ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

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IMPACTS OF DEMOGRAPHIC CHANGES ON FORESTS AND FORESTRY IN ASIA AND THE PACIFIC

by

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Contents

INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

Working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

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EXECUTIVE SUMMARY

Impacts of demographic changes on forests and forestry are not widely understood beyond a very broad and superficial relationship in which population growth increases the demand for goods and services provided by the forests. Therefore, a thematic study on the impacts of predicted demographic changes on forests and forestry has been conducted as part of the Asia Pacific Forestry Sector Outlook Study II. The purpose of the study is to assess how the demographic changes have impacted forests and forestry in the past and to identify what are the likely impacts up to 2020.

This study covers 33 countries in the region. The region is classified into four subregions: East Asia, South East Asia, South Asia and the Pacific Islands. This breakdown follows the geo-political classification of the United Nations. Likewise countries are further divided into three groups: Developing countries, Small Island countries and Developed countries, identified on the basis of gross national income per capita, agricultural dependency (agricultural population and the contribution of the agricultural sector in the national economy), the extent of urbanization and annual population growth rates.

The relationship between demographic changes and forests and forestry is not linear; it is influenced, or mediated, by other factors such as science and technology, economic development, socio-political processes and human adaptation to change. The demographic factors covered by the study include (a) population size and growth, (b) population distribution and (c) population structure.

The population of the Asia-Pacific region is increasing and will continue to swell. However the rate of increase has slowed down compared to the past. Most of the population increase will be in Developing countries and South Asia. Population density is increasing in all sub-regions and groups; however it will remain stable in the Pacific Islands and Developed countries by 2020. Likewise, population density on arable land and forests will increase in all sub-regions and groups except East Asia, mainly due to China and Japan. Japan's population has stabilized and even started to shrink whereas the rate of expansion of forests has been quite high in China, far exceeding the population growth. The region will have a negative rural population growth rate by 2020, meaning that population increases will occur only in urban areas. The annual rate of change for urban populations is decreasing, however it is quite high compared to the population growth rate.

Agricultural population growth is in a declining trend, although the agricultural population is increasing in absolute numbers. Nevertheless, agricultural population will decline in East Asia and Developed countries by 2010. The working age and elderly population is increasing in the region whereas younger populations are on the decline. Countries within the region show two distinct patterns of age structure change by 2020. The Developed countries such as Japan, Singapore, Australia, Republic of Korea, New Zealand, Singapore and Brunei Darussalam will increase their proportion of elderly populations whereas working age populations are likely to increase in Small Island and Developing countries, with a decrease in younger age populations. Population aging will also be visible in some of the Developing countries including Sri Lanka, China and Thailand by 2020. The annexes summarize major demographic trends of the Asia-Pacific region from 1980 onwards, with projections up to 2020.

Impacts of demographic changes on forests and forestry are assessed in terms of (a) forests and land use changes; (b) resource degradation (c) housing demand and its implications on wood products and (d) environmental concerns such as urban greening/forestry, recreational demand and water availability and usage.

Forests and land use. Population pressure is often cited as a primary reason for land use changes, forest encroachment and conversion to crop lands and built up areas. However, there is no "linear relationship" that shows that an increase in population puts more pressure on land and forests, as argued by different studies. This increase in pressure depends on the stage of development of the country, which is influenced by their dependency on land (agricultural population), extent of urbanization and level of income.

The pressure on land and forests has increased in Developing countries with the growing population and rapid urbanization. However, this situation largely varies at the country level. In Small Island countries, major land use changes are observed, mainly due to a combination of population pressures, loss of traditional controls on land, shifting cultivation, pasture development, mining and logging activities. However, this situation varies by country depending on the extent of forest cover.

The demographic changes have less impact on land and forests in Developed countries since these are in final stages of urbanization; population is stabilizing and has less land dependency. However, growing demand for housing has resulted in further urban sprawl and a loss of natural vegetation and open space. Most of the Developed countries have shifted their population pressure to other countries with the exception of Australia and New Zealand, which are self sufficient for their wood products. Rapid conversion of forests in Indonesia, Malaysia and Myanmar for palm oil plantation is evidence of the transfer of pressure.

Forest degradation. The rising human population has resulted in a dramatic increase in the demand for wood products, which has led to overexploitation or harvesting beyond sustained yields. This has led to forest degradation in many Developing and Small Island countries. Forest degradation has been reported even in forested transition countries like India. Yet forest conditions have improved in Developed countries such as the Republic of Korea and Japan, mainly because of a widespread realization of the environmental values of the forests combined with reduced dependency on forests.

Housing demand and wood products. Housing demands are likely to remain constant or increase at a lower rate in most Developed countries like Australia, Japan, New Zealand and Republic of Korea due to high rates of household formation, declining household size and rural to urban migration, despite low population growth and population ageing. In most of the Developing countries, housing demand will escalate due to an increasing proportion of the working age population, rapid urbanization and increasing affordability. The housing demand in India and China will be quite high, and this will have a greater impact on the demand and consumption of wood products. Small Island countries might not have high demand for housing as they are constrained by traditional customary practices of land ownership. The housing needs have traditionally been met either by the extended family or through kinship groups.

