

4 DRIVERS IMPACTING THE FOREST SECTOR

INTRODUCTION

The direction of forest and forestry development is largely determined by factors external to the sector and, in particular, larger societal changes. The impacts of these on forests and forestry may be direct or indirect. External factors may include changes in demography, the economic situation, policies and institutions, advancements in science and technology and, perhaps most importantly, the responses of society to critical environmental changes; these often have an overwhelming impact on how forests are managed. Growing concerns about the provision of ecosystem services, especially in the context of climate change mitigation and adaptation, have added new dimensions to the sphere of forest management. Collectively, these changes modify society's behaviours, altering the nature of goods and services demanded and how these are produced and consumed. These larger changes also affect policies and programmes in other sectors, impacting on forests and forestry through backward and forward linkages. The main drivers of change and their impacts on forests and forestry are outlined in the following sections.

DEMOGRAPHIC CHANGES

Demographic changes have an overwhelming impact on land use, in general, and forestry, in particular. Population size, growth rates, densities, urbanization, migration and changing age structures impact forests and forestry, both directly and indirectly. However, in general, it is not so much the number of human beings that has the crucial impact on forests, as the way in which human society is organized (Westoby 1989).

Population growth

With a population of 3.6 billion people, the Asia-Pacific region accounted for about 55 percent of the world's population in 2005. By 2020, the population in the region will increase by 600 million, resulting in a total population of 4.2 billion (**Figure 4.1**). This will account for about 60 percent of the global population increase, escalating demands for food, fuel, water and fibre – placing tremendous pressure on resources, including land and forests, within and outside the region.

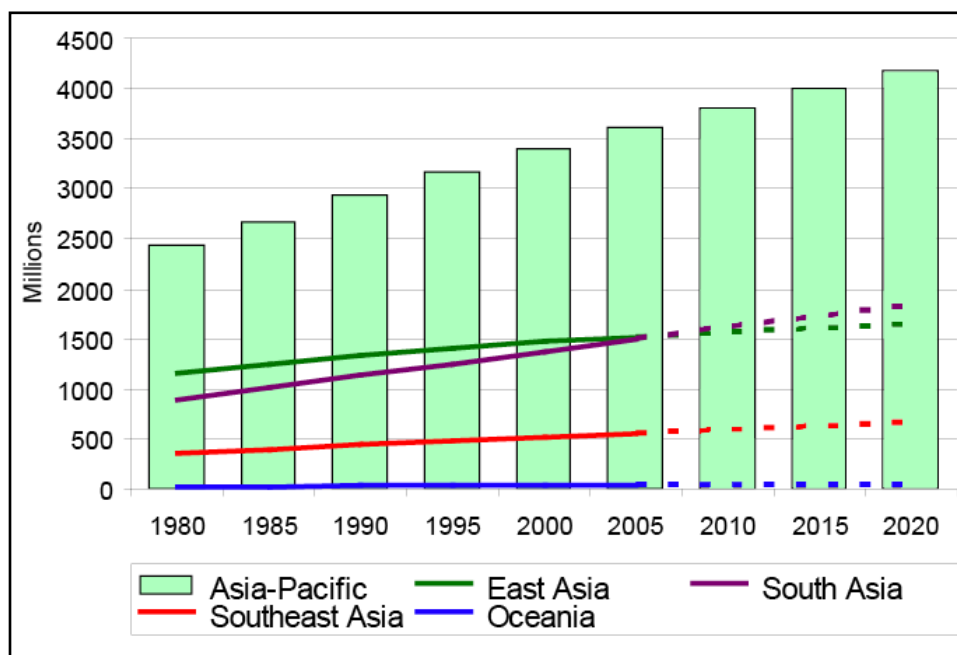


Figure 4.1. Population growth in Asia and the Pacific* (millions), 1980-2020

Source: UN (2009). * Medium variant.

Within the Asia-Pacific region, South Asia will become the most populous subregion, overtaking East Asia. Primarily, this is an outcome of negative growth in population in Japan and very low growth rates in China (largely due to the rigid population policies), Mongolia and Republic of Korea (ROK); conversely high population growth rates continue to be the norm in most South Asian countries.

The Asia-Pacific regional population grew at an annual rate of 1.2 percent between 2000 and 2005, and has continued (and will continue) to grow – though at a declining rate – in the next decade:

- a) at 1.06 percent between 2005 and 2010;
- b) at 0.97 percent between 2010 and 2015; and
- c) at 0.86 percent between 2015 and 2020.

However, growth rates differ among subregions and among countries within each subregion. In several countries, population growth rates are above 2 percent and will continue to remain high in the coming years. At the other end of the spectrum are countries with growth rates of less than 0.5 percent or, as is the case of Japan, negative growth.

Population growth has important implications for the forest sector. In addition to affecting the demand for forest products and services, population growth affects demands for other goods and services and thus has multiple and derived impacts on forests, for example, through demands for packaging or through increasing newspaper circulations.

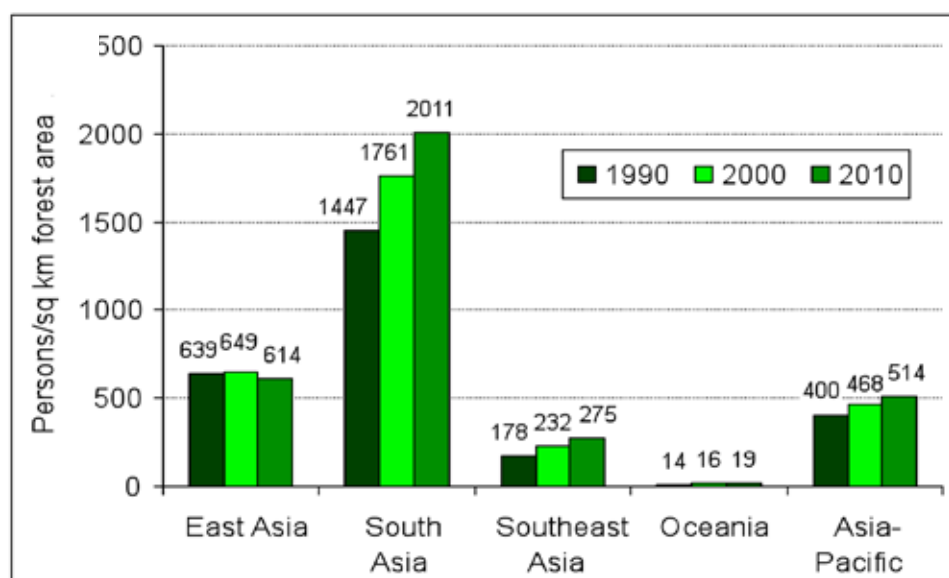
Population density provides an indication of the pressure on land and other natural resources including forests. The Asia-Pacific region is the world's most densely populated region and projections suggest continued increases in population densities, which will likely increase pressures on land and other resources (**Table 4.1**). Population growth is generally fastest in developing countries in the region, many of which are already very densely populated. While the overall density of population provides a general picture, density per unit of arable land and forest provides a better indication of potential pressures on natural resources.

Table 4.1. Population density in the Asia-Pacific region (number/km²)

Regions	1980	1990	2000	2005	2010	2020
East Asia	101	117	128	133	136	143
South Asia	218	274	334	363	392	446
Southeast Asia	82	101	119	128	136	151
Oceania	3	3	4	4	4	5
Asia and the Pacific total	86	103	120	127	134	147
World	34	41	47	50	53	59

Sources: Based on FAO (2009a) and UN (2009).

Among the various subregions, South Asia has the highest population density, close to three-times that of the regional average and more than seven-fold the global average. South Asia's population density will continue to increase, in view of the rapid growth of population in the subregion. Within South Asia, population density varies; Bhutan has the lowest density, 14 persons/km², while Bangladesh is the most densely populated with 1 180 persons/km². The density of population in relation to forest area has increased significantly in South Asia during the past 20 years (**Figure 4.2**). Comparatively, the ratio of people to forest area in East Asia has declined – largely on account of increases in planted forest area and very low population growth rates. In contrast population density in relation to forest area has increased in all other subregions, with the highest absolute increase in South Asia.

**Figure 4.2. Population per unit forest area in the Asia-Pacific**

Source: Based on FAO (2010) and UN (2009).

Population densities in Southeast Asia are variable, with many countries having significant areas of very dense population, offset by large areas with very low population density. For example, the island of Java in Indonesia has a population density in excess of 800 people/km², whereas other parts of Indonesia such as Kalimantan (17 people/km²) and Irian Jaya (4 people/km²) have relatively low populations. Viet Nam (252 people/km²) is the most densely populated country in Southeast Asia, while Lao PDR (25 people/km²) has the lowest population density.

Population density in the Oceania subregion is very low, largely on account of Australia's very large geographic area and a very low population density of three people/km². Similarly, both New

Zealand and PNG have relatively large areas and low population densities. However, population pressures on resources are significant in some of the small Pacific Island Countries, such as the Marshall Islands (330 people/km²) and South Tarawa (2 330 people/km²) in Kiribati.

Population density is a critical factor when land and other natural resources are the most important source of income. Where dependence on agriculture for employment and incomes is high, forest conservation faces enormous challenges. Conversely, in countries where dependence on land has declined significantly (for example Japan), high levels of forest cover have been maintained notwithstanding high population densities. However, often more developed countries have transferred potential land-use pressures to less developed countries through trade.

Changing age structures

Change in population age structures is an important demographic factor that indirectly affects land use and forestry. Two contrasting trends that could potentially bring about important changes in demands for forest-derived goods and services are observed in the region:

- Increasing proportions of elderly people in the populations of developed countries including Australia, Brunei Darussalam, Japan, New Zealand, Republic of Korea and Singapore (**Box 4.1**). In many of these countries, more than 15 percent of the population is over 65 years old; in Japan more than one-quarter of the population exceeds 60 years of age. Ageing will also be a major issue in China, where birth rates continue to decline in response to the rigid population policies.
- In contrast, most other countries, especially in South Asia, will have a high proportion of working age people by 2020, especially as large numbers of people presently in younger age groups move into the working age group (see **Table 4.2**).

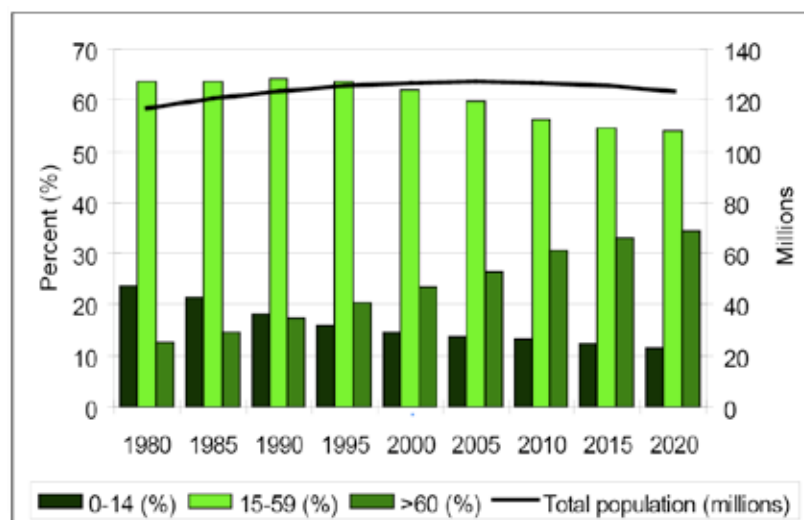
Table 4.2. Age structures in Asia and the Pacific (percentage of total population)

	Population aged 0-14			Population aged 15-59			Population aged 60+		
	1980	2000	2020	1980	2000	2020	1980	2000	2020
East Asia	34	25	18	58	64	64	8	11	18
South Asia	40	36	27	54	58	63	6	6	9
Southeast Asia	41	32	24	53	61	64	6	7	12
Oceania	30	26	23	59	61	59	12	13	18
Asia and the Pacific	37	30	23	56	61	64	7	9	13

Source: Basnyat (2008, updated: UN 2009).

