CHAPTER 6

Forestry

6.1 Introduction

Globally, forestry, like other sectors, will continue to face numerous challenges and changes resulting in an increasingly intense scrutiny of the contribution of forests to sustainable development. The general trend during the past 20 years has been an intensification of demand pressures on a diminishing forest resource base. The demand for forest products and services has increased in response to increase in population and income.

Historically, production of wood and wood products has been the main objective of forest management and other functions were not explicitly accounted for. However, there has increasingly been a shift away from this towards assigning a higher priority to the environmental and social functions of forests. Conflicting demands and differing views of the relative importance of various goods and services provided by forests and alternative land uses will increasingly have to be reconciled. The complexity of predicting future developments in forestry is increased by demands for a more equitable distribution of the benefits from forests, for safeguarding the rights of forest dwellers and indigenous people, and for ensuring widespread participation in decision-making.

The predecessor to this study, *World agriculture: towards 2010*, (Alexandratos, 1995), provided a general indication of the principal changes occurring in the forestry sector. Many of the changes outlined in the previous study still persist, but a number of new issues are also emerging, reinforcing or shifting the direction of development of forestry at all levels. A brief comparison between the conclusions and projections of the two studies is useful, both to demonstrate changes in fundamental structures in the forestry sector since the previous study, and also to highlight conceptual changes in outlook studies. Since the 1995 study, FAO has markedly strengthened its capacity in forestry sector outlook work through a variety of studies including a *Global Forest Products Outlook Study*, a *Global Fibre Supply Model* and a range of regional outlook studies, commencing with an *Asia-Pacific Forestry Sector Outlook Study* and a *Forestry Outlook Study for Africa* (in progress). At the same time, baseline forestry data have been updated and improved through the *Global Forest Resources Assessment 2000* (FAO, 2001c).

Probably the greatest conceptual shift has been the development, throughout the 1990s, of a clear consensus that there is no impending "global forest crisis". In part, this recognizes that previous

projections of consumption of wood products have not adequately taken into account all relevant factors. Thus, for example, the 1995 study noted "a nearly tripling of consumption (of forest products) in developing countries over the next two decades … In the developed countries, the growth in consumption of forest products is projected to be lower than the growth of their economies, with consumption somewhat less than doubling over the next 20 years". These projections implied an industrial roundwood consumption of around 2.7 billion m^3 by 2010. More recent projections suggest global consumption of roundwood will be markedly lower, reaching only 2.4 billion m^3 by 2030. Similarly, estimates of fuelwood consumption are projected to be lower than the 1995 forecast, while the supply situation looks more promising. There is evidence of real improvements in forest management and harvesting and processing technologies, increases in plantation establishment and a better appreciation of the role of trees outside forests in wood supplies. At the same time, the pressure for agricultural expansion – often achieved at the expense of forest land – is expected to be less during the next three decades, suggesting that a more sustainable future may be at hand for the forestry sector.

This chapter revisits some of the issues dealt with in the 1995 study, discusses new factors that may affect the development of the sector, and outlines a broad scenario to illustrate likely developments during the next three decades. The following sections consider, in turn: the forces shaping developments in the forestry sector; the principal changes expected over the period to 2015 and 2030; and major perspectives and issues relating to forestry, including possible policy responses. A concluding section summarizes likely scenarios for developments in the forestry sector to 2015 and 2030.

6.2 The presente state of forests

Forest area. One of FAO's major forestry programmes is the periodic Forest Resources Assessment (FRA), which produces a statistical snapshot of the global status of forest resources once in a decade. The most recent of these, the *Global Forest Resources Assessment 2000* (FRA 2000; see FAO, 2001c) estimates the global forest area in 2000 at about 3 870 million ha or about 30 percent of the land area. Tropical and subtropical forests comprise 48 percent of the world's forests, while temperate and boreal forests account for the remaining 52 percent. Natural forests are estimated to constitute about 95 percent of global forests, while plantation forests constitute around 5 percent. Developing countries account for 2123 million ha (55 percent) of the world's forests, 1850 million ha of which in tropical developing countries. FRA 2000 revealed a net annual decline of the forest area worldwide of about 9.4 million ha between 1990 and 2000. Annual forest clearance was estimated at 14.6 million ha, and annual forest area increase at 5.2 million ha. Nearly all forest loss is occurring in the tropics.

Table 6.1 Global forestry at a glance, 2000

	Total forest				Annual cover change	
	Area	Share of land area	Area per capita	Plantation Area	1990-2000	
	'000 ha	%	ha	'000 ha	'000 ha	%
Africa	649 866	21.8	0.85	8 036	- 5 262	- 0.78
Asia	547 793	17.8	0.15	115 847	- 364	- 0.07
Oceania	197 623	23.3	6.58	2 848	- 365	- 0.18
North and Central America	549 304	25.7	1.15	17 533	- 570	- 0.10
South America	885 618	50.5	2.60	10 455	- 3 711	- 0.41
Europe	1 039 251	46.0	1.43	32 015	881	0.08
World	3 869 455	29.6	0.65	186 733	- 9 391	- 0.22

Source: FAO (2001c).

Supply of wood and wood products. Supplies of wood are not drawn on all global forests but from a significantly smaller area. FAO's Global Fibre Supply Model (see Bull, Mabee and Scharpenberg, 1998) estimates that only around 48 percent of global forests are available for wood supply. The remainder is either legally protected or physically inaccessible, or otherwise uneconomic for wood supply.

The greater part of global wood production is burned as fuel; fuelwood at present accounts for over 1.7 billion m^3 or around 55 percent of the annual global wood harvest. The vast majority of wood burning occurs in developing countries where wood is often the most important source of energy. Annual global production of industrial roundwood currently amounts to slightly over 1.5 billion m^3, around 45 percent of the global wood harvest. Two-thirds of industrial wood products are consumed in developed countries, which account for less than one-fifth of the global population. Interestingly, annual per capita wood consumption in tropical and temperate and boreal regions is approximately equal (just over 0.5 m^3). In temperate and boreal countries, however, more than 75 percent of wood consumption is in the form of industrial wood products while, conversely, in tropical countries more than 85 percent of wood consumption is in the form of fuelwood.

Forest-dependent people. It is estimated that around 450 million people, or about 8 percent of the global population, live in forest ecosystems. Around 350 million of the world's poorest people are entirely dependent on forest ecosystems for their livelihoods. These people are often marginalized in terms of opportunities for development and, as such, are dependent on forests for their livelihood. Reducing forest pressures created by expansion of agriculture, grazing and fuelwood gathering depends on more general economic and social development to provide alternative income-earning opportunities. While development can reduce the pressures emanating from rural poverty, it also generates increased demands for a number of forest products. Direct and indirect impact of this on forests will largely depend on technological changes in production and the pattern of distribution of and access to forest products.