Residential building construction is one of the most important drivers of demand for wood products, especially for sawn timber. With increasing housing demands, the need for wood products is likely to increase. Use of wood in interior decorating is also gaining momentum, which will further increase demand for wood and wood products. Nevertheless, the increasing proportion of the elderly population in Developed countries will have a positive impact on the use of wood and the types of wood products as seen in Japan.

Urban greening. Cities of the Asia-Pacific region are expanding their green zones to enhance their appearance, preserve ecosystems and to fight against global warming. However, this situation varies by country based on the stage of development. In Developed countries like Japan, the practice of urban greening was initiated a century ago whereas the concept is still emerging in many Developing countries like China, India, Malaysia, Indonesia and the Philippines. Nevertheless, urban greening is likely to expand with the increasing affluent and

health conscious society in the region. Urban forestry or urban greening programmes are underdeveloped and virtually non-existent in the Small Island countries.

Recreational demand. Recreational demands on forests are growing in the region along with rapid urbanization and changes in age structure, even in the Developing countries. People will have less direct contact with commodity production from the land because of migration to urban areas; this may increase interest in non-consumptive uses of forests including the conservation of forests for the provision of ecological services and wildlife habitats as well as for recreation. Improvements in adult literacy may further increase environmental awareness, which is likely to increase recreational demand from forests.

Water availability and use. The Asia-Pacific region will have abundant water availability by 2020. While water availability is decreasing, water demand for agriculture, industry and households is increasing as a result of population growth and economic development. Large amounts of water are still used for agricultural and irrigation purposes. Many Asian countries have been overextracting water and cultivating water-demanding crops. Conflicts between and within the sectors are being observed regarding water allocation, as evident in Australia. Further to this, studies have shown that biofuel plantations will eat up cropland and trigger food and water crises in many parts of the globe, especially in India and China.

Likely impacts by 2020. The direct population pressure on forests and land will decline in Developed and most of the Developing countries whereas it may increase in Small Island countries. Land use intensity will change as people move from rural to urban areas and this has the potential to slow conversion of forests. Increasing urbanization will increase demand for green spaces, especially for amenities and recreation in the Developed and Developing countries. The table below summarizes the likely impacts of demographic changes on forests and forestry in the region by 2020, in combination with other factors.

Potential impacts on forests and forestry by 2020

Groups	Likely impacts
Developed countries	• Reduction in direct pressure on land and forest resources • Diversion of arable land for forestry activities • Forest fragmentation • Increasing demand for urban amenities such as urban forestry and recreation • High awareness of the importance of forest conservation for ecological functions and environmental services • Shortage of labour for forestry activities due to population aging and high urban population • Demand for wood products likely to remain stable but changes in type of wood product demand • Decline in population likely to reduce pressure on forests and other resources
Developing countries	• Reduction in pressure on land and forest resources, however this varies by country depending on other factors • Forest clearance for agricultural purposes, shifting cultivation and built up area expansion • Forest degradation due to high dependency on forests for firewood and other forest products • Increasing demand for employment and better living conditions, declining interest in traditional occupations, especially agriculture • Increasing demand for urban amenities such as urban forestry and recreational activity • Labour availability for forestry activities may increase as a larger proportion of the population moves into the working age group and many countries remain predominately rural • Escalating demand for wood products due to increases in housing demand combined with changing preferences favouring wood flooring and furnishing • Increasing awareness on important roles of forests due to improvements in literacy rates
Small Island countries	• Increased pressure on land and forest resources • Forest conversions for agricultural purposes, shifting cultivation and built-up area expansion • Labour availability for forestry activities may increase as a larger proportion of the

Groups	Likely impacts
	population shifts towards the working age

The influence of demographic changes on forests and forestry largely depends on interactions between several factors. The aforesaid impacts tend to be localized and vary from country to country, depending on extent of development.

1. INTRODUCTION

Background

The human population grew at unprecedented rate during the last two decades globally as well as in the Asia-Pacific region. The region accounts for more than half of the world's population. During the last 25 years, the population of the region grew by more than a billion (2.45 billion in 1980 to 3.6 billion in 2005), and is likely to reach to 4.2 billion by 2020. However, population growth changed its character and form in the twentieth century with the advancement of technology and medical facilities. This has resulted in major demographic transitions, such as changes in rates of births and deaths, age composition and rural population growth rate.

The impact of demographic changes on forests and the environment is often discussed in terms of biological carrying capacity, i.e. the maximum number of individuals that a resource can sustain. However, many factors influence carrying capacity, such as economic development, socio-political processes, trade, technology, and consumption preferences. Many studies have already shown that demographic changes in conjunction with the other factors have impacted natural resources in general and forests in particular (Outlaw and Engleman, 1999; Hunter, 2000; FAO 2007a).