Box 4.1**Population ageing in Japan**

Population ageing in Japan will have significant impacts on the work force as well as implications for the nature of demand for services and products, including for forests, wood and wood products. Japan's demographic transition is characterized by a declining population and significant change in the population age structure (see figure below). The total population is already in decline, largely due to very low birth rates. At present, the proportion of people aged above 65 is increasing, while the proportion of those of working age is declining rapidly. In forestry, labour scarcity has become a significant challenge, with fewer young people willing and available to undertake forestry careers – especially low-skilled labouring employment. A number of economists and demographers have outlined the implications of such demographic changes (including for example a significant slowing down of the economy, reductions in savings, and changes in patterns of consumption, etc.); the linkages between different variables and potential impacts on forests are complex, with income and substitution effects relating to people's preferences playing important roles in determining outcomes.



Demographic changes in Japan, 1980-2020

Source: UN (2009).

Implications of changing age structures on forests and forestry could vary considerably, as outlined below:

- Projected increases in working age populations in many developing countries imply a high potential demand for housing and concomitant growth in demand for wood and wood products. Partly this may be offset by demand contractions in countries with ageing populations.
- Changing age structures could also affect overall economic performance. Productivity tends to decline in economies with high proportions of elderly in their populations. In the absence of immigration, the ratio of the aged non-working population to the working population increases, increasing levels of dependency and, where available, affecting expenditure on social security. Changes in the proportions of population in various age groups may also change the composition of goods and services demanded. For example, differences in overall demand for housing, and the types and size of houses demanded. The competitiveness of economies – where based on abundant supplies of labour – could decline in the context of ageing populations, encouraging relocation of labour-intensive industries (for example, sawmilling, furniture manufacturing, etc.) to countries with abundant and cheap labour.
- Ageing populations also have a direct impact on labour availability. Labour shortages are

already evident in many developed and emerging economies, especially affecting agriculture, fisheries and forestry (**Box 4.2**)

Box 4.2	Population ageing and skills shortages in Australia
<p>“Over the next five years the estimated impact of population aging will be equivalent to a shortfall of 195,000 workers. Modeling has shown that every industry is likely to be adversely affected by population aging. As the population ages, skill shortages will become more acute, particularly in industries where there is already a high proportion of older workers. For example, the proportion of workers who are 45 years and older ranges from 52.1 percent in agriculture, fisheries and forestry industries to 24.4 percent in the retail sector.”</p> <p>Source: NAFI and A3P (2006).</p>	

Urbanization

Urbanization is a key demographic variable, which impacts land use, in general – and forests and forestry, in particular. The Asia-Pacific region is urbanizing at a very rapid rate. In 2005, about 38 percent of the region’s population was urban and urban populations are expected to increase to about 47 percent by 2020 (**Figure 4.3**). Of particular interest is rapid urbanization in East Asia, especially in China, where the urban population is expected to increase by about 230 million by 2020, while the rural population will decline by about 120 million.

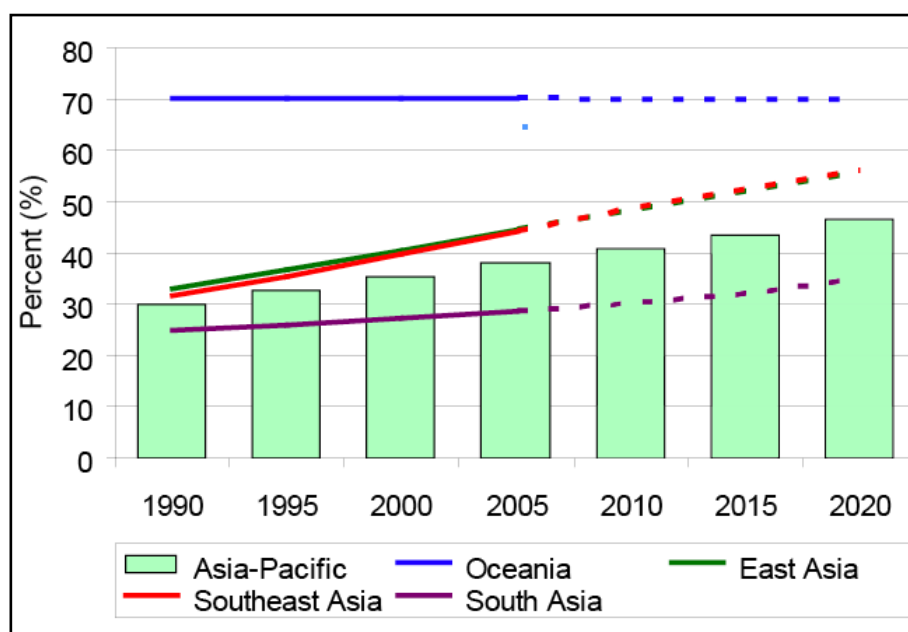


Figure 4.3. Percentage of Asia-Pacific population living in urban areas, 1990-2020

Source: Basnyat (2008, updated: UN 2009).

Among the various subregions South Asia will remain the least urbanized, while the Oceania subregion will be the most urbanized largely due to already high levels of urbanization in Australia and New Zealand. Changes in the rural-urban distribution of populations tend to have complex direct and indirect impacts on land use and forests. In general, urbanization brings about a change in the characteristics of labour markets and primary sources of income, reducing the dependence on land. If the share of agriculture in employment and income declines, so does the pressure to expand cultivation onto forest land. Urbanization and industrial development also change relative costs and prices; for example, while inputs like fertilizers help to enhance land productivity, increasing labour costs make

cultivation of marginal areas less economic. There are several instances where urbanization and consequent rural de-population have encouraged tree growing – intentionally or incidentally.

However, urbanization can also have direct and indirect negative impacts on forests. For example, coastal areas of the Asia-Pacific region have witnessed rapid expansion of urban settlements, affecting coastal ecosystems like mangroves. Often mangrove areas have been destroyed to accommodate expanding urban settlements or shrimp farming, and even when they are spared immediate destruction, many are affected by unsustainable removal of wood and other products. Similarly, expansion of urban settlements onto prime agricultural land may trigger forest clearance elsewhere. Construction booms in rural and urban areas have led to clearance of forests and woodlands and there are instances where even culturally or environmentally precious tracts (for example, sacred groves) have been cleared to make way for residential and commercial buildings.

The economic crisis and concomitant loss of jobs in industrial and services sectors during 2008/2009 slowed migration to urban areas. There is anecdotal evidence of workers returning to rural areas, driven back to their origins by job losses in urban areas. Such short-term reversals were also reported in the aftermath of the 1997-1998 Asian economic crisis; once growth recovers, the normal trend of urbanization is expected to resume.

International migration

A major development in the last two decades has been growth in international migration. In 2007, the number of migrants originating in the Asia-Pacific region was estimated at 50 million people or about one-fourth of total migrant workers in the world. Annual remittance flows to developing countries in the Asia-Pacific region in 2008 were estimated as about US\$152 billion, or about 46 percent of remittances to all developing countries in the world (Ratha *et al.* 2009). For a number of countries, remittances are critical to national income (**Table 4.3**) and often far exceed Foreign Direct Investments (FDI) and official development assistance.

Table 4.3. Remittance flows to selected Asia-Pacific developing countries, 2008

Country	Remittances (US\$ billion)	Remittances as share of GDP (%)
Bangladesh	8.98	9.6
Cambodia	0.32	4.2
China	40.64	1.0
Fiji	0.18	4.8
India	51.97	3.3
Indonesia	6.80	1.4
Nepal	2.73	16.8
Pakistan	7.03	4.2
Philippines	18.64	11.3
Samoa	0.14	22.8
Sri Lanka	2.95	7.8
Viet Nam	7.20	8.0

Source: Ratha *et al.* (2009).

Migration and remittances have important implications for land uses, as indicated below:

- Migration significantly reduces pressures on land by providing families of migrant workers with an alternative source of livelihood. Households in receipt of remittances often move away from subsistence cultivation and, in many cases, invest in small enterprises, reducing their dependence on land.
- Most migrants are of working age, especially, from younger age groups. This reduces the availability of workers in their country of origin, increases wage rates and often encourages abandonment of cultivation of marginal areas, enabling natural regeneration of forests. Often, labour-intensive annual and seasonal crops are replaced by less labour-demanding tree crops, or land is left fallow, enabling regrowth of natural vegetation.

There are contrasting views on the impact of the recent economic crisis on international migration and remittances. While some decline in remittances in the short run is expected, the long-term upward trend is expected to resume once global economic recovery commences. In the meantime, the numbers of workers seeking opportunities abroad may have increased. The declining proportion of population of working age in many countries (especially where birth rates are low) will increase the demand for migrant workers; notwithstanding the anti-immigrant sentiments of some segments of society.

Demographic changes: an overview

The relationship between demographic changes and forests and forestry is not linear; it is influenced, or mediated, by other factors such as growth of economies, developments in science and technology and, most importantly, policy and institutional changes driven by social and political evolution, which help societies to alter resource-use patterns. Obviously, patterns of resource use may change significantly in time and space depending on the collective impact of these factors, as outlined in **Figure 4.4**.

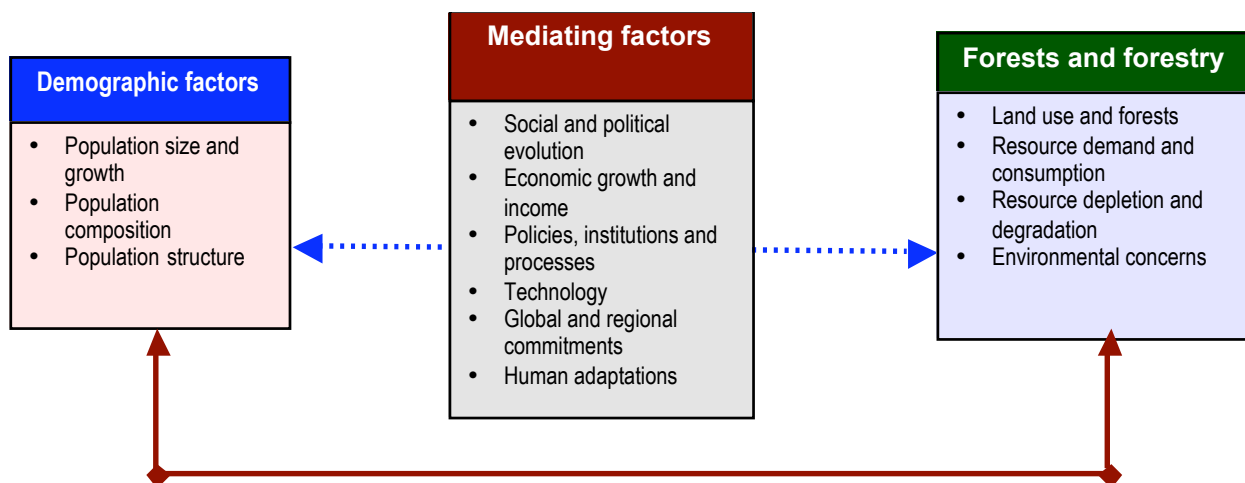


Figure 4.4. Conceptual framework supporting analysis of demographic changes and forests and forestry

Source: Modified from Hunter (2000).

ECONOMIC CHANGES

Changes in economic situations directly and indirectly impact on the use of natural resources, including forests. Demands for goods and services change in response to changes in income, as does the ability of society to alter systems of production including the technology adopted. As incomes increase, the composition of the basket of goods and services consumed changes and society is willing and able to pay more for ecosystem services. Consequently, economic changes are likely to have an overwhelming impact on forests and forestry. The emerging changes in economic situations and how these may affect the forest sector are outlined below.

Growth in incomes

The Asia-Pacific region has registered impressive economic growth and is the most economically dynamic region in the world. In 2007, the region accounted for 27 percent of world GDP (World Bank 2009b), an increase of 2 percentage points on its share of 25 percent in 1990 (**Figure 4.5**). Growth rates in the post-1997 period averaged 5 percent for the whole region, with East Asia, and particularly China, taking the lead. Since 2006, Asia and the Pacific has become the world's second largest aggregated economy, accounting for 29 percent, or nearly a third of global GDP (UNESCAP 2010). The Asia-Pacific regional GDP has registered an increase from about US\$7.7 trillion in 1996 to US\$10.7 trillion in 2006 (at 2000 constant prices). Much of this increase is due to rapid growth in China and India, the most populous countries in the region. Rapid economic growth has led to significant reductions in the number of impoverished people. The region is on target to accomplish the Millennium Development Goal of halving poverty by 2015.