Conservation of biodiversity and other values. The global area of forests in formally protected areas is estimated to be 479 million ha, or 12.4 percent of total forest area (FAO, 2001c). On the surface, this shows considerable progress towards the recommendation of the International Union for the Conservation of Nature and Natural Resources (IUCN) of having at least 10 percent of forest area in protected areas. Significant challenges still remain, however, in ensuring balanced representation of all forest types, and in ensuring effective protection of forests. At present, many countries still fall well short of having 10 percent of their forests protected, while in many other countries the representation of protected forest types is badly skewed. Furthermore, in many developing countries, protection is afforded to protected forests on paper only, while in reality they remain subject to substantial encroachment including logging, deliberate burning and other forms of clearing or degradation.

6.3 Forces shaping forestry and areas of change

Statements about what is likely to happen in the future necessarily include elements of speculation, increasingly so the longer the projection period. As explained in Chapter 1 (see also Appendix 2 on the approach followed in this study), the objective is to sketch out the "most likely developments" to 2015 and 2030 in the forestry sector, taking into account foreseeable changes. Projections are not trend extrapolations – they incorporate an evaluation of factors, already under way or expected to become important in the future, which would cause deviations from past trends.

In many countries forestry is a low-priority sector and what happens to forests and forestry is to a great extent decided by changes outside the sector. The multifunctionality of forests, arising from the diverse values assigned to them, adds to the complexity of management. The development and future of individual forests, and of forests as a whole, will largely depend on the relative importance assigned to each of these values and on the strength of political advocacy for each value. The key questions in developing an outlook for forestry over the next three decades are the factors that will have an impact on each of

these demands and how policy environments will evolve to alleviate and reconcile demand pressures.

Increasing demands for forest products arise from growing populations, increasing prosperity as a result of economic development and changes in consumer preferences. In this latter category, the most significant changes in preferences include the explicit recognition of the value of the environmental and social dimensions of forestry. Trends in each of these central, shaping pressures are examined below.

Demographic changes. Population growth, together with agricultural expansion and agricultural development programmes, is a major cause of forest cover changes (FAO, 2001c). Population growth results in an increase in demand for food, which is met through intensification and arable land expansion. As discussed in Chapter 4, a net increase of 120 million ha is projected in developing countries to expand crop production over the period to 2030. Part of this is expected to come from forest clearance. Population growth will also increase demand for wood and wood products, including fuelwood. Changes in population distribution, especially urbanization, will change the demand for fuelwood, especially charcoal, when incomes are insufficient to procure alternative sources of energy. Depletion of wood resources from areas supplying urban centres has been a major problem in several countries and this is expected to persist during the next three decades, unless alternative sources of energy are more widely used.

The overall impact of demographic changes on forests will vary between countries. In most developed countries where population has stabilized, deforestation has been arrested. Indeed the extent of forest cover is on the increase, primarily because of reversion of agriculture areas to forests. The number of countries where this process could happen is expected to increase.

Economic changes. Rising incomes and changes in income distribution are major factors affecting forestry. With rising incomes, demand for forest products increases, especially for processed items (e.g. panel products, furniture, printing and writing paper, and so on). In countries where control of access to forests is weak, increased demand for forest products is likely to exacerbate problems of poor forest management and excessive (including illegal) logging. In some countries, however, increasing prosperity may actually reduce some of the poverty-driven pressures on forests by providing alternative sources of livelihood. Growth of the industrial and services sectors reduces direct dependence on land.

Forests have often served as an engine for economic growth. In the early stages of economic development many countries have harvested forests as a means of capital accumulation. Most developed countries have gone through a phase of forest depletion during the early years of industrial development and many developing countries are currently moving through this phase. The challenge for developing countries that rely on forestry as a significant earner of foreign exchange is to maintain a healthy rate of development without excessively depleting forests.

The scenario that may emerge by 2015 and 2030 could be as follows:

- More countries in Asia and South America would have made significant progress in terms of economic growth, leading to significantly reduced dependence on land.
- Some countries that have depended on forests to generate investment funds would have diversified sufficiently, reducing their dependence on forests and increasing their willingness to adopt more sustainable management practices. However, there will still be several countries in Asia, Africa and South America where economic development and growth of the non-farm sectors would be inadequate to facilitate such a major shift from land-based activities. Deforestation and its attendant problems are likely to persist in these countries.
- In several countries economic progress would enable substantial increases in investment in large infrastructure projects, often resulting in deforestation. This is particularly the case in a number of countries in Asia and South America. Forest clearance for infrastructure development (such as large irrigation and hydroelectric projects) and expansion of area under industrial crops could counterbalance the reduction in forest clearance for arable cropping.
- Even in Asian and Latin American countries that make significant economic progress, if large areas of deprivation persist, people will continue to

depend on land and other natural resources, exerting direct and indirect pressure on forests.
- While consumption of forest products is expected to stabilize in the developed economies, an increase in consumption of all wood products is expected in most developing countries.
- The demand for forest services such as recreation and ecotourism is expected to increase.

Political, social and institutional changes. The last two decades have witnessed major changes in the openness, transparency and decentralization of governance. Local communities and groups have achieved an increasing say in the management of natural resources.

More pluralistic institutional arrangements for resource management are expected to emerge and strengthen. Several countries have revised their forest policies and changed legislation, enabling the participation of the private sector in forest management, including community groups and farmers. Participatory approaches such as joint forest management and management by forest-user groups are becoming more acceptable, although the area managed under such arrangements is still very small. These efforts are expected to gain momentum during the next three decades.

Forestry departments in many developing countries could change their structure and functions. Their primary responsibility will shift from direct management of forests to policy development and other regulatory functions. Actual resource management will largely be the responsibility of the private sector, including farmers and local communities. The proliferation of information (and the potential for misinterpretation) requires proper interpretation and improved public access to information. This will be another important emerging function of the public sector forestry agencies.

Forests, environment and global initiatives. The growing concern about the environment encompasses a wide range of forest functions, including protection of watersheds, conservation of biodiversity and the perceived role of forests as carbon sinks. As water becomes a more critical resource, the role of forests in flood control, in rainfall interception and in controlling erosion will assume even greater importance, requiring better knowledge and quantification.

These concerns have become a key driving force in forestry initiatives following the 1992 UN Conference on Environment and Development (UNCED). UNCED Agenda 21, in particular Chapter 11, has formed the basis for several initiatives. Three international, legally binding conventions, the Convention on Biodiversity (CBD), the UN Framework Convention on Climate Change (UNFCCC), and the Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa (CCD), are of direct relevance to forestry. They have highlighted the importance of forests in providing a range of goods and environmental and social services, and have helped to widen the focus of international attention from forests proper to trees in fragile ecosystems such as drylands and mountains.

National and international non-governmental organizations (NGOs) and advocacy groups have brought forestry and environmental issues to the forefront of public debate. NGOs and civil society will continue to have a pioneering role in influencing forestry policies and programmes. Since UNCED, countries have attempted to make forestry policy more consistent with the concepts of sustainability and environmental soundness. The Ad hoc Intergovernmental Panel on Forests (IPF), the Intergovernmental Forum on Forests (IFF) and the United Nations Forum on Forests (UNFF) have helped to articulate the policy, institutional, social, environmental and technological issues relating to forest management, although commitment to a legally binding mechanism for conserving and managing forests still remains elusive.