Forests provide an array of goods and services critical to economic development and human well-being. The demands of a growing population on forests are increasing in both magnitude and variety. However, the impacts of demographic changes are not widely understood beyond the very broad and superficial relationship that population growth increases demand for goods and services provided by forests. In this context, a thematic study on the impact of predicted demographic changes on forests and forestry has been conducted as part of the Asia Pacific Forestry Sector Outlook Study II (APFSOS II).

Some of the important demographic factors which could impact on forests and forestry by 2020 include population size and growth, population distribution and population structure. Taking these factors into account, the study attempts to answer the following key questions:

- What are the broad trends with regard to the key demographic variables?
- How have these trends in combination with other drivers impacted forests and forestry in the past and what are the likely prospects for impacts to 2020?
- Do the impacts of demographic factors vary across (a) countries and (b) time?

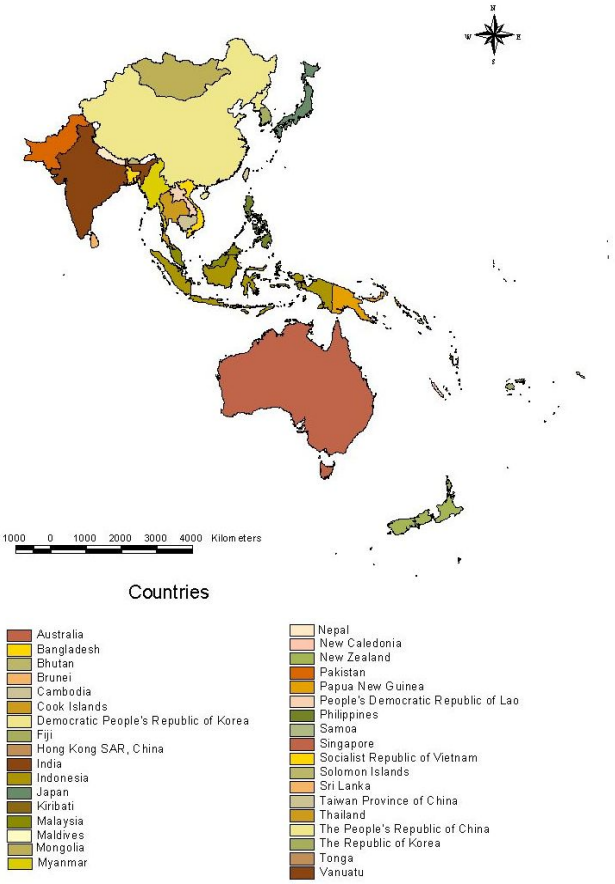
Study objective

The overall objective is to assess how the demographic changes have impacted forests and forestry in the past and their likely impacts to 2020 in the region. Specifically the study aims to:

- Identify the set of demographic factors that may impact on forests and forestry
- Analyse data including projections relating to changes in population, urbanization, age structure and other factors that will impact the sector
- Review analysis of existing information and knowledge on the impacts of demographic changes on forests and forestry
- Analyse and discuss how demographic changes have impacted forests and forestry in the past, with likely prospects for the future (by 2020) in association with other factors

APFSOS II countries

This study covers 33 countries from the Asia-Pacific region. The region is classified into four subregions and three groups. Map 1 shows countries covered under this study. Table 1 presents countries in each sub-region, following the geo-political classification of the United Nations.



Map 1. Countries covered under this study

Table 1. Classification of countries into different sub-regions

Sub-region	Countries
East Asia	Democratic People's Republic of Korea, Japan, Mongolia, People's Republic of China, Hong Kong SAR, China, Taiwan Province of China, Republic of Korea
South East Asia	Brunei, Cambodia, Indonesia, Malaysia, Myanmar, People's Democratic Republic of Laos, Philippines, Singapore, Socialist Republic of Viet Nam, Thailand
South Asia	Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
Pacific Islands	Australia, Cook Islands, Fiji, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Samoa, Solomon Island, Tonga, Vanuatu

Countries in the Asia-Pacific region are divided into three groups on the basis of population growth rate, extent of urbanization, gross national income (GNI) per capita income and dependency on agriculture (Table 2) with country specific situations in Annex 1.

Table 2. Major characteristics and countries under each group

Sub-groups	Major characteristics	Countries
Developing countries	Agriculture-based economy, high population growth rate, largely rural	Bangladesh, China, Cambodia, Bhutan, India, Indonesia, Nepal, Democratic Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Viet Nam
Small Island countries	Marine-based economy, high population growth rate, largely rural	Cook Islands, Fiji, Kiribati, New Caledonia, Samoa, Solomon Islands, Tonga, Vanuatu, Maldives
Developed countries	Industrialized and service sector-based economy, slow population growth rate, highly urbanized	Australia, New Zealand, Japan, Republic of Korea, Singapore, Brunei Darussalam

Study approaches and methods

Conceptual framework

The relationship between demographic changes and forests and forestry is not linear; it is influenced or mediated by other factors such as science and technology, economic development, socio-political processes and human adaptation to change. Figure 1 presents the conceptual framework of the study, which not only shows the links between demographic factors and forestry, but also points out the influence of other mediating factors. The study acknowledges the importance and influence of mediating factors such as income, poverty, technological advancement, trade, policies, institutions and processes on forests and forestry.