Although, at the aggregate level, the region's economic performance is unparalleled, there are considerable intercountry differences in the state of national economies, including per capita incomes and GDP growth rates (**Table 4.4**). The region has some of the poorest and richest countries in the world, with national per capita income (measured in terms of Purchasing Power Parity [PPP]) varying from US\$960 in Nepal to over US\$30 000 in Australia and Japan. The annual growth rates of national economies have also varied during the past decade, from less than 1 percent (and even stagnation as in the case of Japan) to more than 10 percent in the case of China. These disparities stem from differences in resource endowments including human and financial capital, the state of technology, and the policy and institutional frameworks that enable the effective use of the human and natural resources. Countries in various income groups have been growing at different rates, as summarized in **Table 4.4**.

Table 4.4. Distribution of countries based on per capita income and GDP growth rates with share of population per grouping, 2000-2007 averages¹

Income group (per capita income 2005 US\$ international PPP)	GDP growth rate %						Proportion of the regional population in income groupings (%)
	<2	2-4	4-6	6-8	8-10	>10	
<US\$1 000		Nepal, Timor-Leste		Myanmar			2.8
US\$1 000-2 000	Kiribati, PNG, Solomon Islands		Bangladesh	Lao PDR, Viet Nam	Cambodia		7.4
US\$2 000-4 000	Tonga	Vanuatu	Indonesia, Pakistan, Philippines, Samoa, Sri Lanka	India, Mongolia	Bhutan	China	81.4
US\$4 000-6 000	Fiji			Maldives			0.03
US\$6 000-10 000		Thailand					1.8
US\$10 000-20 000		Malaysia					0.7
US\$>20 000	Japan	Australia, Brunei Darussalam, New Zealand	ROK, Singapore				5.9
Proportion of the regional population in GDP growth groupings (%)	4.5	4.0	19.2	34.7	0.4	37.1	

Sources: World Bank (2007a); ADB (2008).

More than 81 percent of the Asia-Pacific population lives in countries with per capita incomes in the range US\$2 000 – 4 000 (PPP). Within this group, the fastest growing countries (with growth rates exceeding 6 percent) account for 83 percent of the population of the group, largely due to China and India. However, this group also has the largest number of people living in poverty, with India alone accounting for nearly one-third of the global poor (World Bank 2008b).

In several countries, both incomes and economic growth rates are extremely low. These include Nepal, Timor-Leste, PNG and Solomon Islands. Most of these countries are endowed with significant natural resources including forests. However, policy and institutional constraints are impeding capacities to use these resources to support rapid sustainable development.

The high income economies – Japan, Australia, Brunei Darussalam, New Zealand, ROK and Singapore account for about 6 percent of the regional population. Although these countries' growth rates have been slow in recent times, the absolute increases in income have been substantial and these countries account for a high proportion of final consumption of wood and wood products. However, considering the low population growth rates (negative growth rate in Japan) and low income growth rates, demands for wood and wood products in these countries are unlikely to increase significantly.

Outlook for growth

Until early 2008, growth forecasts for the Asia-Pacific region have been buoyant, with considerable optimism about future economic growth in the region. With the exceptions of 1997/1998 and 2001/2002, the overall economic growth rate for the region has been impressive, at more than 5 percent. Since

¹ Information is unavailable for DPR Korea.

1996, China has maintained exceptionally high growth rates, above 10 percent for several years, helping the country to transform into a global economic power. India has also performed very well, with growth rates exceeding 8 percent in a number of years in the last decade. Although there have been periodic downturns – for example, the long-term stagnation of the Japanese economy since 1990, the downturn of some of the Southeast and East Asian economies in 1997/1998, and a slowing down in 2001/2002 on account of the global economic downturn – many Asia-Pacific economies have maintained high growth rates. Largely this is attributed to:

- High savings and investments: in some countries (in particular the most populous emerging economies) this has exceeded 30 percent of GDP.
- Favourable investment climates, resulting in very high inflows of FDI: the Asia-Pacific region accounted for about 17 percent of global FDI net inflows in 2007. Countries such as China and India remain highly attractive destinations for FDI in many sectors.
- The Asia-Pacific region's ability to take advantage of trade opportunities: in 1990, the region exported goods and services worth about US\$773 billion (in constant 2000 US dollars) accounting for 19 percent of global exports. By 2007, regional exports had increased to US\$2.8 trillion (in constant 2000 US dollars), approximately 23 percent of the global value of exports (Inoguchi 2010).

These factors have contributed to high rates of growth and, until recently, forecasts of future growth have been very optimistic. By 2020, the regional total GDP is expected to exceed US\$22 trillion (**Figure 4.5**).

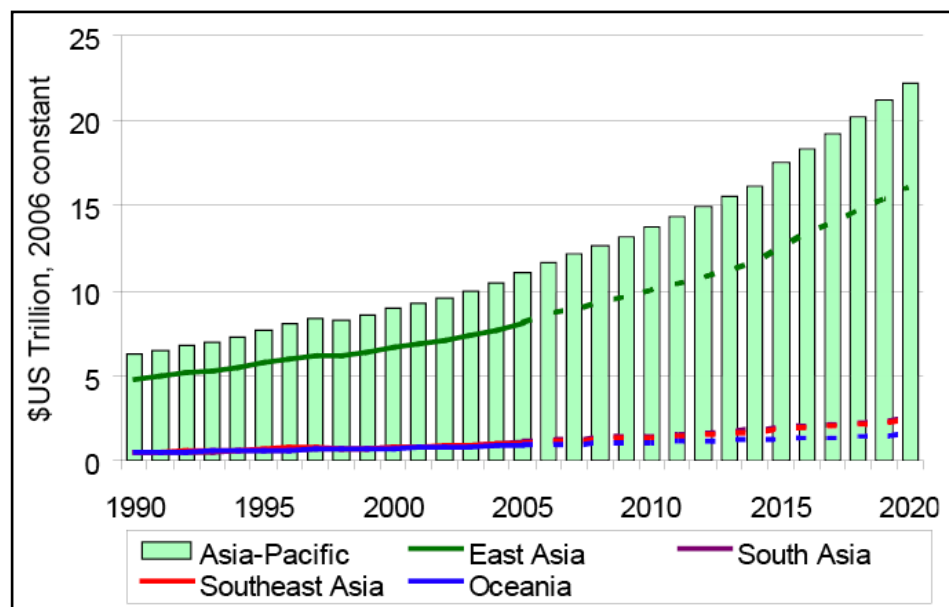


Figure 4.5. Trends and forecasts of GDP growth, 1990-2015

Sources: Based on World Bank (2007a); UN (2008a).

The 2008/2009 global economic crisis has led to some decline in growth of incomes, especially for countries whose growth has been dependent on exports and FDI. However, there are signs of an early recovery, especially of the emerging economies. (**Box 4.3**).

Box 4.3**Impact of the global economic crisis**

The recent global economic crisis has cast doubts on previously upbeat forecasts for Asia-Pacific economies, which have been revised downwards (IMF 2008; World Bank 2009a). The economic downturn, especially the collapse of the housing sector in the United States, initially affected financial markets and subsequently cascaded into a global economic crisis. While it was initially believed that impacts on Asia-Pacific economies would be limited (some analysts argued that the economies have been 'decoupled'), this proved to be incorrect. There has been a significant slowing in regional economies, especially those that are highly dependent on FDI and exports. De-leveraging by banks has led to a severe credit squeeze and capital flight from Asia-Pacific economies, wiping billions of dollars from stock values. The credit squeeze has reduced availability of investment funds and operational capital. More importantly, recession in OECD economies – important markets for goods from the Asia-Pacific region – has particularly affected export-dependent Asia-Pacific economies. Reduced demand for export goods has led to closure of production facilities and consequent increases in unemployment. Closure of factories has led to the return of migrants to rural areas and there is anecdotal evidence of migrants from other countries returning to their home countries, affecting remittances and accentuating unemployment problems.

Although most countries are attempting to overcome problems through various stimulus packages, uncertainties about future growth rates persist. What is now being witnessed is very different from most previous financial recessions in terms of magnitude; recovery will be a very slow and gradual process (IMF 2009). A number of authors have postulated three possible scenarios for future growth of the global economy:

- Rapid recovery: 'The good scenario': this assumes that the current crisis is part of the normal business cycle and there will be rapid recovery of investment, production, consumption and trade, supported by various interventions. The global economy will soon revert to a business-as-usual scenario. However, to date the evidence fails to support this scenario.
- Slow and prolonged recovery: 'The bad scenario': many analysts point out signs that the decline of the global economy is bottoming and the process of recovery is underway. However, the current crisis is an outcome of fundamental weaknesses in economic and financial systems. Repairing these will be a prolonged process and economic recovery will likely be extremely slow and anaemic.
- Further decline: 'The ugly scenario': there are a number of analysts of the view that the decline is yet to reach its bottom and the worst is yet to come. Production, consumption and trade will decline further, as will employment and living standards, with significant increase in the number of impoverished people.

While growth rates in Asia-Pacific economies may decline, the region as a whole is expected to perform better than other regions in view of high savings and investment rates and the robust domestic demand in many countries. There are already indications of stabilization and improvement in the economic situation in view of the stability in the Asia-Pacific financial sector, lower costs of oil imports, and the impacts of economic stimulus packages that a number of countries have initiated.

Income distribution, inequality and poverty

High growth rates since 1990, especially in China and India, have led to significant reductions in poverty, although the region still accounts for the largest number of the world's impoverished people – of any region – as well as the largest number of undernourished (**Table 4.5**). Notwithstanding the declining proportion of poor people in Asia and the Pacific, the region still has more than 900 million people living on less than US\$1.25 per day (UNESCAP 2010). In terms of income distribution, Asian Development Bank analysis shows that, for a set of 15 selected Asian countries, the ratio of income/expenditure shares between the richest 20 percent in the population and the

poorest 20 percent in the population ranges from 4.46² (Pakistan) to 11.37 (China) (ADB 2007).

In addition to income differentials between countries, disparities within individual countries are on the increase, between different regions within countries. Most often, growth has remained centred on the segments of society and localities that are already relatively better off and are able to take advantage of opportunities provided by growth and globalization. Intra-national differences are particularly evident in large countries such as China and India. Under current models of development, largely relying on growth and 'trickle-down' effects, continued reduction of poverty will require that high growth rates are sustained.

Table 4.5. Undernourished populations in Asia and the Pacific

Subregion/region	1990-1992		1995-1997		2003-2005	
	millions	% share in total population	millions	% share in total population	millions	% share in total population
East Asia	183.5	15	152.0	12	131.8	10
South Asia	282.5	25	284.8	22	313.6	21
Southeast Asia	105.6	24	88.6	18	86.9	16
Oceania	0.7	2	0.5	2	0.9	3
Asia and the Pacific	572.3		525.9		533.2	

Source: FAO (2008a).

The incidental correlation between high levels of poverty and the distribution of forests has led to detailed analysis of forest-poverty linkages (RECOFTC 2009a). Much of the poverty in forested areas stems from lack of access to resources and poorly developed infrastructure – education, health care, transportation, etc. – curtailing opportunities. Ethnic and caste prejudices may also limit opportunities, although a number of countries are attempting to remedy this.

Policies and strategies pursued to address these inequities will have important implications on the forest sector. Two broad approaches are being used to 'bring development' to these hitherto neglected areas, with differing implications for forests and forestry.

- The most commonly pursued approach to improve linkages to underdeveloped areas involves intensified resource extraction (for example, logging, mining, large-scale commercial agriculture, tapping energy resources, etc.). However, such accelerated resource extraction seldom helps in sustainable development; while there may be some improvement in living standards through trickle-down processes, this approach fails to address basic issues of growing inequalities. There are several instances where such efforts (for example, logging and mining) have adversely affected the livelihoods of local communities. For example, logging in Sarawak during the 1990s engendered clashes with the indigenous Dayak population (UNHCR 2004).
- Alternatively, investments in human resources and technological developments lead to more people-centred development and this may also have a positive impact on forests and forestry, promoting sustainable resource management. Increasing incomes through the provision of ecosystem services (for example, ecotourism) will be an integral part of such development.