These developments have not only generated pressures against the conversion of forests to alternative land uses but they have also resulted in a closer scrutiny of forestry practices, including logging of natural forests and plantation management. These concerns are expected to dominate the debates at local, national and global level and would have the following implications:
- increasing concern for protecting the environment, leading to a better recognition of the global, national and local significance of forests; improved mechanisms to determine the trade-

Table 6.2 Trade in forest products as a proportion of production, 2000

Region	Industrial roundwood			Sawnwood			Wood-based panels			Pulp			Paper and paperboard		
	P mln	E m^3	S %	P mln	E m^3	S %	P mln	E m^3	S %	P mln	E mt	S %	P mln	E mt	S %
Africa	69	6	9	8	2	25	2	1	50	3	1	33	3	1	33
Asia	229	11	5	54	7	13	47	15	32	22	2	9	95	12	13
Oceania	47	9	19	8	2	25	4	1	25	3	1	33	4	1	25
North and Central America	624	15	2	194	57	29	60	14	23	86	18	21	112	25	22
South America	153	2	1	30	5	17	11	3	27	11	5	45	10	1	10
Europe	464	71	15	128	56	44	65	23	35	47	11	23	100	58	58
World	1587	114	7	421	128	30	189	56	30	171	38	22	323	98	30

Note: P=production; E=exports; S=exports as share of production (in percentage).
Source: FAOSTAT.

offs between competing objectives; and appropriate arrangements to share costs and benefits;
- recognition of the rights of indigenous and forest-dependent people and an increasing concern to protect their livelihood;
- integration of tree cultivation with other land uses, to reduce environmental problems and to enhance income opportunities; and
- global and regional initiatives to enhance the role of forests in mitigating climate change, especially their potential as carbon sinks.

International trade. A significant proportion of global production enters international trade, reflecting the difference between the geographic distribution of industrial roundwood production and processing capacity, and of demand for forest products. Table 6.2 shows that the export share of more processed products is significantly higher than that of less-processed products, reflecting most countries' efforts to capture foreign exchange earnings through higher value-added forest processing. For example, the export share of sawnwood and wood-based panels is much higher than that of its raw material, namely industrial roundwood, and likewise for paper and wood pulp.

The largest forest product trade flows are intraregional. Europe, North America and Asia combined account for 90 percent of the value of forest product exports and around 95 percent of imports. Europe accounts for almost a half of the global trade in forest products, and 80 percent of European trade is between European countries. Similarly, trade between the United States and Canada accounts for around 70 percent of North and Central American trade, while Japan is a partner in around 35 percent of trade in the Asia-Pacific region.

As further trade liberalization takes place and barriers to trade diminish, there could be significant changes in the composition, volume and direction of trade during the next three decades. Countries will continue to develop domestic wood-processing facilities, and thus the share in trade of processed and semi-processed products will increase relative to that of unprocessed products. Economic growth in Asia is creating new opportunities for trade of processed and unprocessed wood and this could accelerate the shift in the direction of trade already evident. Increased demand from Asia coupled with restrictions or outright bans on logging of natural forests in some of the Asian countries have to some extent contributed to unsustainable (often illegal) logging in Africa and Latin America.

Developments in science and technology. Developments in science and technology and their wider diffusion could lead to the emergence of more knowledge-based operations and management. The ability to take advantage of natural processes will increase considerably, leading to

more benign approaches to resource management. Access to knowledge and information will improve, and even societies that have historically been isolated will have access to information. Of particular interest to forestry are the following probable developments:

- Better understanding of ecological processes will improve the ability to fine-tune human interventions, minimizing the adverse effects of several forestry practices.
- Application of improved remote sensing technologies will allow the state of resource changes to be assessed on a real-time basis and to be available to wider groups of people.
- Improved knowledge of the chemical and genetic make-up of a large number of species will widen the scope for their use, leading to the emergence of new processes and products.
- Significant improvements in processing technologies will reduce raw material requirements (for example, see Abramovitz and Mattoon, 1999) and environmental pollution.
- Increased use of tree breeding and application of vegetative propagation technologies will ensure availability of high-quality planting materials, especially for establishment of large-scale plantations.
- Energy sources will probably shift, with wind and solar power becoming more important and widely accessible. This may have a significant impact on forestry, especially on the use of fuelwood.

Tree breeding is increasingly drawing on a range of biotechnological tools. These fall broadly into three categories: (i) biotechnologies based on molecular markers that help quantify genetic diversity and identify promising genotypes and genes for subsequent use in breeding programmes; (ii) technologies that enhance vegetative propagation; and (iii) genetic modification. While the first two techniques are relatively commonly used to support existing tree-breeding programmes, genetic modification is still at an experimental stage. To be of practical value, genetic modification must offer unique features that cannot be economically delivered through selection or more conventional breeding and that are capable of offsetting the costs and time involved. All new technologies must be tested and proved to be environmentally safe before they can be used on a large scale. Important traits in forest trees, such as growth rate, adaptability to harsh environmental conditions and stem and wood quality, are governed by an array of genes and may not lend themselves readily to genetic modification. Should genetic modification be pursued on a large scale in forestry, the characteristics most likely to be targeted are simple inherited traits, such as modified lignin content, insect and virus resistance and herbicide tolerance. There are, to date, no reported large-scale or commercial plantations of genetically modified trees.

Although changes up to 2015 may be slow, by 2030 developments in science and technology are expected to have more far-reaching impacts. But the pace of adoption of technological change will vary enormously between and within countries. This will depend on investment in human resources, on providing favourable institutional arrangements, etc. In the short term, disparities in access to and ability to use knowledge may widen. Large areas of underdevelopment may persist in a number of countries, limiting the participation of a sizeable section of people in knowledge and technology-based activities.

Globalization and its impacts. Economic liberalization and increasing interdependence will provide new opportunities, but will also mean that perturbations in one sector or country could easily affect other sectors and countries. Environmental interdependence such as in global climate change or the transboundary effects of deforestation and other related changes, could affect economic interdependence. The implications of economic and environmental integration on forestry could be far-reaching. Of particular importance could be the following factors:

- The movement of technologies, processes and products across countries will increasingly be based on comparative (competitive) advantages. Traditional forest-based enterprises that fail to take advantage of the emerging opportunities will fade out and be replaced by more efficient producers.
- Regional and international trade agreements will continue to alter the pattern of trade in forest products. While tariff barriers may become less important, several non-tariff barriers, such as those relating to certification

and ecolabelling, could become critical in determining access to certain markets (Bourke and Leitch, 1998).

- Global, national and local pressure groups will play an increasing role in shaping forest management, each group trying to push their agenda based on the group's interests and objectives.