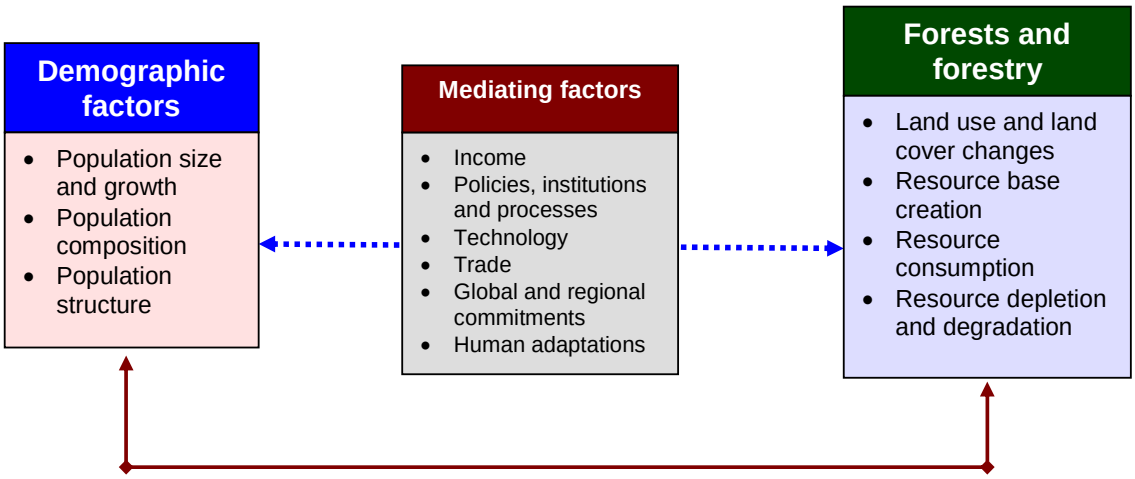


Figure 1. Conceptual framework
Source: Modified from Hunter, 2000.

The demographic factors discussed in this study include population size, growth, distribution and structure. The current trends are reviewed and impacts and implications are discussed in association with other factors.

Population size and growth increase demand for goods and services. More land is required to cope with the growth in demand for agricultural products and housing. Population change will also have bearings on demand for wood and non-wood products as well as environmental services.

Population distribution is revealed by two aspects:

- *Urbanization*, which may either reduce resource dependency, especially firewood, or increase demand for engineered forest products for construction, repair and renovation
- *Agricultural population*, wherein a decrease in number may reduce diversion of forests for agricultural purposes or dependency on forests

Population structure affects values and perceptions, altering forests and forestry (career consciousness, life style, education, family status) by increasing demands on forest lands for recreation uses. Likewise population structure also affects labour availability for forestry activities.

Study methods

The study is based on a review of secondary sources of information collected and collated through various published and unpublished sources. The study largely follows a content analysis approach on collecting and collating secondary sources of information. Content analysis is an approach for the analysis of the documents and texts that seek to quantify the contents in terms of predetermined categories in a systematic and replicable manner.

The demographic data were collated from the United Nations Common Database and land and forest related data were analysed from FAOSTAT, as of 16 December 2007. Demographic trends and projections are based on the medium fertility scenario as it is the "most likely scenario" and many research scholars and international organizations use this as a basis for their analysis.

The study computed the average annual growth rate for land use or consumption changes by using the compound growth rate formula whereas the log derivates formula was used for population changes. The annual growth rate computed for the purpose of this study may differ with the Asia-Pacific regional and sub-regional data because some of the countries are not participating in APFSOS II.

Databases and publications of other agencies such as the World Bank, Asian Development Bank, Economic and Social Commission for Asia and Pacific, United Nations Environment Programme, International Institute of Applied Sciences, World Resources Institute etc were also reviewed and analysed. The study also reviewed a wide array of literature, mainly available on websites.

Structure of the report

The study report is organized in four sections. This introductory section highlights the study background, objectives and methodology, while section two discusses demographic trends in the Asia-Pacific region by sub-regions and groups, including population size and growth, population distribution and population structure. Section three analyzes the impacts of the demographic changes on forests and forestry in terms of land use changes, pressure on forests resources, housing demand and its consequences on wood demand and environmental issues. Section four summarizes the study findings and identifies the countries where the demographic changes are likely to have an impact on forests and forestry by 2020 in association with other factors.

2. DEMOGRAPHIC TRENDS

Demographic changes significantly alter the demand for forest products and services and are therefore an important element influencing the long-term outlook. The most important demographic factors which could impact forests and forestry include population size and growth, population distribution and population structure. This section discusses major trends of these factors among APFSOS II participating countries from 1980 to 2005 with projections to 2020.