Economic growth can be expected to proceed at varying rates across countries, provinces and

² i.e. in Pakistan, total expenditure of the most wealthy quintile (20 percent) is greater than expenditure by the least wealthy quintile, by a factor of 4.46.

localities according to variances in initial conditions, factor endowments, quality of institutions and economic policies of countries. Inequalities between and within countries are unlikely to diminish during the outlook period and poverty, both relative and absolute, will still be a significant problem.

Furthermore, the number of impoverished and food-insecure people is projected to increase in the context of the current economic crisis, primarily due to significant increases in unemployment. Declines in demand for all products (especially in developed countries, which are severely affected by the economic crisis) have led to significant reductions in employment, consequent income losses and increases in poverty (**Box 4.4**). Governments in the region are pursuing a number of countermeasures, the effectiveness of which, in reviving economies, will be evident in due course.

Box 4.4	Economic crisis, unemployment and poverty				
<p>One of the major consequences of the economic crisis is escalating unemployment. Slackening in demand for products has led to closure of factories on an unprecedented scale. Loss of employment and consequent reductions in incomes have led to further declines in demand and further scaling down of production. Estimates by the International Labour Organization indicate sharp increases in unemployment as indicated in the table below.</p> <p>Unemployment scenarios (millions of people).</p>					
Region	2007	2008	2009		
			Scenario 1	Scenario 2	Scenario 3
East Asia	32.2	36.2	39.6	39.1	49.0
Southeast Asia and the Pacific	15.7	15.8	16.0	18.0	18.4
South Asia	31.8	32.2	32.6	35.7	37.1
Asia-Pacific	79.7	84.2	88.2	92.8	104.5
World	180.2	188.6	209.6	219.6	239.9
<p>Source: ILO (2009a).</p> <p>A potential consequence of loss of employment is reverse migration, especially migrant workers returning to their countries of origin and urban workers returning to their rural homes. It is too early to assess potential impacts, although there is anecdotal evidence of unemployed workers returning to rural areas. Loss of income and increases in poverty are major consequences.</p>					

Emergence of a middle class

While poverty persists in many areas, the rapid growth of a middle class in the Asia-Pacific region is a notable development, particularly in the most populous countries, namely China and India. The number of people likely to move into middle income categories in the next two decades is estimated at 800 million to 1 billion individuals. (**Box 4.5**). This will have a tremendous impact on demands for all products, including food, fibre and fuel and will have major consequences for natural resources, especially land, water and forests.

Box 4.5	The surging middle class in China and India
<p>'Middle class' is defined by the World Bank as, "persons with a per capita income of \$4 000 to \$17 000 (in 2000 international dollars)". In 2006, developing countries were home to 56 percent of the global middle class. According to the World Bank, this figure is expected to reach 92 percent by 2030, with China and India accounting for two-thirds of the expansion (contributing 52 percent and 12 percent of the total increase respectively).</p> <p>China</p> <ul style="list-style-type: none"> • China was home to 56 million people in the global middle class in 2000. • Driven by rapid economic growth, China's middle class is predicted to rise to 361 million people by 2030, and will represent nearly 25 percent of the country's total population. • China's middle class is expected to become one of the world's largest consumer market segments. <p>India</p> <ul style="list-style-type: none"> • Between 1985 and 2005 the annual average growth rate of household incomes in India was 3.6 percent. This is expected to accelerate to 5.3 percent between 2005 and 2025, significantly altering the shape of India's income pyramid. • Average household incomes will triple by 2025. Taking into account the distribution of income, the number of middle class people is expected to increase more than ten-fold; from about 50 million in 2005, to 583 million in 2025. • India will become the fifth largest consumer market in the world with consumption expected to quadruple by 2025. • Housing construction and provision of other utilities are expected to grow at an annual rate of 6.1 percent. <p>This growth in middle class consumers will have a tremendous impact on the global demand for goods and services. For example, construction and the demand for wood and wood products are expected to continue swelling in these countries despite the slowdown during late 2008 and early 2009.</p> <p>Sources: World Bank (2007c); Beinhocker <i>et al.</i> (2007).</p>	

More importantly, the next decade and beyond will see a more informed generation with very different values and perceptions. While aspiring to higher living standards, there will also be a growing emphasis on quality of products and services. Green products will be in greater demand, as will ecosystem services. People's willingness and ability to pay for ecosystem services will increase, including intensification of demand for recreational services – including ecotourism. To some extent this trend is already evident.

Structural changes and dependence on land

Changes in the shares of various sectors in terms of contribution to national incomes and employment provide an indication of structural transformation of national economies. From economies based predominantly on subsistence agriculture in the early half of the twentieth century, the share of the manufacturing and services sectors in Asia-Pacific economies has increased significantly during the last few decades. Growth of the industrial and services sectors have reduced dependence on agriculture for income and employment (**Table 4.6**).

Table 4.6. Agriculture's contribution to GDP and agricultural populations* in selected countries

Country	Contribution of agriculture to GDP (%)		Agricultural population as % of total population		Agriculture share in employment
	1990	2007	1990	2007	(year: %)
Lao PDR	61	42	78	75	1995: 85.4
Bhutan	36	21	66	65	n.a. (outdated figures only)
PNG	31	35	82	74	2003: 72.3
India	29	18	58	51	1995: 66.7
China	27	11	72	63	1990: 53.4
					2002: 44.1
Malaysia	15	10	26	14	1990: 26
					2004: 14.8
Thailand	12	11	57	44	1990: 64
					2005: 42.6
ROK	9	3	16	6	1990: 17.9
					2005: 7.9
Australia	5	2	6	4	1990: 5.6
					2005: 3.6
Japan	3	1	7	3	1990: 7.2
					2005: 4.4

* Agricultural population is defined by FAO as "all persons depending for their livelihood on agriculture, hunting, fishing and forestry. It comprises all persons economically active in agriculture as well as their non-working dependents."

Sources: World Bank (2007a); FAO (2010b).

While the share of agriculture in GDP has declined rapidly (largely due to rapid growth of the industrial and services sectors), agriculture still provides the majority of employment and income in some countries. Globally, the share of employment in agriculture has declined from about 40.8 percent in 1998 to 33.5 percent in 2008 (ILO 2009b). The decline in the number of people involved (either partially or fully) in agriculture in the various subregions is indicated in **Table 4.7**. However, the absolute number of those involved in agriculture in the region is rising, especially in South Asia, while in other subregions the agricultural populations remain relatively stable (Figure 4.6).

Table 4.7. Share of agricultural population in total population (%)

Region/ subregion	1990	2000	2006
East Asia	64	59	56
South Asia	59	54	51
Southeast Asia	55	49	46
Oceania	21	21	20
Asia Pacific	60	55	52
World	46	42	40

Source: FAO (2010a).

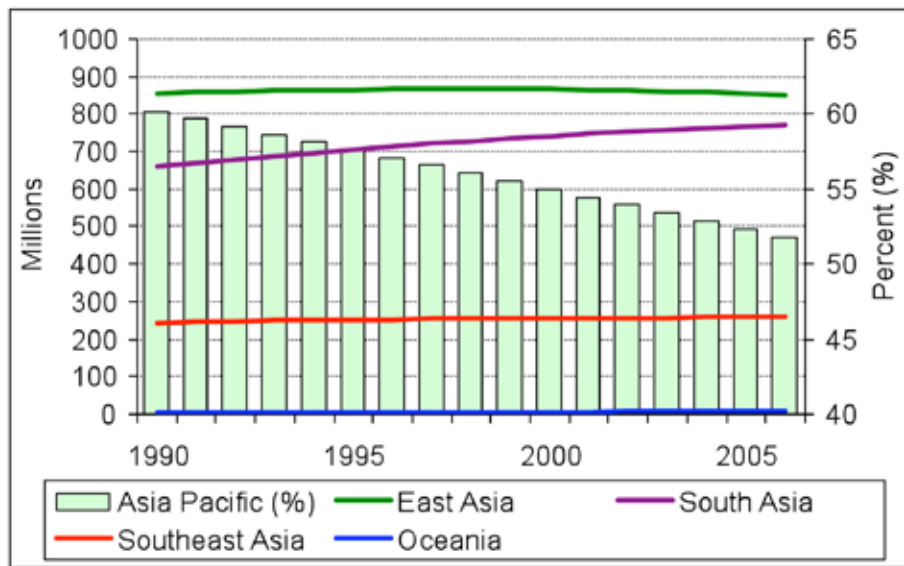


Figure 4.6. Population partially or fully involved in agricultural activities and percentage in regional population, 1990-2006

Source: FAO (2010a).

Taking into account the share of agricultural income and employment, the degree of structural transformation in Asia-Pacific economies varies:

- In several low income economies, the share of agriculture in GDP and employment, although declining, remains high. This implies continued dependence on land as an important source of income, with consequences for forests, especially in the context of high population growth rates.
- Middle income and emerging economies have witnessed significant reductions in the share of agriculture in GDP, largely due to rapid growth in the manufacturing and services sectors. However, agriculture continues to provide the majority of employment. Employment growth in non-agricultural sectors has often been extremely slow. More importantly, this also implies very low per capita incomes in the agriculture sector, increasing pressures on forests to provide income through a diverse array of activities, including collection of woodfuel, NWFPs, grazing, etc and further clearance for agriculture.
- In developed economies, agriculture's share in GDP and employment has declined significantly, reflecting major structural transformations. Even when agriculture remains important, for example in New Zealand, it is highly capital-intensive and the proportion of population directly dependent on agriculture is low. In some countries, for example Japan, agriculture receives significant subsidies and often the share of income derived from agriculture by farming households remains low.

Structural change and evolution in economies has important implications on land use, in general; and the forest sector, in particular. Land-use conflicts, especially on account of continued expansion of agriculture, are particularly severe in countries where most income and employment are from agriculture and where the pace of structural transformation is slow. Most deforestation occurs in these countries. Stabilization of national forest situations begins when dependence on agriculture declines, although in many cases there may initially be accelerated deforestation, as a result of investments in infrastructure, urban development and expansion of industrial cash crops. In general, reversal of agricultural expansion starts once economies increasingly come to rely on the industrial and services sectors for income and employment and agricultural growth takes place through enhancing the productivity of land. Along with income increases, demands for ecosystem

services and the ability to pay for them also increase, helping to improve the forest situation

While such transitions are taking place in the Asia-Pacific region, the pace of change will vary considerably among countries. Within the time horizon of this outlook (the year 2020), several countries will remain largely agrarian, depending primarily on agriculture and forests and forestry for significant shares of incomes and livelihoods. The pace of transition will largely depend on how quickly countries are able to recover from the current economic crisis. A 'job-less recovery' could increase dependence on agriculture and other informal sector activities with possible negative impacts on forests.

Investments in industries and infrastructure

While development of the industrial and services sectors could reduce land dependency and thus the compulsion to clear forests for farming, this in no way guarantees the protection of forests. Surging industrial demand has led to a different kind of pressure on forests, especially mining and infrastructure development. Mineral-rich forest lands are under severe threat and in many cases mining concessions have been justified under the pretext of 'national development' and bringing development to backward areas. Vast areas of hinterland are being opened up through road and rail networks, profoundly changing the economy of rural areas and land values. China and India have already invested huge sums in improving transportation networks, enhancing connectivity of areas (including forests) that have remained remote. Similar impacts can be expected from advances in the economic development corridors in the Mekong subregion, which could significantly affect forests in Lao PDR and Cambodia. A real estate investment boom has led to land price escalation and there are several instances of forest land being encroached upon to build resorts, golf courses, etc. Small-scale encroachment by landless farmers is being complemented or replaced by encroachment by real estate developers.

Rapid growth in demand for industrial raw materials will accelerate the pace of exploitation of minerals and water (for energy and irrigation) in the Asia-Pacific region. This will be particularly the case for resource-rich countries, which are responding to the growth in demand for raw materials and energy in the emerging economies. For example, Bhutan and Lao PDR are giving considerable thrust to hydropower generation as an important source of foreign exchange earnings. This has important implications on forests and forestry in such countries. Land-use conflicts are expected to continue and intensify as the sources of pressure on forest land shift from agriculture to the industrial and services sectors.