However, economic integration is not necessarily a benign process conferring benefits to all at the same time. Disparities in access to knowledge, resources and markets could widen the economic gap between countries, and could also accentuate resource-use conflicts within countries.

6.4 Probable changes up to 2015 and 2030

In view of these driving forces, what will be the changes in forestry during the next three decades? Because of the complexity of factors and their interaction, it is difficult to provide a clear indication. However, we can indicate the broad direction of probable changes.

Forest and tree resources. The key issue for forest and tree resources is progress towards wider adoption of sustainable forest management (SFM). There is some evidence of progress, although scattered and disparate. In some areas, excellent forest management complies with criteria agreed upon for SFM. Elsewhere, mainly in the tropics, substantial tracts of forests remain unmanaged and are frequently severely degraded by careless logging, burning or other destructive practices. Initiatives to remedy the situation include the development and implementation of criteria and indicators for SFM, and subsequent adjustments to forest management practices; establishment of certification processes; implementation of pilot projects and operations aimed at reduced impact logging; and extension of improved silvicultural systems.

All these initiatives are helping efforts to manage forests to meet a range of long-term objectives and demands. In most developed countries, forest stocks have been increasing for a number of years, both because management of existing forests has been intensified (including the establishment of forest plantations) and because significant land areas of marginal farmland have been allowed to regenerate as secondary natural forest. The challenge for these countries is to continue to improve forest management to encompass the new dimensions of sustainability. Conversely, in a number of developing countries, even to arrest deforestation and forest degradation would mean considerable progress.

Shift in the source of wood supplies. During the next three decades, the shift away from dependence on natural forests for wood production is expected to strengthen. Increasingly wood is being obtained from intensively managed plantations, thus reducing the pressure on natural forests and woodlands and enabling the latter to fulfil other functions. Between 1980 and 1990 the area under forest plantations increased from about 18 million ha to nearly 44 million ha. By 2000 it had increased further to a total of 187 million ha. Although plantations account for only 5 percent of forest cover, they have become a significant source of roundwood supply.

There is also an increase in tree cultivation on farms and other land outside forests. In several countries (e.g. in Bangladesh, India, Kenya and South Africa) trees from farms are an important source of industrial roundwood and fuelwood. Often such efforts are supported by industries through provision of technical assistance and assured prices. Stable or increasing prices and secure tenure are needed to encourage such efforts. As farmers adopt more integrated land uses with trees as an important component, an increasing proportion of local wood supplies is expected to come from trees outside forests.

Consumption of industrial roundwood. Consumption of industrial roundwood during the next 30 years is expected to move modestly upwards. The most recent projections of FAO's Global Forest Products Model estimate that global consumption of industrial roundwood in 2030 will be around 2 400 million m^3, an increase of around 60 percent on current consumption. Much of this increase will result from an increase in population and income in developing countries, leading to an increase in per capita consumption of wood (and particularly paper) products. Offsetting these trends will be changes in consumer preferences, changes in tech-

niques of forest management, more efficient utilization of wood and residues, and the development of new products.

Current indications are that the real prices of most forest products are unlikely to increase significantly in the long term. There may be short-term fluctuations, but these will be evened out through changes in supplies and shifts in sources of supplies, including substitution by non-wood products. Similarly, the spread of SFM may reduce supply and increase costs in the short term, but it is unlikely to affect supplies in the long term. In fact, by making supplies sustainable, it is expected to stabilize long-term supplies and thus help maintain price stability.

A marked change will take place in the share of roundwood grown on plantations. Industrial roundwood production from plantations is expected to at least double during the next 30 years, from the current 400 to around 800 million m^3. By 2030 plantations will supply about a third of all industrial roundwood.

Much of the growth in demand for wood during this period will, consequently, be met from increased plantation supplies, and this will necessitate some technological changes to match wood qualities with consumer demands. In parallel, significant changes in the type of timber produced in natural forests are likely to induce shifts in the relative prices of forest products, leading to shifts in demand. For example, there is an increasing scarcity of large tropical logs, which will necessarily constrain the production of hardwood plywoods and large-dimension sawn timber. Consequently, demand for softwood, plywood or other reconstituted panels may increase. Similarly, solid wood products made from tropical timbers are likely to become premium products leading to a shift in demand towards cheaper wood-veneered products.

Changes in forest-based industries. Changes in prices and demand, together with the development of new technologies and changes in resource availability, are affecting the types and volumes of forest products. The most striking change in the manufacturing of forest products during the past 30 years has been the growth in production of wood-based panels and paper products as compared with sawn timber. Since 1970, global production of sawn timber has remained largely static, while production and consumption of wood-based panels have more than doubled and production of paper and paperboard has almost tripled.

As Table 6.3 shows, output levels of processed wood products (wood-based panels and paper products) have been increasing, even though levels of industrial roundwood production have remained static or declined. This has been made possible by improvements in processing efficiencies. This trend encompasses the effects of utilizing recycled paper and wood but, more important, the development of products that minimize waste by making fuller use of processing residues. A generation ago, solid wood furniture was the norm, but today much utilitarian furniture is made from fibreboard with a veneer covering or from cheap and abundant softwoods such as plantation-grown pines. Similarly, there has been considerable expansion in the types and range of paper products. The development of a broader range of reconstituted paper and panel

Table 6.3 Average annual production of selected forest products

Five-year period	Industrial roundwood	Sawnwood	Wood-based panels	Wood pulp	Paper and paperboard	Recovered paper
	mln m^3	mln m^3	mln m^3	mln mt	mln mt	mln mt
1971-75	1 318	428	87	102	131	35
1976-80	1 415	452	102	125	170	51
1981-85	1 457	445	104	136	193	61
1986-90	1 660	503	124	155	240	83
1991-95	1 501	437	130	162	282	104
1996-00	1 523	419	165	171	323	134

Source: FAOSTAT.

and board products has also allowed much greater use of processing residues, enhancing the overall efficiency of wood use.

One of the key changes that can be expected over the period to 2015 is the rationalization of industry capacities. At present there is a significant global overcapacity in pulp and paper facilities, panel plants and sawmills, as evidenced by relatively low returns to forestry sector investments. Much of this overcapacity is the result of distortions in investment decisions created by government incentives (including low stumpage prices, direct investment incentives and tariff protection). Obsolete processing technology and inappropriate location of processing have increased the uncompetitiveness of forest-processing industries in many countries.

A number of factors are forcing greater competition in forest product markets. Trade liberalization is an obvious one. The pressures created by wood scarcity, widespread adoption of market-based economies and greater environmental scrutiny are other factors altering the structure and location of forest-based industries. The period to 2015 and 2030 will certainly witness a much greater reliance on competitive advantages in determining patterns of forestry industry investment.

Wood as a source of energy. As noted above, an estimated 55 percent of global wood production is used as fuelwood. Tropical countries account for more than 80 percent of global fuelwood consumption. There is, however, considerable regional and national variation. Asia and Africa together consume more than 75 percent of global fuelwood. The Regional Wood Energy Development Programme (RWEDP) in Asia estimates that wood supplies 18 percent of all energy used in its member countries. In Africa wood is still the most important source of household energy, used mainly for cooking, although cottage industries (such as food drying and brick-making) also consume significant volumes in some countries.