Population size and growth

The total population of the Asia-Pacific region was 3.6 billion in 2005, more than half of the world's population (55.3 percent). Figure 2 shows distribution of population by sub-region. Developing countries contain more than nine tenths of the population (94.1 percent) followed by Developed countries (5.9 percent). Less than one percent of the regional population (0.1 percent) lives in Small Island countries.

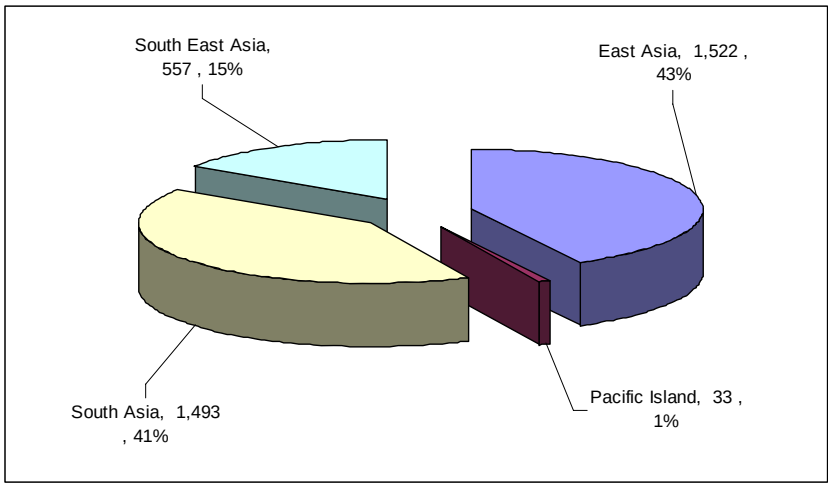
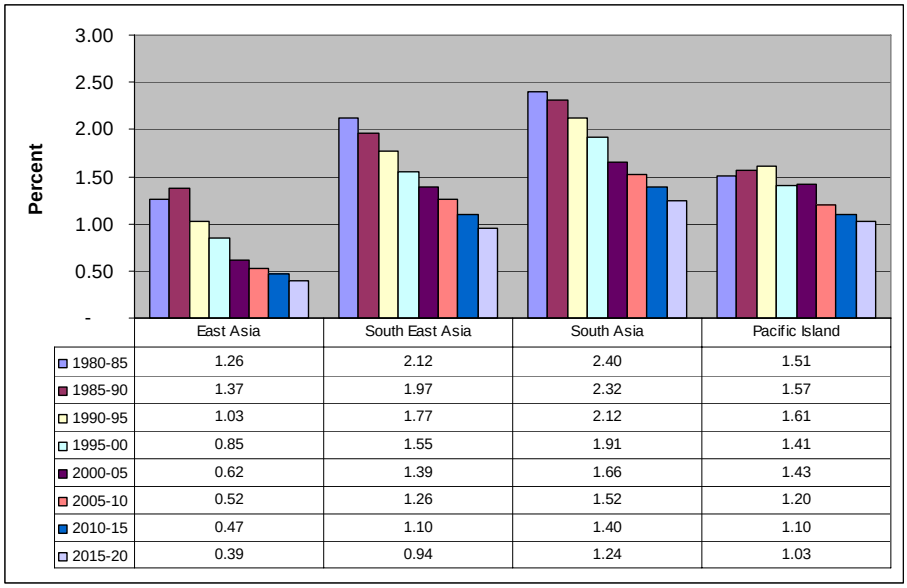


Figure 2. Distribution of population in the Asia-Pacific region in 2005
Source: United Nations Statistics Division, 2007.

Population is more unevenly distributed between the countries. The population size ranges from 14 000 in Cook Islands to 1.3 billion in China. More than 70 percent of the regional population resides in two countries, namely China (1313 million) and India (1134 million). China is the most populous country in the region with nearly 36.4 percent of the population, followed by India (31.5 percent), Indonesia (6.3 percent), Pakistan (4.4 percent) and Bangladesh (4.3 percent). More than 80 percent of the regional population lived in these five countries in 2005. Eleven countries in the region have less than one million people: Bhutan, Brunei Darussalam, Cook Islands, Fiji, Kiribati, Maldives, New Caledonia, Samoa, Solomon Islands, Tonga and Vanuatu.

Annual population growth rate in the region, as in the rest of the world, is declining. The region's annual population growth rate was higher than the world's average till 2000, but from 2000 onwards it became lower. Rates of increase in population will be confined to Developing and Small Island countries because these groups have high annual population growth (see Annex 3) compared to the regional situation. The annual population growth of Developing countries will be less than one percent by 2020 whereas it will be slightly more than one percent in Small Island countries. Developed countries will have negative annual population growth by 2020 due to low fertility rates.