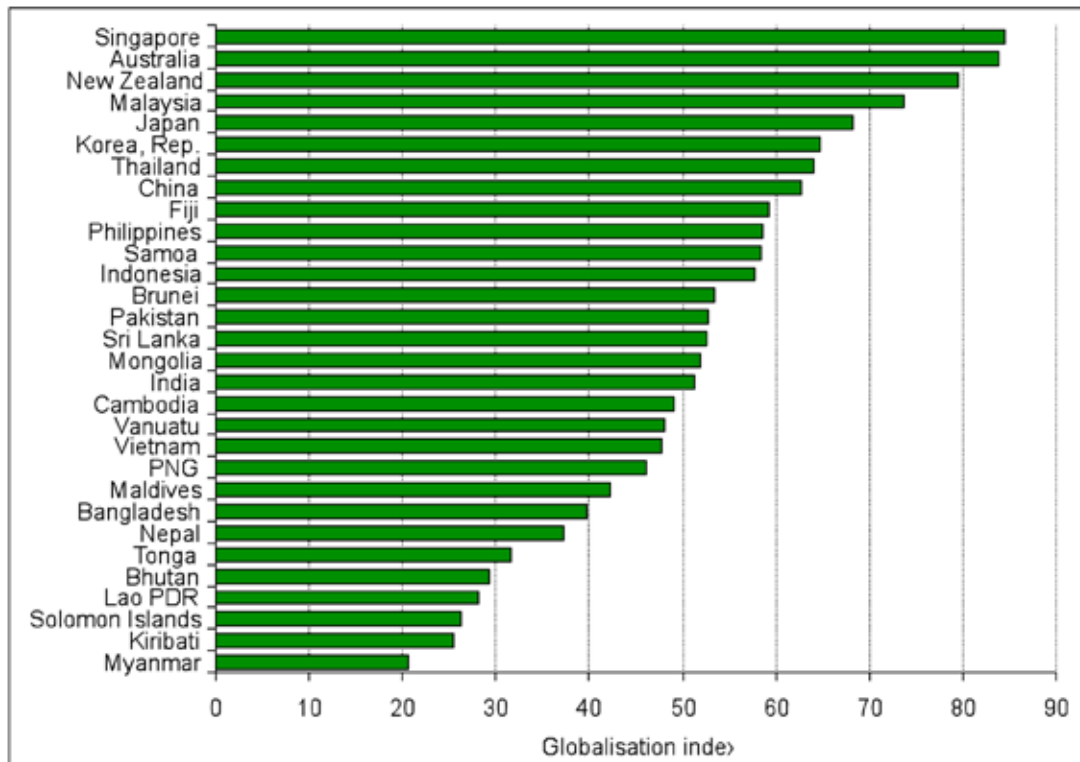
Globalization and its impacts

Globalization – involving accelerated flows of investments, technology and goods and services across national borders – has been a major factor in the development of the Asia-Pacific region (Inoguchi 2010). Globalization also encompasses information exchange, travel, cultural interaction and global agreements and regulations to support the increased interaction among people. Although the extent to which Asia-Pacific economies have been integrated into the global economy is variable (**Box 4.6**), the rapid growth of many Asia-Pacific economies can, to a significant extent, be attributed to their ability to take advantage of the opportunities provided by globalization.

Box 4.6

Index of globalization for selected Asia-Pacific economies

An index ranking the cumulative levels of economic, social and political globalization (a score of 1 is credited to the least globalized countries and scores of 100 accrued by the most globalized countries) incorporates a number of Asia-Pacific countries. The index ranks Singapore, Australia and New Zealand as the most globalized economies, while Myanmar, Kiribati and Solomon Islands are the least globalized.



Source: Source: Dreher (2006, updated Dreher *et al.* 2008).

Factors that have accelerated globalization processes include:

- *Global and regional economic cooperation and trade agreements.* Although there has been a stalemate as regards the Doha round of WTO trade negotiations, several regional and bilateral agreements have helped to liberalize trade in the region. Tariff barriers have been significantly reduced and reductions are expected to continue, notwithstanding potential short-term setbacks.
- *Expansions in FDI and trade.* The Asia-Pacific region's share in FDI and trade has expanded phenomenally during the last two decades. However, the ability of countries to take advantage of these opportunities has varied depending largely on national political and institutional environments.

Three broad patterns of globalization have been observed in the Asia-Pacific region:

1. Growing affluence and increasing demand for consumer products in some countries have attracted FDI, largely to take advantage of market opportunities. Transnational corporations, already well-established in many developed and emerging economies, have invested heavily in industrial and infrastructure facilities intended to cater to the growing demand for products and services. A typical example, in the forest sector, is the pulp and paper industry. Economic growth implies a rapid expansion in markets for a wide array of paper

products and this has led to an enormous capacity expansion in the sector, during the last two decades. More than half of all new investments in pulp and paper facilities have been in the Asia-Pacific region.

2. For a number of countries, especially those rich in natural resources (including minerals, land and forests) and/or with abundant labour supply – and where regulatory environments are weak – globalization has led to intense exploitation of these resources. Examples include large-scale logging in many Southeast Asian countries, and rapid expansion of labour-intensive production of furniture (for example in China, Viet Nam, Indonesia, etc.). Escalating prices of food and other agricultural products have led to large-scale public and private sector land acquisition by capital-rich countries (**Box 4.7**).

Box 4.7	Agricultural land acquisitions in Asia
<p>Soaring food prices in 2007 and 2008 led to a scramble to acquire agricultural land by governments and private investors from countries with limited arable land and growing demand for food and other products (for example rubber), including biofuel crops. Such acquisitions have been reported in Cambodia, Indonesia, Lao PDR, Mongolia, Pakistan and the Philippines. Key Asia-Pacific countries acquiring land include China, India and ROK. Globally, behind Africa, Asia is arguably the hottest target for farmland investments. The International Food Policy Research Institute has highlighted several proposed or finalized Asia-based deals in excess of 100 000 hectares. Because most Asian countries limit foreign ownership of land, leasing is the easiest and most common form of international land investment in Asia. A number of studies have highlighted the economic, social and environmental impacts of such overseas acquisitions. Forest clearance and displacement of traditional users, including small farmers, are major issues relating to such land acquisitions. Local communities are sometimes 'pressured and intimidated' into leasing their land.</p> <p>Source: Kugelman and Levenstein (2009).</p>	

3. Moving production facilities offshore – from high cost countries to the relatively low-wage Asian countries – is another important trend.

As described earlier (**Box 4.3**) the recent economic crisis has had a negative impact on these aspects of globalization, especially as consumer demand slumped in developed country markets.

While the globalization process will persist and strengthen in coming years, globally-driven development could proceed in new directions (Inoguchi 2010). Much of the earlier globalization process has been driven by the corporate sector, in particular transnational corporations focused primarily on profit generation. This has led to considerable economic asymmetries, with most of the benefits accruing to small segments of the population. Reactions to such exploitative globalization could lead to:

- a) Strengthening of anti-globalization sentiments, driven by a coalition of diverse interests; resulting in protectionist measures and a reversal of the globalization process; and
- b) A more inclusive approach to globalization, involving all stakeholders and fully taking into account the social and environmental implications of globalization.

Considering the diverse situations prevailing in the region, it is difficult to make generalized predictions about how the process of globalization will evolve in coming years.

POLITICS, POLICIES AND INSTITUTIONS

Changes in the larger policy and institutional environments are probably the most important drivers of change affecting the forest sector – directly and indirectly. Overall, national economic development is largely a function of the performance of the larger political system, especially, its effectiveness in creating a favourable policy and institutional environment, including capacity to resolve intersectoral and interstakeholder conflicts.

Politics and governance

Changes in the larger political and institutional environment directly and indirectly impact forests and forestry. The overall political frameworks in Asia-Pacific countries differ considerably, ranging from democratic governments elected through transparent processes to authoritarian regimes providing little space for people's participation. In between there are flawed democracies and hybrid regimes (Economic Intelligence Unit 2009 – see **Box 4.8**). While it is possible to characterize political systems, often subjectively, envisioning the direction of future changes is extremely difficult. Although there has been some shift from authoritarian regimes and an environment for pluralism is emerging (empowering a multitude of players), the majority of the people continue to live under hybrid or flawed democratic environments.

Box 4.8	Democracy Index 2008
<p>The Economic Intelligence Unit has developed a composite system of democracy ranking for countries based on (a) electoral processes and pluralism, (b) functioning of government, (c) political participation, (d) political culture and (e) civil liberties. Full democracies have a composite score of 8 to 10, while countries with less than 4 are grouped as authoritarian regimes. Between these extremes are (a) flawed democracies with a score of 6 to 7.9 and (b) hybrid regimes with a score of 4 to 5.9.</p> <p>In the Asia-Pacific region, only four countries are characterized as full democracies (Australia, Japan, ROK and New Zealand), while the majority are categorized as flawed democracies or hybrid regimes. Although there has been some shift from authoritarian to hybrid regimes, on the whole the development of true democratic systems and pluralism has stagnated.</p> <p>Source: Economic Intelligence Unit (2008).</p>	

While authoritarian and hybrid regimes will present semblances of outward stability, 'flawed democracies' could witness considerable turmoil, especially as diverse groups, including those who have been marginalized for a long time, exert pressure to gain a share of power. Improved opportunities for education and better access to information will have profound impacts, helping in the transition to full democracies. However, there could be polarization of divergent groups, with potential for continued conflicts and instability. State capitalism and government-business coalitions are gaining traction in many countries. Often such coalitions promote appropriation of public resources (through less-than-transparent privatization processes), accentuating conflicts (**Box 4.9**) and undermining the emergence of fully functional democracies.

Box 4.9	Politics, governance and forest conflicts
<p>In view of high population densities and growing demands for goods and services, competition for limited natural and financial resources is very intense in many Asia-Pacific countries. Failure to develop efficient political processes, corruption and poor governance have increased conflicts, some of which – over time – have transformed into religious, political and ethnic conflicts. For various reasons, forests are often the most affected areas. Forests adjoin some of the most underdeveloped and deprived areas, often populated by the most marginalized groups in society. Government presence is often very limited in these areas and, when present, is often seen as an agent of exploitation. With increasing demand for resources, vast tracts of forests have been opened up for logging, mining, etc, undermining the livelihoods of local communities. Such marginalization has provided a fertile ground for the emergence of extremist movements in many countries in the Asia-Pacific region. In some countries, vast tracts of forests receive little or no effective management, due to the presence of insurgents. Often timber and other products are important sources of income to support conflicts.</p>	

Policy changes

Overall political changes are unleashing changes in policies in several spheres, affecting forests and forestry directly and indirectly. Some of the major changes in the larger policy environment, outside the forest sector, are outlined below:

1. Changes in economic policies, especially an emphasis on market-oriented approaches, including privatization. This has been a major thrust for most governments in the Asia-Pacific region, although the pace of reform has varied, depending on political systems. Through the second half of the twentieth century, several countries in the region were pursuing a socialist planning framework with substantial government control on economic activities. These economic regimes are now changing, though the pace of change is variable. While some have opted for a gradualist approach, in others changes have been abrupt; often in response to political and economic crises. Considering that Asia-Pacific countries have generally benefited from more open economic policies, economic liberalization will continue, notwithstanding the occasional protectionist sentiments aired in the context of the current economic crisis.
2. Broad national economic policies also affect other policies relating to land use, energy, industry, trade and environment, all in turn affecting forests and forestry – directly and indirectly. Of particular importance in regard to land use are policies that assign ownership, tenure, or rights to use of land. Ownership and security of tenure form the backbone of efficient land use and have a direct bearing on forests and forestry. For example, China is implementing changes in tenure relating to forest ownership and these will have significant impacts on conservation and management of forest resources (**Box 4.10**). Similar changes in land tenure are being made in several other countries – for example the Forest Rights Act in India and similar legislation in other countries (see **Box 2.23**).

Box 4.10.**Forest tenure reform in China**

Collective forests in China account for 58 percent of forest land and have great potential to significantly contribute to rural livelihoods. Tenure in China's collective forests has undergone many changes in the past 30 years. While these forests were originally managed by village-level administrations, in 1980 some provinces initiated a partial transfer of user rights to households. However, a lack of clear and secure rights and few guaranteed tangible benefits from the forests, combined with little input into decision making, resulted in low motivation for forest management by local populations and resulted in continuous forest degradation.