Fuelwood consumption is mainly determined by income levels, availability of wood supplies and availability of alternatives. As consumers become wealthier they prefer other forms of conventional energy, particularly electricity and liquid fuels. Therefore, while overall consumption of fuelwood is increasing, per capita consumption is declining. In most countries there is a surplus of fuelwood, although there is often localized scarcity, especially in areas adjacent to urban centres, which are sometimes subject to rapid deforestation for charcoal production. In some cases, increasing electricity and gas prices (for example because of the privatization of utilities) have resulted in a switch back to fuelwood.

Dramatic changes in fuelwood consumption are unlikely over the next 15 years. Access to alternative fuels will become easier, but the majority of current wood-using communities are likely to be still burning wood in 2015. The shift towards alternative fuels may accelerate beyond 2015, depending on developments of infrastructure and on improvements in the efficiency and cost-effectiveness of generating energy.

Role of forests in mitigating climate change. Increasing concern over CO_2 emissions and their potential impacts on global climate has focused attention on the role of forests in regulating atmospheric concentrations of carbon. Forests serve as carbon reservoirs by storing large amounts of carbon in trees, understorey vegetation, litter and soil. Newly planted forests, or degraded forest areas that are allowed to regenerate, act as carbon sinks by absorbing and storing carbon as their biomass increases. Conversely, when forests are cleared or degraded, their sink potential is reduced and they can become a substantial source of CO_2 emissions. Therefore projects that focus on afforestation, improved forest management and forest protection can reduce net volumes of atmospheric carbon dioxide and thus play an important role in mitigating climate change.

Estimates of the carbon sink capacity of forests suggest a potentially highly significant role. Overall, forests contain just over half of the carbon in terrestrial vegetation and soil, amounting to 1 200 Gt of carbon. Boreal forests account for more carbon than any other terrestrial ecosystem (26 percent), while tropical and temperate forests account for 20 and 7 percent, respectively. The Intergovernmental Panel on Climate Change (IPCC) has estimated that, globally, carbon sequestration from reduced deforestation, forest regeneration and plantation development could equal 12 to 15 percent of the total carbon dioxide emissions expected to be generated by fossil fuels between 1995 and 2050.

The Kyoto Protocol is the key framework for international agreement on stabilization of greenhouse gas concentrations in the atmosphere. Article 3.3 of the Kyoto Protocol clearly states that "the net change in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks, shall be used to meet the commitments under this Article of each party". However, the protocol is unclear about the extent to which forests will be included in the principal mechanisms for regulating carbon emissions. There remains considerable debate over rules for incorporating forestry projects in emission reductions under the clean development mechanism (CDM).[1] Some efforts are under way to develop trading in carbon emission permits and some CDM pilot projects are under implementation, but there is still uncertainty regarding the future potential of these arrangements.

Non-wood forest products (NWFPs). Forests produce many other products besides wood. The vast majority of these NWFPs are subsistence goods, used by the household that collects them, or traded only in local markets (see Table 6.4). There are, however, a number of products that have been developed commercially and an estimated 150 NWFPs are traded internationally. Most are traded in relatively small quantities and supplies are typically unstable, with varying quality and unreliable supply chains. There are, however, a number of exceptions to these general trends including, for example, rattan, bamboo and gum Arabic.

As mass-produced consumer goods become increasingly accessible to even very remote communities, the dependence on inferior NWFPs has declined. The disintegration of many traditional livelihood systems has exacerbated this trend, as has the overexploitation of many NWFP stocks. In the past, the commercialization of NWFPs has been viewed as a potential development path for forest dwellers in less developed countries. Increasingly, however, there is recognition that natural systems for the production of NWFPs are not intensive enough and generally too unreliable to provide a basis for large-scale industrial development. Development of NWFP programmes is also hindered by lack of focus, institutional and policy neglect, lack of research and development funding by NWFP producers and lack of capital. The future is likely to see only a handful of key species being cultivated on a commercial scale no longer controlled by forest dwellers. Thus, the opportunities for poor forest-based communities to profit substantially from NWFP development are likely to remain very limited.

Protected areas, biodiversity and environmental protection. IUCN has established a goal of having 10 percent of each country's land area under some form of protected status. Ideally, this should

Table 6.4 Classification of non-wood forest products (NWFPs) by end uses

End use	NWFP examples
Food products and additives	Wild meat, edible nuts, fruits, honey, bamboo shoots, birds' nests, oilseeds, mushrooms, palm sugar and starch, spices, culinary herbs, food colorants, gums, caterpillars and insects, fungi
Ornamental plants and parts of plants	Wild orchids, bulbs, cycads, palms, tree ferns, succulent plants, carnivorous plants
Animals and animal products	Plumes, pelts, cage birds, butterflies, lac, cochineal dye, cocoons, beeswax, snake venom
Non-wood construction materials	Bamboo, rattan, grass, palm, leaves, bark fibres
Bio-organic chemicals	Phytopharmaceuticals, aromatic chemicals and flavours, fragrances, agrochemicals/insecticides, biodiesel, tans, colours, dyes

Source: FAO (1998c).

[1] The clean development mechanism enables developed countries (with national emission reduction commitments) to undertake emission reduction projects in less developed countries, and to include the reductions thus achieved in their national commitments.

include a representative sample of all ecofloristic zones, so that 10 percent of all types of natural forests would be protected. At present, it is estimated that some 80 countries have formally attained the IUCN 10 percent goal, but around 100 countries currently still have less than 5 percent of their national land area under protection. Overall, it is estimated that more than 30 thousand protected areas have been established and that these cover about 3.7 percent of the global land area.

Working in collaboration with FAO's Global Forest Resources Assessment 2000, the World Conservation Monitoring Centre (WCMC) reported that the number and extent of protected areas grew steadily throughout the latter part of the twentieth century. However, much work needs to be done to harmonize national and international data, including data from different agencies in the same country. In addition, the interpretation of the concept of protected areas often differs substantially among countries, making aggregation at the global level unreliable.

Although the number and extent of protected areas have increased markedly in most regions since the 1960s, in many countries there will be diminishing opportunities to establish protected areas in their traditional form. In countries where conservation efforts fall below the IUCN target, there are often already intense land use pressures, or strong conflicts between economic and environmental objectives. Consequently, there will be a need to develop innovative means to combine conservation objectives with SFM and the creation of sustainable livelihoods. For the next 30 years, therefore, it is expected that the total land area under strict protection will increase only moderately, but greater areas are likely to be placed under SFM, in which conservation concerns are among the criteria.