The average annual population growth rate across all sub-regions is declining (Figure 3), however the rate of decline varies. By 2020, the population of East Asia will stabilize, since population growth will be 0.39 percent per annum. This can be largely attributed to China and Japan. China's population growth has been quite low since 1970s, due to the strictly enforced government population control policy, whereas Japan has a negative trend of population growth. The population of South Asia will continue to grow at 1.24 percent per annum till 2020. This may increase pressures on forests since large majorities of the population still depend on agriculture and are predominately rural. This situation is not likely to change by 2020 since change in structure of the economy is very slow, despite India's high economic growth.



	East Asia	South East Asia	South Asia	Pacific Island
1980-85	1.26	2.12	2.40	1.51
1985-90	1.37	1.97	2.32	1.57
1990-95	1.03	1.77	2.12	1.61
1995-00	0.85	1.55	1.91	1.41
2000-05	0.62	1.39	1.66	1.43
2005-10	0.52	1.26	1.52	1.20
2010-15	0.47	1.10	1.40	1.10
2015-20	0.39	0.94	1.24	1.03

Figure 3. Average annual population growth rate in the sub-region from 1980 to 2020

Source: Computed from United Nations Statistics Division, 2007.

While population growth rates are on the decline, their levels exhibit large variations across countries. Country specific details of population changes are presented in Annex 2 and Annex 3. By 2020, negative population growth will be observed in Cook Islands and Japan. This is because of migrations in Cook Islands, whereas in the case of Japan, this is largely due to an ageing population and a decline in birth rate. In 2006, the population of elderly citizens (65 years and over) was 26.6 million, constituting 20.8 percent of the total population. Total fertility per woman is 1.32, which is far below the replacement level (2.1 per women) (Ministry of Internal Affairs and Communication Japan, 2008).

The countries whose population will stabilize by 2020 (population growth of less than 0.5 percent per annum) include China, Cook Islands, Fiji, Japan, Democratic Republic of Korea, Republic of Korea, Sri Lanka, Thailand and Tonga. The annual population growth of India will decline from 1.8 percent per annum in 2005 to 1.3 percent per annum by 2020. Decline of population growth especially in the two most populous countries, India and China, will have major impacts on the demography of the region and thereby on forests and forestry.

The population of the Asia-Pacific region is increasing and will continue to increase further. During the last 25 years, the population grew by 1 718 million, or from 2 446 million in 1980 to 3 604 million in 2005. The population is likely to rise by 560 million people, reaching 4 164 million by 2020. The increase is not only large in absolute numbers but is also unevenly distributed across sub-regions and groups. By 2020, South Asia will have the highest

population (East Asia had the highest population in 2005). This increase was quite noticeable because India, Pakistan and Bangladesh have high annual population growth rates (Annex 3). Most of the increase in population will be in Developing countries. The population of Developing countries will increase from 3 389.8 million in 2005 to 3 946.1 million in 2020 whereas the population of Small Island countries will reach to 2.9 million by 2020 from 2.4 million in 2005.

Increase in population size may affect forests and forestry from both the demand and supply sides. It may expand the market for forest products and provide more labour for forestry activities, but it may also increase pressures on forests by increasing the demand for land and wood and non-wood forest products.

Population density

Population density determines pressure on land, which is expressed as the average number of people per square kilometre (PSK). Population density is generally measured in terms of land area but there are several other methods as well which provide more accurate measures of population density such as physiological density (population divided by the amount of arable land) or ecological optimum (density of population which can be supported by the area's natural resources).

Land

The Asia-Pacific region occupies one fifth (28.44 million square kilometres) of the world's land area although it provides a home for more than half of the world's population. Box 1 presents distribution of land area by sub-region, groups and countries.

Box 1. Distribution of Land Area within Sub-region, Groups and Countries

Of the total land area of the region (2.84 billion ha), nearly half of the land is occupied by East Asia (40.4 percent), followed by Pacific Islands (29.9 percent), South East Asia (15.2 percent) and South Asia (14.5 percent). Likewise, Developing countries share more than two thirds of the regional land (70.1 percent) followed by Developed countries (29.6 percent).

More than two thirds (70.3 percent) of the region's land is occupied by three countries namely China (32.8 percent), Australia (27 percent) and India (10.5 percent). Countries with less than one thousand square kilometres of land include Brunei Darussalam, Cook Islands, Kiribati, Maldives, Samoa, Singapore and Tonga.

Source: Computed from Annex 4.

Annex 4 shows trends and projection of population density in the Asia-Pacific region from 1980 to 2005 and projections till 2020. The population density of the region will reach 146 people PSK by 2020 compared to 86 in 1980. Population density in Developed countries will remain stable by 2020 whereas it will have increased from 20 persons in 1980 to 36 persons PSK in 2020 in Small Island countries. Population densities of the Developing countries will increase from the current level of 170 persons PSK in 2005 to 198 persons in 2020. Increases in population density in Developing countries may exert more pressure on land, since dependency on agriculture is quite high.