In 2003, China embarked on a new phase of reform of the tenure system for collective forests in order to address this problem. The reforms will have far-reaching impacts and historical significance. The reforms focus on devolution of land-use rights and forest ownership in collective forest areas to individual households, allowing households to exclusively use these lands and forests for income generation and livelihood improvement. To date, 59 million hectares of collective forests have been transferred to individual households, accounting for 34.5 percent of the total collective forest area. By 2013, it is expected that nearly all provinces in China will have undertaken tenure reform for collective forests.

Tenure reform for collective forests is a top priority for the State Forestry Administration and also receives political support from the highest levels, under the New Countryside Development Initiative. In June 2008, the Central Committee of the Communist Party of China and the State Council of China issued a set of guidelines promoting tenure reform for collective forests. The guidelines confirm the importance of collective forest tenure reform to increase forest farmers' incomes and in promoting forestry development. In tandem with collective forest transfers to individual households, five key areas will be addressed to secure the new tenure system:

1. Reform of the current harvesting management mechanism including development of a new harvesting quota system to ensure that farmers have real rights to the forests.
2. Regulate forest land markets and forestry markets to ensure fair and efficient trade.
3. Support the public finance system, for example, by establishing and refining compensation systems for provision of ecological benefits through forests.
4. Increase sources of forest investment, for example, promoting mortgage loans secured by forest ownership or land-use rights.
5. Refine social services systems for forestry, including development of Forest Farmer Cooperatives.

Sources: SFA (2009); Ma Qiang (personal communication, 2009).

3. Policies relating to liberalization of investments and trade have had a range of impacts on the forest sector. Rapid expansion of FDI (especially in wood industries) and increased trade in forest products are two major outcomes. Trade liberalization on account of several countries' accession to the WTO, and other bilateral and multilateral trade agreements, has also impacted forestry in several ways. Local and national supply chains have expanded into global supply chains; local availability of wood and other raw materials has become less important in developing a viable wood products industry.

The larger policy changes – in economics, industries, agriculture, trade, environment, energy, etc. – have brought about significant changes in forest policies, reflecting society's changing perceptions about the roles of forests and forestry. Although land-use conflicts persist in most countries, there has been increasing recognition of the multiple functions of forests. While direct economic benefits – from converting forest land to grow more profitable crops, or focusing on commercial wood production – dominated forest policies a few decades ago, this has changed in

many countries; an increasingly environmentally-conscious public has brought about major policy shifts, with large tracts of forests set aside exclusively for service functions.

Institutional changes

Shifts in policies have led to concomitant institutional development within and outside the forest sector, at different paces in different countries. Institutional changes largely reflect a shift from centralized control at the national level, to greater involvement of subnational and supra-national entities. These changes stem from two broad tendencies; towards localization and towards globalization.

The shift from centralized national level institutions to the greater involvement of both local and international institutions has created substantial tensions. Economic and environmental implications of globalized resource use have necessitated a series of international initiatives relating to economic cooperation and trade. Similarly, a number of initiatives intended to address global environmental problems have taken root, especially since the 1992 United Nations Conference on Environment and Development (UNCED).

Forestry institutions are under tremendous pressure to bring about changes in their functions and structures (FAO 2008b) and there have been some major changes in this regard in the Asia-Pacific region. Although public sector forestry agencies have dominated the institutional scene for a long time, the last couple of decades have witnessed a significant pluralization of institutional arrangements. Some of the major changes in this regard include:

- Privatization of many commercial functions, especially logging, plantation management and wood processing.
- Separation of policy and regulatory functions from management functions within the public sector, leading to the establishment of commercially-managed, public sector corporations.
- Greater involvement of local communities in the management of forest resources. Pioneering efforts in this regard include systems of Forest User Groups in Nepal, Community-Based Forest Management in the Philippines and Joint Forest Management in India. In most South Pacific countries, communal ownership has been the norm for centuries, although presently many of the benefits from management of natural resources do not accrue to communities. In many countries, marginalization of local communities during colonial periods is being remedied through changes in policies and legislation.
- Civil society organizations are increasingly active, although the extent of their involvement depends on overall political frameworks. Both national and international civil society organizations are actively shaping the forest agenda at local, national and international levels and this involvement is expected to continue.

Forest governance issues

In many countries with weak political frameworks, forest governance continues to be a major challenge on account of corruption. Increasing international attention is being given to improving forest law enforcement to counter illegal logging and its associated trade, and corruption. In the context of rapid escalation of wood product demand and growing trade, countries with large tracts of forests and inadequately developed policy and institutional frameworks have particularly suffered from increased illegal logging. Illegal logging and corruption have the following consequences:

- Loss of legitimate income from forests as a significant share is appropriated by those involved in illegal logging and other corrupt practices.

- Diminished attractiveness of countries as destinations for FDI, especially where corruption imposes significant informal costs on investors.
- Illegal logging makes sustainable forest management less attractive. The expansion of illegal logging and trade promotes a parallel economy, which undermines legal operations. There is growing concern about the larger ramifications of illegal logging. The criminality associated with illegal logging tends to undermine the rule of law and affects democratic institutions.

A number of initiatives are underway to improve forest governance, law enforcement and legal trade. The most important of these is the Asian FLEGT (trade) process, involving key forestry countries, especially in Southeast Asia. With greater cooperation among law enforcement agencies of the countries (see **Box 4.11**), tracking illegal production and trade of forest products is garnering increased attention. Some recent developments, such as inclusion of illegal trade of wood under the purview of the United States' Lacey Act and due diligence procedures developed by the European Union will have far reaching implications on forest products trade in Asia and the Pacific (**Box 4.12**).

Box 4.11	Forest law enforcement and governance in Asia
<p>In Asia, multilateral arrangements on forest law enforcement and governance (FLEG) have targeted explicit improvement in reducing corruption and illegal activities within – and associated with – forests and forestry. In East Asia, a FLEG process emerged out of a series of multistakeholder consultations in 2001. The Bali Declaration, arising from a 2001 Bali Ministerial FLEG meeting, affirmed commitments to eliminate illegal logging and associated trade, and corruption. It also developed a comprehensive list of actions – encompassing a range of dimensions across the political, legislative, judicial, institutional, administrative, research, policy and advocacy spheres, as well as agreement to share expertise and disclose information relating to conservation and protection – to be undertaken at national and international levels. However, while the FLEG process has certainly helped to raise the profile and level of debate on forest governance, it is more difficult to ascertain its impacts on the ground.</p>	

Box 4.12	New trade and procurement policies impacting timber trade and illegal harvesting
<p>Amended Lacey Act</p> <p>In May 2008, the United States Congress passed landmark legislation to address the role of the United States market in the global ‘illegal logging crisis’; thereby becoming the first country to ban imports of illegally harvested wood and wood products. A 2007 analysis by the Environmental Investigation Agency (EIA) estimated that United States consumption of high-risk timber and wood products (not including pulp and paper) comprised up to 10 percent of annual wood imports, to the value of US\$3.8 billion, in 2006. The Lacey Act – a longstanding wildlife trafficking statute (originally passed in 1900) – was amended to prohibit commerce in plants and derived products, including all timber and wood products that are illegally harvested or traded. It also increased transparency by requiring importers to declare information on species, country of origin and similar information that can be used to validate the legality of imports. The legislation also prohibits trade in animals and plants sourced in contravention of another country’s laws. The effects of the revised Lacey Act are already being felt in the market.</p> <p>EU due diligence</p> <p>In April 2009, the European Parliament passed a proposal to strengthen legislation to crack down on the illegal timber trade in its member states. The new ‘due diligence system’ makes it an offence to sell wood products and timber derived from illegal logging, and increases the responsibility of operators by requiring information on the source of products, including country and forest of origin. Data on suppliers and intermediaries will also be required. EU member states must ensure – within two years of the regulation’s entry into force – that all timber and timber products be labeled with this information. Financial penalties, to be set by EU member states, must reflect the degree of environmental and economic damage caused by the illegal activity.</p> <p>Sources: EIA (2009a); EIA (2009b); European Forest Institute (2009); NEPCON (2009).</p>	

Illegality is not confined only to timber products. In recent years, there has been rapid growth in trade of NWFPs, including plants and animals. A number of (mainly developed) countries have established mechanisms – for example Wildlife Crime Bureaus – to detect and prevent illegal trade in animals and animal parts. Forensic laboratories specifically aimed at fighting wildlife crimes have been established in a number of countries. However, the variability and complexity of wildlife trade chains, the porosity of borders and difficulties in guarding large areas against the threat of wildlife removal, makes wildlife depletion difficult to address (Traffic 2008a).

ENVIRONMENTAL DRIVERS

Increasing demands for goods – in response to population and income growth – have led to rapid depletion of natural resources and declines in environmental quality; often adversely affecting some people's livelihoods. A number of societies in Asia and the Pacific have a strong environmental ethic, rooted in religious and cultural beliefs; some of which are being reinforced in the context of growing ecological knowledge and awareness. Instances of adverse environmental impacts stemming from inappropriate resource use (and impacts on livelihoods) have created substantial awareness among the general public of the need to pursue paths of sustainable development.

Key environmental drivers that influence the use of natural resources are discussed in the following sections.

Local environmental issues

There are numerous instances of local environmental issues mobilizing public action to protect forests and other natural resources. An early example of local action that created widespread concern about the adverse impacts of deforestation was the 'Chipko movement' in the Indian Himalayas. Forest management that focused largely on wood production came under increasing criticism from local communities and civil society organizations in view of adverse impacts on biodiversity, declines in the quality, quantity and regularity of water supplies, and degradation of land. Similar examples have been, and remain, widespread throughout the region – including protests against natural forest logging in New Zealand through the 1970s and 1980s; ongoing protests against logging old-growth forests in Tasmania, Australia; indigenous people's protests against logging in Sarawak, Malaysia; and protests against land clearing in Papua and Kalimantan in Indonesia. More recently, instances of developmental activities – for example construction of large irrigation and hydropower projects and mining – are affecting the livelihoods of people through environmental degradation.

Protests by local communities are resulting in more systematic efforts to assess the impacts of developmental activities on the environment and livelihoods. Many countries are making ex-ante environmental impact assessments a prerequisite for implementation of development projects. Systems of public hearings have been introduced in a number of countries to ensure broad-based participation in making decisions that have environmental implications. For example, in Pakistan the Environmental Protection Agency conducts public consultation and hearings on a wide range of environment-related issues.

National environmental issues

National level environmental disasters, such as floods and landslides, have often triggered responses by governments. This has led to some drastic interventions including partial and total logging bans, as well as increased investments in afforestation in a number of countries. A growing constituency of environmentally-conscious citizens, including relatively high income groups, is demanding improvements in the quality of environmental management and wields sufficient influence to sway policy decisions. Increasingly affluent middle-classes are willing and able to pay for some ecosystem services. In many Asia-Pacific countries a very active domestic constituency, including civil society organizations, is driving the environmental agenda.

In response to local and national environmental issues, a number of countries have strengthened their environmental legislation. New institutions, including 'green courts', have been established in some countries to resolve disputes relating to the environment (**Box 4.13**).

Box 4.13 **'Green courts' in Asia-Pacific countries**

'Green courts' are trial courts especially designated to adjudicate cases involving environmental disputes and violations of environmental laws, including forestry laws. Motivation to establish green courts has come mainly from heightened awareness in different sectors of society regarding environmental injustices and intergenerational inequities, driving a continuing increase in numbers of environmental cases pending in courts.

A growing number of legal practitioners acknowledge that the traditional lenses through which the judicial eye interprets legal provisions and applies them to environmental cases have become inadequate. Environmental law has grown as a specialized area of law, requiring separate adjudication due to certain unique features (Sharma 2008) including:

1. Requirements to resolve complex technical and scientific questions.
2. Overlapping of civil and criminal remedies, as well as public and private interests in environmental adjudication.
3. Rapid evolution of a substantial body of international environmental instruments spanning a range of issues including: trade in endangered species including timber, ocean and marine pollution, illegal transnational shipments of hazardous wastes, and global climate change.
4. Development of fundamental environmental principles such as the precautionary approach, polluter-pays, sustainable development, prevention at source and procedural transparency.