Biodiversity is important at the level of ecosystems, species, populations, individuals and genes. There is a need for better management to safeguard biodiversity at all these interacting levels. While some losses in biodiversity over time are inevitable through both natural and human-induced causes, diversity can be conserved and managed through a wide range of actions, from the establishment of nature reserves and managed resource areas, to the inclusion of conservation considerations in improvement and breeding strategies of species under intensive use. The key to success will lie in the development of programmes that include a strong element of active gene management and that harmonize conservation and sustainable use of forest genetic resources within a mosaic of land use options. The sustainability of programmes will depend on genuine efforts to meet the needs and aspirations of all interested parties, and will require close and continuing collaboration, dialogue and involvement of stakeholders in planning and executing related programmes.

Some environmental threats will continue to require protective actions involving forestry. For example, combating desertification will remain a priority for many sub-Saharan countries, as well as throughout the Near East, and parts of North and South Asia. Watershed protection and flood control will continue to be crucial in countries with extensive steep lands and in their downstream neighbours. Weaknesses in institutional arrangements to mobilize concerted action will remain the principal constraint, exacerbated by the lack of financial resources, and difficulties in identifying beneficiaries and their willingness and ability to pay.

Forest-based recreation and ecotourism. Ecotourism is a rapidly growing function of forests. It is defined as ecologically sustainable tourism that fosters employment and cultural understanding, appreciation and conservation. More generally, it comprises a symbiotic relationship between the environment and tourism, and provides an economic incentive for conservation.

Ecotourism comprises a relatively small part (about 7 percent) of the world's travel and tourism industry. Nonetheless, it constitutes a significant source of foreign exchange earnings in some countries. A major question mark is the extent to which it can serve as a means of financing conservation. The market for forest- and conservation-based holidays is limited, and often a few sites with exceptional tourism values attract the vast majority of visitors, such as Yellowstone National Park in the United States, or the Khumbu region in Nepal. Paradoxically, this places extreme pressures on these exceptional sites. Nonetheless, in many instances, forests contribute to overall landscapes that are highly valued for tourism or recreational

purposes, for example in Switzerland or the Canadian Rocky Mountains.

Changing consumer preferences are the key determinant of the future growth of ecotourism. In developed countries, where leisure activities are most extensive, recreation markets are becoming more competitive. It is thus quite conceivable that actual forest-based recreation may decline over the next 30 years, even though forests are likely to be increasingly accessible. If increased recreation does occur, it is most likely to be where significant other services are provided. In developing countries, forest recreation is likely to increase together with increased affluence and the development of infrastructure to facilitate access to forests.

Food security and poverty alleviation. There is increasing discussion about what forests and forestry could do to alleviate the widespread prevalence of poverty and food insecurity. In many countries, forests and forest products are an important source of livelihood for rural communities. Traditional approaches to forest management by public sector agencies or the private sector have failed to consider this aspect. Forest-based informal activities such as firewood collection, charcoal production, pit sawing and collection and trade of NWFPs, including medicinal plants, will remain important means of livelihood for a large number of people. In recent years poverty alleviation has become the focal area of attention for international organizations (see Chapter 8), and the role of forests and forestry in this can be expected to be reconsidered.

6.5 Major perspective issues in world forestry

Emerging markets and their impacts on the direction and volume of trade. One of the principal questions relating to the future development of industrial forestry is the extent to which new markets will emerge, and the effects they may have on directions and volumes of trade. Several demand growth poles may emerge over the coming 30 years, with significant impacts on global trade. The largest potential markets are in the populous countries of Asia, particularly China and India. At present these two countries, with around 40 percent of world population, consume less than 10 percent of the world's industrial wood. Other developing countries such as Indonesia, Brazil, Bangladesh and Nigeria all have large populations, but relatively low per capita rates of industrial wood consumption. If developing countries like these significantly raise their per capita consumption of industrial wood products, there will be a significant shift in patterns of trade.

Table 6.5 shows that in Sweden and the United States, per capita consumption of wood products is currently at least tenfold that of the developing countries shown. Given that most of the world's most populous developing countries will continue to experience per capita incomes far below levels in developed countries, per capita consumption of wood products will also continue to lag behind.

The transition countries form another important emerging market. Throughout the 1990s most

Table 6.5 Apparent consumption of wood products (per thousand persons)

	Industrial roundwood (m^3)		Sawnwood (m^3)		Wood-based panels (m^3)		Wood pulp (mt)		Paper and paperboard (mt)	
	1978	1999	1978	1999	1978	1999	1978	1999	1978	1999
China	168	177	40	31	2	30	3	10	13	71
Brazil	384	502	113	101	17	14	15	27	23	42
India	28	27	14	18	0	0	1	2	2	4
Indonesia	64	152	19	9	3	6	1	7	3	24
Nigeria	91	88	29	18	3	2	0	0	2	3
Sweden	5 562	6 963	522	463	151	128	573	901	180	206
United States	1 470	1 546	529	584	153	187	196	216	272	350

Source: FAOSTAT.

of these countries have been in serious recession. During the next 15 years, there seems little doubt that major wood producers such as Russia are likely to regain much of their pre-transition wood supply capacity. At the same time, wood product consumption in Eastern European countries is also likely to rise, following increasing consumer affluence. This improved outlook suggests that marked changes in patterns of trade, particularly in European and North Asian markets, might be expected.

Impact of globalization. Continuing globalization has an impact on markets for forestry and forest products in four ways: further trade liberalization in forest product markets; standardization in production processes, product quality and regulatory environments; an increasing role for foreign investment and investment by multinational corporations; and wider spread of environmental advocacy and concerns.

During the past decades there has been significant liberalization of trade in forest products. The liberalization process culminated in the General Agreement on Tariffs and Trade (GATT) Uruguay Round, during which the majority of tariff barriers for forest products were reduced to fairly moderate levels or completely removed. Similarly, the past two decades have seen considerable standardization in market and regulatory requirements. Most countries have adopted trade, investment and even environmental policies, which have reduced national insulation and promoted a greater level of standardization. Thus, while there is still room for further progress towards free trade in forest products and standardization in markets, changes in trade conditions during the next 30 years are likely to be less important than other factors in determining the shape of forestry.

The globalization of environmental advocacy really came of age at UNCED in 1992. UNCED witnessed the birth of global acceptance of sustainable development, and acceptance of SFM as the core paradigm for forestry development. At the same time, throughout the 1990s environmental advocacy has firmly embraced the concept of transnational environmentalism. Issues such as global warming and the role of forests in carbon sequestration, the development of multicountry criteria and indicators of SFM, and international forest certification processes are all indicative of growing concerns about the environmental implications of forestry. Perhaps even more important implications are those related to the globalization of environmental concerns. The scrutiny and interventions of environmental NGOs and development agencies have imposed greater accountability on multinationals and have forced governments to write and enforce environmental legislation and regulations. Governmental decisions relating to forests are now subjected to wider scrutiny at local, national and global levels, and there are increasing pressures to make forestry practices compliant with widely acceptable environmental standards.