Population density per land area across all sub-regions is increasing. From 2005 to 2020, population density will increase rapidly in South Asia from 362 to 445 persons PSK. Likewise, the population density of South East Asia and East Asia will reach 141 and 152 persons by 2020 from 132 and 129 persons PSK in 2005. In the Pacific Islands, over the next 15 years population density will remain almost stable since it will reach 5 persons per square-

kilometre by 2020 from 4 persons in 2005. This figure is dominated by Australia and New Zealand which have very low population densities in the sub-region.

These sub-regional averages mask many differences in population density at the country level (see Annex 4). The region's population densities will vary from 2 persons in Mongolia to 7,206 persons PSK in Singapore by 2020. By 2020, Bangladesh, Maldives and Singapore will have more numbers of people PSK whereas Australia, Bhutan, Mongolia, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands and Vanuatu will have less than 25 persons PSK. The population densities are increasing in all countries except Cook Islands and Japan, as both of these countries have negative population growth.

Arable land

Many countries in the region have the potential to increase their food production substantially, yet only a small fraction of the increase is likely to come from expanding arable land. Arable land area of the region is stabilizing despite increases in population. Figure 4 presents the number of persons PSK of arable land. The number of persons PSK of arable land in the region increased from 598 in 1980 to 777 in 2005, which is mainly due to the increase in population.

The number of persons PSK of arable land is increasing across all sub-regions and groups except for East Asia, where population density on arable land decreased from 1 093 persons in 1980 to 989 persons PSK of arable land in 2005, as a result of an expansion of arable land. There is a marginal increase of population density PSK of arable land in the Pacific Islands, which is mainly due to Australia. Australia has a low population density PSK of arable land (41 persons) and possesses more than 95 percent of arable land in the sub-region. The rest of the Pacific Island countries have high population density PSK of arable land.

Despite the high population growth in South Asia, the expansion of arable land has virtually stopped during the last 25 years and land has been diverted for other uses (Annex 10). As a result of this, population density on arable land increased from 455 persons in 1980 to 776 persons in 2005. Likewise population density on arable land in East Asia increased from 607 persons in 1980 to 842 persons in 2005.

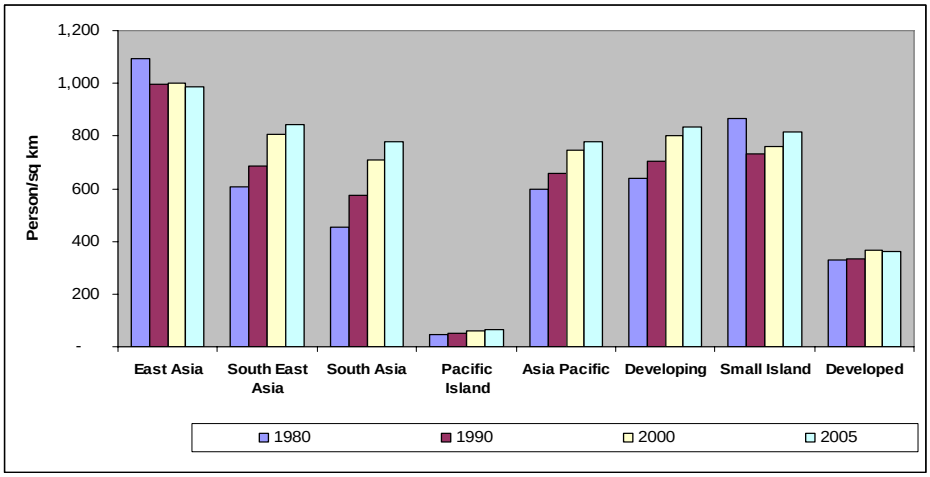


Figure 4. Number of persons per square kilometre of arable land
Source: FAO 2007b.

During the last 15 years (1990-2005), the rate of expansion of arable land in Developing and Small Island countries has declined considerably whereas it has virtually stopped in Developed countries. In Developing countries, population density on arable land increased

from 638 persons in 1980 to 835 persons PSK in 2005. In Small Island countries, population density decreased from 868 persons in 1980 to 762 persons PSK in 2000 but increased to 814 persons in 2005. This is mainly because of an expansion of arable land. During 1980-1990, arable land expanded at 3.5 percent per annum whereas population grew at 1.8 percent per annum and this proportion was 0.9 percent and 1.6 percent respectively during 1990-2005. Population density on arable land in Developed countries increased from 327 persons PSK in 1980 to 360 in 2005. However, it started to decline from 2000 onwards. Population pressure on arable land may increase in Small Island and Developing countries whereas it may not exert pressure in Developed countries.

Forests

The ratio of people to the size of forests provides a suggestion of the extent of human pressure on forests. Figure 5 shows the trends of population density PSK of forest area in the region from 1990 to 2005. At the regional level, the population density PSK of forest increased from 394 in 1990 to 491 in 2005, mainly due to increases in population and decreases in forest cover.