Asia-Pacific countries that have established green courts include Australia (1979), New Zealand (1991) and the Philippines (2008). India has developed draft legislation to create a similar mechanism.

Australia's Land and Environment Court and New Zealand's Environment Court act as 'one-stop shops' or single windows for all environmental adjudication. They comprise judges and commissioners who are required to have a wide mix of qualifications. Both courts have 'reviewing and enforcement jurisdiction' in relation to environmental and planning statutes.

In the Philippines, green courts comprise 117 trial courts at municipal and regional levels, mandated to prioritize hearings of environmental cases over those that are criminal and civil in nature. Forty-five of these 117 green courts have been designated as 'Forestry Courts'. In 2006, cases related to violations of the Forestry Code represented 65 percent of 2 353 pending environmental cases.

In India, although legislation to establish a green court is pending, a 'Forest Bench' is already operational within the Supreme Court. The Forest Bench is a three-judge bench that deals with prominent issues including conversion of forest land for non-forest purposes, illegal felling, potentially threatening mining operations, afforestation and compensation by private user agencies for using forest land. Around 2 000 interlocutory applications relating to forest issues have been disposed under India's Forest Bench. However, the Forest Bench has been criticized as providing micromanagement of forest issues and being a backwards step – towards recentralizing forest management through widening of the government approval window in respect of non-forest uses and working plans for timber felling.

Sources: Sharma (2008); Soriaga (personal communication, 2009).

Regional and global environmental issues

Transboundary issues such as smoke haze, wildlife enforcement networks and shared ecological corridors, present challenges to countries in the region. Shared ecosystem and water resources are notably contentious, including zones around the Mekong River Basin and the Bay of Bengal. Initiatives such as the Mekong River Commission (MRC), involving neighbouring countries (in the case of the MRC – Thailand, Lao PDR, Cambodia and Viet Nam) have been created in an attempt to coordinate joint management of shared water and related resources for mutual benefits.

Increasingly, global environmental issues are influencing resource-use decisions. This largely stems from the fact that many environmental problems are global in nature, affecting all human beings, and need to be addressed through collective global action. Climate change is one of the most important of these and, not surprisingly, international initiatives are becoming a major driver of climate change mitigation and adaptation efforts (**Box 4.14**). Following UNCED there have been a number of international conventions relating to various aspects of the environment – for example, the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). Several other agreements and conventions precede UNCED, for example, the Convention on International Trade in Endangered Species (CITES) and the Convention on Wetlands of International Importance (Ramsar Convention). Most international environment conventions and agreements are backed by various implementation mechanisms, providing technical and financial assistance to facilitate country level action. Many countries have developed national strategies and action plans for aspects such as biodiversity conservation, control of desertification and climate change mitigation and adaptation, taking advantage of the various conventions. However, implementation often lags behind policy development on account of resource and institutional constraints.

In general, there is greater awareness of environmental issues at local, national and global levels. However, important questions surround the extent to which these global issues will lead to concerted national and local actions. While international financial and technical assistance will encourage some action, overall impacts will largely depend on national level commitments and will likely be reliant on market-based solutions.

Climate change mechanisms: a key global and regional driver

Climate change mitigation and adaptation have become major issues impacting forests and forestry. International attention is focusing on carbon emissions from deforestation and forest degradation, as well as the potential for conservation, afforestation and reforestation to significantly enhance carbon sequestration. A variety of mechanisms have been developed to potentially support forestry-related climate change initiatives. These include:

- Compliance carbon markets, particularly the afforestation and reforestation provisions of the Clean Development Mechanism (CDM); a system under the Kyoto Protocol through which developed countries can accrue credits by financing greenhouse gas emissions reductions – or sequestration – projects in developing countries.
- Voluntary carbon markets, which for forestry include a wide range of voluntary arrangements and contracts under which one party voluntarily commissions another party to reduce emissions through forestry activities. The arrangements are voluntary in the sense that the parties are not forced to enter such an arrangement by legislation or global treaty and the nature of the arrangement is flexible according to the parties' requirements.
- Reducing Emissions from Deforestation and Forest Degradation (REDD), which envisages the utilization of funding from developed countries to reduce deforestation and forest degradation in developing countries, thereby reducing carbon emissions, but with potential co-benefits such as biodiversity conservation (**Box 4.14**).

During the past decade, climate change has garnered enormous international attention and has been instrumental in returning forestry to centre-stage in global environmental discussions. Given this dominance of climate change policy – especially potential to change the ground rules and playing field – forestry in many countries has been in something of a holding pattern, as governments, the private sector and civil society organizations await clear direction from global discussions.

For developed countries, most are seeking to align climate change policy responses with others; seeking not to place their industries at a substantial disadvantage to competing nations. In New Zealand, for example, forestry was the first sector included within the national Emissions Trading Scheme (ETS). However, the rules of the scheme have been amended several times, most recently – after a change of government – in December 2009. Similarly, Australia has deferred implementation of its Carbon Pollution Reductions Scheme (CPRS); initially to July 2011, and more recently until 2013, and is still considering whether and how forestry will be included in the scheme.

Developing countries have mainly been awaiting decisions on the implementation of REDD and related instruments, including clarification of funding mechanisms. In this regard, the 2009 Copenhagen Accord delivered a mixed result. On the one hand, it affirmed the need for immediate establishment of mechanisms to mobilize resources for REDD-plus, but on the other hand, the timetable for implementation and more detailed guidance on mechanisms and specific funding has yet to be developed (**Box 4.14**).

Box 4.14	Forestry provisions in the Copenhagen Accord 2009
<p>Forest-specific text in the Copenhagen Accord occurs in two sections.</p> <p>Section 6: We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries.</p> <p>Section 8: Scaled up, new and additional, predictable and adequate funding as well as improved access shall be provided to developing countries, in accordance with the relevant provisions of the Convention, to enable and support enhanced action on mitigation, including substantial finance to reduce emissions from deforestation and forest degradation (REDD-plus), adaptation, technology development and transfer and capacity-building, for enhanced implementation of the Convention.</p> <p>Source: UNFCCC (2009).</p>	

In general, it is fair to conclude that over the coming decade, “where climate change goes, forestry will follow”. Climate change will be the key determinant in shaping new forestry policies; for better or worse:

- ‘For better’ – if international negotiations yield significant new and additional funding for forestry; within workable mechanisms that encourage and enable real change on the ground. Similarly, if discussions create a global environment in which compliance and voluntary markets for forest-based carbon sequestration can flourish. At present, it seems unlikely that discussions will progress rapidly enough that visible changes to forests in the Asia-Pacific region will be seen by 2020. However, it should be hoped that necessary international agreements, conventions and policy foundations can be put in place. The onus will then be on the forestry sector to deliver on its carbon sequestration potential and promises.
- ‘For worse’ – if protracted negotiations on forestry and climate change unravel, yielding no new mechanisms for support; or if new mechanisms are either too unwieldy to be workable, or if supporting funding and resources are negligible. In this case, there is potential that forestry may have spent a decade, debating and planning for a future that never arrived. Such a scenario could be envisaged if the world concludes that it is far easier to achieve carbon gains from approaches devoid of the difficulties and complexities associated with forestry and REDD. In this case, forestry might move back to the sidelines of international attention.

TECHNOLOGICAL CHANGES

Technological changes will be a major driver impacting forests and forestry, affecting all parts of the sector; although in many countries, the uptake of cutting-edge technologies is slow and uncertain and may not have widespread impacts in the period to 2020. Technology will determine which goods and services are produced; how and where these are produced; which processes are used; how they are transported to markets; where they are sold; and even how they are disposed of at the end of their useful life. Enhancing productivity and resource-use efficiency will become critical in the resource-constrained situations that exist in many Asia-Pacific countries. Climate change mitigation and adaptation will also require significant changes in science and technology capacities.

Markets and public policies are the main factors impacting technological developments. Demand for goods, including associated costs and prices, has been a major determinant of technologies. For example, labour shortages (and consequent high wages) have led to the development of labour-saving, capital-intensive technologies. As environmental and social issues become important, public policies and legislation (that change cost and incentive structures) are becoming important drivers of technological changes. Direct investments in research and development by governments play a major role in this regard.

The state of science and technology in the Asia-Pacific region differs significantly among countries, primarily reflecting the diverse social and economic conditions. A strong correlation exists between levels of economic development and the sophistication of science and technology. High income countries (for example Japan, Australia, ROK and New Zealand) have been able to invest significantly in science and technology, giving these countries a competitive edge in high technology products. Emerging economies, such as China and India, and middle income countries, such as Malaysia and Thailand, are also investing in science and technology; increasing their competitiveness in producing certain products and services. In most other countries research and development capacity remains underdeveloped, affecting capacities to produce products and services with high components of value added, or to develop more efficient, competitive and cost-effective technologies. The absence of significant domestic science and technology capacity leaves many countries highly dependent on technologies developed elsewhere, notwithstanding that these may not be optimal to meet specific needs. While some technologies can be easily adapted, others require substantial modifications and many countries are lacking such capacity.

Broadly, innovation in forestry can be grouped as follows:

- Productivity-enhancing technologies (for example, genetic enhancement, tree improvement, utilization of wastes and residues, innovations that enhance labour productivity).
- Harvesting and processing technologies that improve recovery (reducing input-output ratios) and reduce energy needs (for example, reduced impact logging and reconstituted wood products).
- Technologies that enhance social and environmental benefits (for example, technologies that enhance carbon sequestration capacities).

These various technologies are discussed in greater detail, below.

Productivity-enhancing technologies

Improving land productivity will remain a major concern in the Asia-Pacific region, considering the very high population densities in many countries. As increasing areas of forest are set aside to provide ecosystem services, it will be imperative to enhance productivity of areas that remain earmarked for wood production. Most countries have a long history of efforts to improve productivity of plantations. Much of the thrust of conventional tree improvement programmes has been to take advantage of natural differences in productivity and other desirable characteristics (for example, resistance to pests and diseases, or tolerance of salinity and alkalinity).

Advances in gene transfer technologies and tree genomics are providing new avenues for genetic modification of trees. Qualities considered for genetic modification include herbicide tolerance, reduced flowering or sterility, insect resistance, wood chemistry (especially lower lignin content) and fibre quality. Reducing lignin content is receiving increased attention in the context of production of cellulosic biofuels. However, research and deployment, including field trials of genetically modified trees, remain contentious issues. Concerns have been raised about impacts on ecosystems, especially potential invasiveness, impacts on biodiversity and the transfer of genes to other organisms.

Harvesting and processing technologies

Improving economic efficiency and minimizing environmental damage have been the primary objectives of harvesting innovations. Labour scarcity, allied with increasing costs of labour, has encouraged significant mechanization of logging and transport industries. Sophisticated harvesting, conversion and transportation technologies have been deployed in a number of countries, especially in industrial forest plantations.

New techniques have been developed to identify the source of logs; using tags, paints and chemical compounds that can be read by detection devices. New-generation radio frequency identification tags and bar codes can easily track the movements of logs from forests to markets, helping to distinguish legal timber from illegally-sourced wood. Tree genome studies could eventually help to identify genetic differences between individual trees and this could be a powerful tool in combating illegal logging, especially when logs are processed as furniture and other products (Oi 2009, see **Box 4.15**).

Box 4.15	Tree genome technologies to fight illegal logging
<p>In the past, systems of permits to collect and transport timber from forests provided a relatively effective approach to prevent illegal logging. However, rapid growth of international trade in highly processed products has created a number of challenges, as wood is converted into processed products – including furniture, paper and panel products – transported over long distances and sold in distant markets. Once converted into processed products, it becomes very difficult to identify sources of supply or to determine whether the timber was collected legally or illegally. Ongoing efforts to develop genome technologies that are able to identify differences in tree DNA could significantly improve the ability to track origin of products. Proving that a particular product has been produced from illegally procured timber remains a major problem and is extremely expensive. DNA analysis could provide strong evidential techniques, even when timber has been transformed into furniture, panel products, paper, etc. This technology should increase the probability of detection of illegal logging and trade, providing an important tool to control and reduce illegal logging.</p> <p>Source: Oi (2009).</p>	

Technological developments in wood processing largely focus on:

- Economic competitiveness – with emphasis on reducing costs, improving quality and developing new products.
- Energy efficiency and production of energy during wood processing.
- Compliance with environmental standards. For example by reducing effluents and reusing water through ‘closed-loop processing’ in the pulp and paper industry.