There is a long history of foreign direct investment (FDI) in forestry operations. Most FDI in forests and forest-processing operations is undertaken by multinational companies. FDI is seen as a means of developing national economies by generating employment, income and foreign exchange earnings. Education, training and technology transfer also accrue to the "host" country. FDI in forestry operations, particularly those relating to forest purchases or harvesting concessions, is often controversial. Forests are often seen as strategic national assets, and there has been considerable resistance in many countries to relinquishing control of forests to foreign interests. Similarly, multinational companies operating in countries with weak regulations have been responsible for much destructive forest harvesting. Multinational companies are often perceived to be less accountable for environmental damage than domestic companies or government logging agencies.

Privatization of forests remains a significant vehicle for promoting FDI in forests although, with the exception of a few countries, it has not progressed very far. It seems likely that privatization will eventually progress in a number of countries, although this process is likely to be slow and is more likely to find favour in developed countries. Eastern Europe, where there are efforts to transfer formerly centrally controlled forest assets to private ownership, may be an exception to this rule.

Impact of developments in science on forestry practices. In simple terms, a central objective of most forestry science is to improve some part of the processes that convert sunlight into cellulose or of those that deliver forest goods and services. Traditionally, forestry research focused on making the

production process faster, cheaper and better. Such research focused on seedling production, tree growing, harvesting and wood processing as well as all the intermediate steps. The bulk of forest science still operates within these parameters, and over the coming 30 years we should expect improvements across the broad range of the production process, making wood production faster and delivering cheaper and better forest products.

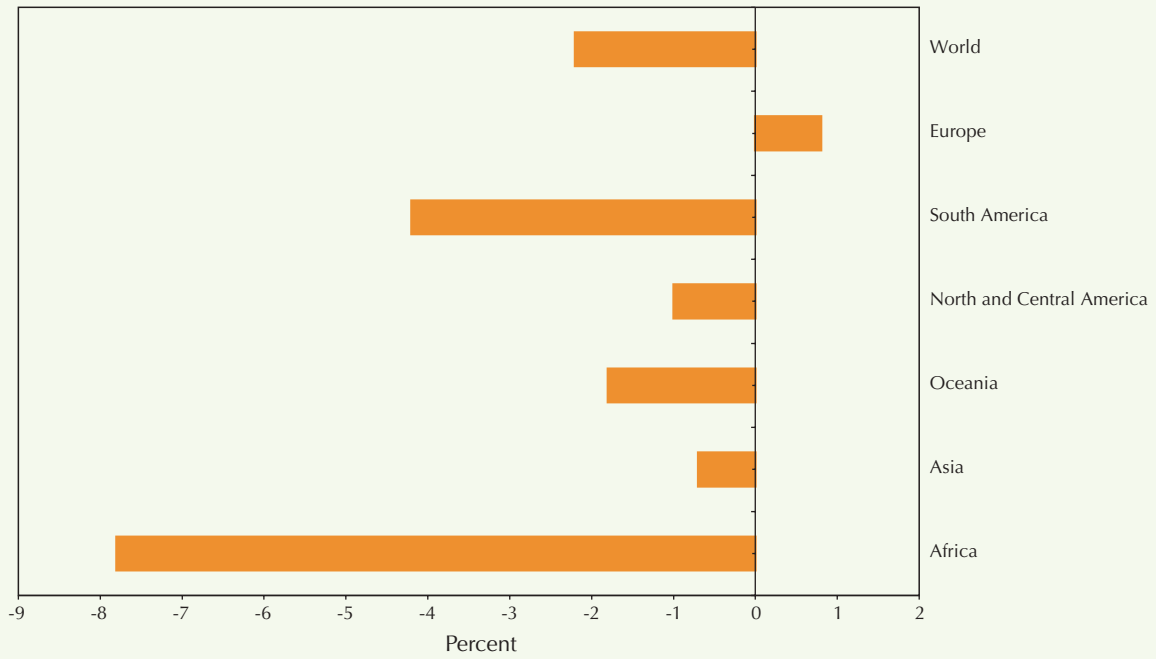
An equally important new trend is to incorporate social and environmental objectives in forest science, management and production. In a number of countries paper production is required to include a minimum proportion of recycled material. Similarly, intensive forest harvesting covering large areas is increasingly considered unacceptable by the public, even though in many instances it is (in the short term) the cheapest means of harvesting and may mimic nature better than alternative systems.

There are also important changes in the technology supporting the monitoring of forests. The increased ease in collecting information (through satellite imagery, the Geographic Information System [GIS], etc.), collating it (database technology), and disseminating it (e-mail and the Internet) means that countries' forest management practices are under far greater international scrutiny. Thus there is far greater leverage to ensure that forestry practices are sustainable.

Deforestation and forest degradation. Deforestation refers to change of forest land cover where tree crown cover is reduced to less than 10 percent. Deforestation has the highest profile of all environmental challenges confronting forestry. It has an impact on the availability of forest goods and services by reducing the area of forest. High rates of deforestation (and forest degradation) may also increase pressure on forestry policy-makers to place forest areas in strictly protected areas or to prevent harvesting in other ways (e.g. through logging bans). This may increase pressure on accessible areas and further reduce production that can be harvested from remaining forest areas.

There is an identifiable relationship between deforestation and levels of industrial development. In subsistence economies with slowly growing populations, forests may absorb the impact of demands for wood and other forest products. The advent of widespread economic development and rapid population growth has generally seen a period of rapid deforestation in industrializing countries. At a certain level

Figure 6.1 Percentage of deforestation by region, 1990-2000



Source: FAO (2001c).

of development, however, further land clearing and forest harvesting become uneconomic, and may also generate increasing criticism related to neglect of social and environmental dimensions of forest management. Thus there exists an apparent curve of changing forest use, which leads from subsistence, through heavy exploitation, to harmonization of harvesting with protection and conservation, as well as social needs and aspirations.

Figure 6.1 shows evidence of this development path. In most European countries, for example, the exploitive period is long past, and forest areas are now gradually expanding. Most developed countries in other regions, including Japan, Australia, New Zealand, Canada and the United States also exhibit either increasing or static total areas of forest.

On a regional basis, deforestation is most rapid in Africa and in South America. It also remains a serious problem in many countries in Asia, Oceania and Central America. Nonetheless, the experience of developed countries suggests that a reversal in deforestation is imminent in a number of developing countries. In fact, the FAO *Global Forest Resources Assessment 2000* shows that in the past decade, developing countries such as Bangladesh, Viet Nam, Algeria and the Gambia have reversed deforestation, and are expanding net forest area. For more than a decade, developing countries such as China, India, the Libyan Arab Jamahariya, Turkey and Uruguay have had plantation establishment in excess of annual deforestation.

Forest degradation refers to changes between forest classes (e.g. from closed to open forest) that negatively affect the stand or site and, in particular, lower production capacity. Extensive logging, without corresponding attention to forest management, has led to large-scale forest degradation, especially where the extraction of mature trees is not accompanied by their regeneration, and where the use of heavy machinery causes soil compaction or loss of productive forest area. Other causes include overgrazing, overexploitation (for firewood or timber), repeated fires and attacks by insects, diseases, plant parasites or other natural sources such as cyclones.

