extensive zones as protected areas, tangible progress in the management of these areas is scarce. Perhaps the greatest progress is occurring at the level of awareness of politicians and governors. There is now greater interest to legislate on the matter, and an increasingly marked awareness in the region in favour of the conservation of the forests.

CORRIGENDUM

Page 29; 4th paragraph; 3rd line:

delete 13.1; insert 12.1



Food and Agriculture Organization
of the United Nations