Many technological developments in wood processing have been consumer driven. Wood processing is towards the end of the forest product value chain, close to consumers and, consequently, compelled to respond to changing demands. Intense competition has also encouraged innovation.

Traditional wood use was largely based on structural properties, especially strength, durability, working quality and appearance. Wood-processing technologies have improved structural and chemical properties, expanding uses and making it possible to employ species that were once considered less useful – for example, the use of rubberwood for furniture and to produce MDF.

New sawmilling technologies include laser and X-ray scanners combined with high-power computing, which makes it possible to scan and store information on log diameter, length and shape and to produce optimal sawing patterns for each log to maximize sawnwood recovery (Bowe *et al.* 2002). Picture analysis to determine surface properties (e.g. knots and colour) has improved the quality of sorting and grading of sawnwood. New methods have been introduced to control drying processes and to measure physical strength, including revealing possible defects (Baudin *et al.* 2005). A number of institutions are involved in research focusing on the development of biomaterials, combining wood and other materials that could have properties far superior to traditional wood. (**Box 4.16**).

Box 4.16	New generation biomaterials
<p>Using a combination of biotechnology applications and new industrial processes, residues from traditional forest operations and new forest plantation resources can become the basis for new products such as bioplastics, natural chemicals, bioenergy and pharmaceuticals. The SCION research group in New Zealand is active in developing new products such as specialty chemicals and intermediates, and functional polymers and additives, for use in adhesives, coatings and plastics. This could result in development of new biocomposite products, bioplastics and thermoset resins that are renewably produced and more easily recycled and degraded at the end of their product life.</p>	

Other technological developments in wood processing include:

- Improved rates of recovery and the use of small-dimension timber, largely through improvements in sawmilling technologies and production of sliced veneer and reconstituted boards and panels.
- Recycling – for example, use of recovered paper.
- The use of micro-organisms to bleach pulp and treat effluents in the paper industry, reducing costs and environmental impacts.
- ‘Total use’ of wood through biorefineries producing a range of biomaterials.

Energy technologies

Woodfuel remains the main source of domestic energy for cooking and heating in most developing countries in the Asia-Pacific region and, although its use may decline, it will still remain an important source of household energy. Perceived risks of fossil fuel dependence and increasing concern about greenhouse gas emissions are drawing attention to the potential of wood as a source of clean energy.

Traditional wood energy systems rely on low-cost technologies, affordable to low-income consumers. The technologies used vary in terms of costs and in production and conversion efficiency. For example, charcoal is produced using a range of kiln types, from traditional mud to metal. Modern wood energy production using co-firing (combustion of biomass together with other fuels such as coal) or wood pellets involves considerably higher investments, but also has much higher energy efficiency. In a number of countries, efforts are being made to develop small-scale wood gasifier units, suitable for households and small-scale enterprises.

Substantial investments are being made to develop and commercialize technologies for producing biofuels from cellulose. The success of cellulosic biofuel will largely depend on its cost competitiveness relative to fossil fuels and other alternatives. The impact on the forest sector remains uncertain, especially considering significant increases in investments in other renewable energy sources, especially solar and wind power.

Technologies from outside the forest sector

Scientific advancements in sectors beyond forestry have led to the emergence of a wide array of new technologies that have profoundly changed forestry, with impacts often much greater than those of technologies developed within the forest sector, itself. For example, many technologies used in forest resource assessment, wood production, wood processing and trade, are outcomes of general purpose technologies developed in other sectors, especially through the integration of different components.

Information and communication technologies

Information and communication technologies (ICTs) have revolutionized many people's lives and change will accelerate as new technologies are developed and deployed. Developments in ICT have played a key role in driving the globalization process by connecting people and sharing information (Hetemäki and Nilsson 2005). Some of the impacts of rapidly changing ICTs include:

- Rapid growth of Internet and mobile communications has created unprecedented opportunities for those who previously remained outside global information loops, including small and medium enterprises. Product marketing has been revolutionized and raw-material procurement, logistics and production processes vastly improved. Adoption of ICT has increased labour productivity, reduced costs and increased turnover (Hetemäki *et al.* 2005).
- The ability of wood products and service suppliers to offer their products through Internet-based stores, or through value-integrating market makers that assimilate wood-based value chains (Nyrud and Devine 2005).
- Fundamental institutional changes, which undermine the power of vertically structured organizations and foster the development of small, active and increasingly networked organizations spanning continents.
- Increased awareness about various forest-related issues, including deforestation, loss of

biodiversity, impacts of forest fires, marginalization of indigenous communities, etc. This has also helped to promote transparency and accountability, with information being increasingly accessible to public scrutiny.

Remote sensing, geographic information systems and global positioning systems

Advancements in remote sensing, geographical information systems and global positioning systems are collectively impacting forest management. The speed at which vast amounts of spatial and temporal data can be analysed and synthesized is revolutionizing forest management in a number of countries and this technology is expected to spread rapidly throughout the region. Improvements in the resolution of satellite imagery and the development of software to interpret images will contribute to real-time monitoring of deforestation, pests and diseases, fires, and other potentially devastating events, while also improving silviculture and management practices.

Low-cost devices for large-scale data storage, graphic terminal and digitizing and scanning devices and the integration of satellite and airborne sensors, GIS and global positioning systems are all providing forest managers with new levels of precision and understanding of the nature and condition of forest resources. Together with high speed processing and communication systems, data can be processed and transmitted directly throughout office networks and to remote locations. These technologies also enhance opportunities for evidence-based public consultation, verification of legality and third-party certification (Bird and Thiel 2007).

Nanotechnology

A number of countries in the Asia-Pacific region, and elsewhere, are undertaking research into nanotechnology, which has the potential to produce a wide array of new, more efficient products (Box 4.17). However, pace of development and wider application of nanotechnologies in the forest sector will be highly unpredictable, depending on scientific breakthroughs and then development of cost-effective technologies. In view of the sophistication required, development and wider adoption of nanotechnology forestry applications are more likely to be confined to only a few countries in the region, at least within the next decade.

Box 4.17	Nanotechnology
<p>Nanotechnology – defined as the manipulation of materials measuring less than 100 nanometres (a nanometre is one-billionth of a metre) – could have considerable direct and indirect impacts on the forest sector by enhancing the efficient use of raw materials and energy. Nanotechnology has the potential to revolutionize all aspects of production and processing, creating new products with unique properties. Most leading wood product producing countries are working on nanotechnology applications.</p> <p>The report <i>Nanotechnology for the forest products industry: vision and technology roadmap</i> envisages potential uses for nanotechnology that include:</p> <ul style="list-style-type: none"> • Developing intelligent wood- and paper-based products with an array of nano-sensors built in to measure forces, loads, moisture levels, temperature, pressure, chemical emissions, attack by wood decaying fungi, et cetera. • Building functionality onto lignocellulosic surfaces at the nano-scale could open new opportunities for such things as pharmaceutical products, self-sterilizing surfaces, and electronic lignocellulosic devices. • Use of nanodimensional building blocks will enable the assembly of functional materials and substrates with substantially higher strength properties, which will allow the production of lighter-weight products from less material and with less energy requirements. • Significant improvements in surface properties and functionality will be possible, making existing products much more effective and enabling the development of many more new products. • Nanotechnology can be used to improve processing of wood-based materials into a myriad of paper and wood products by improving water removal and eliminating rewetting; reducing energy usage in drying; and tagging fibers, flakes, and particles to allow customized property enhancement in processing. <p>Source: Atalla <i>et al.</i> (2005).</p>	

OVERVIEW OF DRIVERS AND CHANGES

Societies in the Asia-Pacific region are undergoing profound changes driven by the combined effects of several factors. The regional population is projected to reach about 4.2 billion people by 2020, an increase of about 600 million from 2005. Most growth will take place in countries where population densities are already very high and severe resource constraints are being faced. Factors such as urbanization and employment-related migration will bring about important changes, especially to people's values and perceptions across a broad range of spheres, including in regard to the nature of demands placed on forests and forestry. Less-populous, forest-rich countries will be affected, both directly and indirectly, by the pressures emanating from countries characterized by high populations, rapid economic growth and natural resource deficits.

The main economic drivers that will impact natural resource use, and in particular forestry, include: current levels of income, income growth rates, distribution of income and extent of poverty. Although the global economic crisis has slowed growth, the Asia-Pacific region has, nonetheless, been growing rapidly during the past decade; spearheaded by emerging economies such as China and India. Along with rapid growth, there have also been major structural changes in many national economies, involving significant reductions in the share of agriculture in income and employment. Most growth is based on the expansion of the manufacturing and services sectors. Rapid growth of national economies will significantly increase the demand for resources, especially food, fuel and fibre, exerting pressures on land and other natural resources, including forests, within and outside the region. Most countries are pursuing 'growth and trickle down' strategies to reduce poverty, which is assumed, will also help to improve the environment. However, achieving rapid economic growth will require substantial resources,

both renewables and non-renewables, which could accelerate the scramble for resources.

Political and institutional changes are another important set of drivers impacting the forest sector. Overall, the region is witnessing important changes in political systems and the institutions that support them. Although authoritarian regimes and flawed democratic processes persist, on the whole, important changes, including strong moves towards market-oriented systems, are leading to the development of more open societies and a pluralistic institutional environment. Greater involvement of the private sector, communities and civil society organizations is bringing about important changes in resource management. This has necessitated a redefining of the roles and responsibilities of public sector organizations that previously dominated the institutional landscape.

Concern about declines in ecosystem services is becoming a major change driver. There is growing awareness about negative impacts of environmental degradation, as well as increased willingness and capacity to bear the costs of protecting the environment. There are several instances of local and national environmental issues that have acted as catalysts for major changes in forest management, including outright logging bans in response to calamities such as floods and landslides. In addition to traditional concerns such as biodiversity loss, watershed degradation and desertification; climate change issues are expected to have significant impacts on the forest sector. The ongoing evolution of environmental policies will continue to affect forest management practices.

Changes in technologies – within and outside the forest sector – form an important driver of change. Rapid developments in information and communications technologies will continue to bring about major changes in all aspects of life, although the digital divide may still persist. Improved access to information will impact on political processes and institutions, with shifts in power away from nation states and large corporations, in favour of civil society organizations, local communities and individuals. Developments in cutting-edge technologies that enhance material and energy efficiency – especially biotechnology and nanotechnology – will also have profound impacts on forests and forestry.

However, the incidence of change will be extremely uneven and forestry in the region will continue to comprise a mosaic of contrasting contexts and situations, as indicated below:

- Notwithstanding the rapid pace of industrialization, the region will maintain a large agrarian society, primarily dependent on land and forests for livelihoods. With land remaining the foundation of livelihoods, conflicts are bound to emerge in the context of population growth and low levels of technology.
- Many countries and localities are witnessing the emergence of industrial societies, taking advantage of opportunities provided by globalization. Demands for food, fuel and fibre as 'feedstock' for rapidly industrializing countries and localities are surging, increasing pressures in countries (within the region, as well as outside) with relatively abundant resources and low population densities. This is particularly the case in developing country contexts. The shift in industrializing countries towards importing substantial components of their wood supplies should reduce pressures on domestic resources, enabling some countries to invest in afforestation and reforestation, to enhance and rebuild domestic resource bases.
- The Asia-Pacific region is also developing expanding knowledge-based, post-industrial societies, predominantly in the advanced industrialized countries, but also encompassing some middle income and emerging economies. Enhancing quality of life (including environmental quality) is a major thrust in such societies, with higher incomes based on knowledge-based activities enabling more attention to be paid to environmental issues.

The Asia-Pacific region clearly presents a range of highly diverse and complex situations. It has some

of the richest countries and also some of the poorest. Even within a given country, inequalities may persist and widen. With the largest number of world's poor and deprived people and a rapidly expanding middle class, disparities within the region will remain stark. Asymmetrical globalization will result in some of the world's most globalized economies, as well as some of the most closed economies. These differences will lead to a broad spectrum of forestry situations, discussed in Chapter 5.