Forest degradation takes different forms. In most cases, degradation does not imply a decrease in the area of woody vegetation, but rather a change in species composition, loss of soil fertility, erosion, reduction in biodiversity and fragmentation of forest areas. One of the most easily identifiable and important indicators of degradation is depletion of standing biomass, particularly mature trees. Forests may be degraded from virgin primary status to secondary forests, to scrub or other wooded land and then perhaps cleared and reafforested as plantation. Broad measures of forest area and deforestation do not capture the changes in values that these shifts encompass. A shift to principles of SFM and active monitoring of indicators of SFM are likely to help document and eventually arrest forest degradation.

Current policy directions will undoubtedly result in a decrease in net deforestation in many countries during the next decade. The rate of forest degradation is also likely to decrease as more attention is paid to sustainable harvesting and utilization practices. In Asia, for example, countries such as Thailand and the Philippines have imposed bans on natural forest harvesting. Although illegal logging and shifting cultivation continue, it should be expected that ultimately the profits of plantation establishment and natural regeneration will outweigh those of defying the bans. Improved policies, particularly those encouraging sustainable forest management, should ensure incremental improvement in forest management on a global basis, which will gradually shift the balance of forestry degradation and clearance to stasis, and then to reforestation and enhanced quality of forests.

6.6 Where is forestry heading?

Future directions will be determined by changing national priorities regarding economic, environmental and social objectives for forestry. At the same time, countries remain subject to a variety of pressures that regularly compromise their ability to invoke rapid change, even when change is clearly desirable. Each country will, consequently, attempt to choose a path that best accords with its priorities, but at the same time will be cognizant of international scrutiny and pressures to comply with benchmark environmental and social standards. Thus, the most important changes will occur with regard to the approaches to meeting demands for a broad range of goods and services, the ways in which pressures for better environmental management are addressed, and the means by which increasing

demands for social equity are satisfied. Each of these key dimensions is discussed below.

Through the 1980s and into the early 1990s, global wood supply projections regularly showed a pessimistic slant. Forecasts showed rapid deforestation, increasing populations and economic development, with an apparent prospect of ever-increasing demand for wood and wood products to be provided from ever-diminishing forest areas. There is, however, a general consensus between recent outlook studies that this rather gloomy picture was overstated. While forest areas continue to decline globally and demands increase, it can also be argued that we have greater wood supply potential than at any time in history.

The key to increasing wood supplies lies in innovation and technological development. In the past 30 years, as concerns for forests and wood supplies have mounted, so too have the number of adaptive measures designed to intensify forest management and wood production. These trends are already evident in an acceleration of plantation establishment, introduction of reduced impact logging techniques, development of reconstituted wood products, increasing emphasis on recycling systems, and introduction of techniques to promote SFM.

The most recent forestry outlook studies indicate that trade and other market mechanisms will ensure that, at a global level, wood supplies will be adequate for the foreseeable future. However, localized shortages will occur in many countries. Wood will also remain scarce for impoverished or otherwise marginalized people with little purchasing power. Providing better livelihoods and living conditions for these people remains a fundamental challenge in many countries. In some countries these problems are being addressed by implementing systems of community-based forest management, or by improving regulation of and rights to forest access.

The question as to whether there is enough wood is likely to be less important in the future. Rather, the key questions will be: Where should it come from? Who will produce it? And how should it be produced? It seems clear that plantations will play a relatively greater role in providing wood. Similarly, trees planted outside the forest, around the farm or household or on boundaries, roadsides and embankments will continue to be an extremely important and underestimated source of wood supplies. Changing patterns of resource availability will have profound implications for forestry administrations in many countries, requiring changes in technology, processing capacity and location of processing industries.

The future for many forest services appears comparatively bright. Environmentally based services such as watershed protection, carbon sequestration, contribution to water quality and maintenance of biodiversity and genetic resources are in the mainstream of environmental concerns. Environmental services of forests have the advantage that their benefits extend outside the forest and consequently affect a more affluent constituency – and therefore more easily attract funding. Other services that are largely used by the rural poor are less likely to attract attention, now or in the future.

In the past, the areas of fuelwood and NWFPs have been generally marginalized in forest policy-making. While the future is likely to see greater attention paid to these products, there is little evidence of rapid progress in their adoption into the policy mainstream. In many instances there is an assumption that economic development will eliminate reliance on these products, and thus they tend to be treated as less important. While there is doubtless some truth in this viewpoint, the reality is that vast numbers of people will remain dependent on these products and therefore they merit attention by policy-makers.

The overriding influence on forestry's future direction will be the evolution and adoption of principles of SFM. Implementation of SFM is likely to involve a range of measures that will substantially alter the ways forests are managed in the future. The two major components of SFM are likely to be increases in the area of forest within protected area networks, and changes in forest harvesting and management to increase the social and environmental acceptability of production forestry.

The most significant change will be the broadening of forest management objectives to incorporate not only wood production, but also environmental and social values. Initially this is likely to encompass significant increases in protected areas. In the immediate future, increasing the area of forest in legally protected areas should be feasible without too much impact on future wood supplies. Further ahead, identifying additional areas for full conservation will

become more difficult. It is likely that, by 2030, new conservation areas will encompass less stringent preservation aspects, and will adopt multiple-use dimensions within a framework of sustainable management. At present, too many conservation areas are afforded protection only in name. In future, it will be important to ensure that there is adequate funding to manage and protect such areas properly.

Eventually all types of land uses, including natural forests and plantations outside the legally protected areas, will incorporate these objectives. By 2030, environmental protection is likely to have become fully integrated into SFM (not just "boxed-in" in designated areas). The accessibility of forests for recreational use will also have improved markedly.

Deforestation is expected to slow down in a majority of countries, and efforts to reverse forest degradation and improve the quality of forests, including enhancing biodiversity and restoring natural processes, will have gathered enormous momentum. It is difficult to project the magnitude and rate of change. There will be notable inter-country and interregional differences. In Asia, for example, rates of agricultural expansion into forest land are likely to decline, largely because forests most suitable for arable cultivation have already been converted. Slow economic growth, continued dependence of a large share of the population on subsistence farming and the availability of forest land suitable for conversion to arable cultivation are likely, however, to lead to continued deforestation in sub-Saharan Africa and, to some extent, in South America.

The likelihood is that moves to collaborative forest management will make only steady progress over the medium term after which, depending on observable success, such moves may accelerate. A crucial requirement is the strengthening of forestry institutions, which are generally under-resourced and weak. Forestry institutions also need to be proactive in intersectoral discussions, in recognition of the fact that many of the most important forces shaping the future of forestry are largely outside the direct influence of the sector. Ultimately, the importance of forestry will depend on how effectively it can be integrated into the activities of all other sectors and to what extent the public as a whole will be convinced about forestry's current and future role in promoting sustainable development.