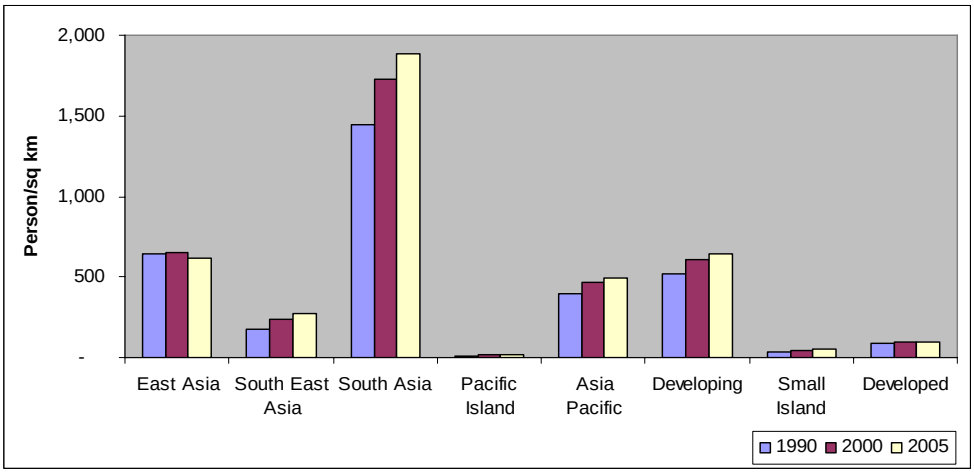


Figure 5. Number of persons per square kilometre of forest area
Source: Annex 5.

Population pressure on forests is extremely high in South Asia and low in the Pacific Islands. Population density PSK of forests in East Asia declined from 643 persons in 1990 to 619 persons in 2005, mainly due to increase in forest cover (see Annex 10) largely contributed by China, which has gained more than 40 million ha of forests during the last 15 years. In the Pacific Islands, population density in forests increased slightly (12 persons in 1990 to 16 persons in 2005). This is mainly because of Australia's low population density yet over two thirds of the land is under forests.

Despite the forest transitions in some Developing countries, especially India, China and Viet Nam, population density PSK of forests increased from 516 persons in 1990 to 645 persons in 2005, mainly because of high population growth and deforestation. In Developed countries, population density in forest areas increased marginally from 92 person in 1990 to 101 persons in 2005.

The regional situation masks many differences at the country level (Annex 5). Population density in forests has increased in all countries except China, Cook Islands, and Viet Nam. However, population pressure on forests varies by country depending upon the extent of forest cover, dependency on forests and level of economic development.

Population distribution

Population distribution refers to the arrangement of population across a space or grouping of population on the basis of certain characteristics. Population is distributed into two categories, urban population and agricultural population, and their distribution across the space (group) or location (sub-region).

Urbanization

Urbanization is a cycle through which a nation passes as it evolves from an agrarian to an industrial society (Kingsley and Golden, 1954). Urbanization is generally expressed as the ratio of urban population to the total population. Urbanization occurs due to push and pull factors. Push factors are related to rural poverty, high population pressure and lack of land, resources and employment opportunities. Pull factors are often related to economic growth, employment opportunities, modern facilities and better living opportunities.

Urbanization across the world is increasing rapidly, mainly due to a natural increase in current urban populations, rural-to-urban migration and the reclassification of certain rural areas (including boundary adjustments) as urban (United Nation Statistics Division, 2007). Urbanization by implosion and counter urbanization has also been occurring in recent years. Urbanization is categorized into three stages based on the extent of the metropolitan population. The initial stage is characterized by rural traditional societies with agricultural predominance. Stage two refers to an acceleration in which a basic restructuring of the economy and investments in social overhead capitals such as transportation and communication take place. The proportion of urban population gradually increases and dependence on the primary sector gradually dwindles. The third stage is known as the terminal stage, where the urban population exceeds two thirds or more of the total population. At this stage the level of urbanization remains more or less static (Davis, 1965). Table 3 classifies the countries on the basis of their stage of urbanization in 2005.

Table 3. Classification of countries based on stage of urbanization, 2005

Stages	Countries
Primitive	Bangladesh, Bhutan, Cambodia, India, Lao PDR, Maldives, Myanmar, Nepal, Papua New Guinea, Samoa, Solomon Islands, Sri Lanka, Thailand, Vanuatu, Viet Nam
Acceleration	China, Cook Islands, Fiji, Indonesia, Japan, Kiribati, Democratic People's Republic of Korea, Malaysia., Mongolia, New Caledonia, Pakistan, Philippines, Tonga
Terminal	Australia, Hong Kong SAR China, Republic of Korea, New Zealand, Brunei Darussalam Singapore

Source: Computed from FAO, 2007d.

The Asia-Pacific region is in the acceleration stage of urbanization, although rates of change of urban population have slowed down. Current trends reveal that the region will have negative rural population growth by 2010. Most of the increase of population will be absorbed by urban areas with consequent increasing population pressures in these locations. The annual rate of change of rural and urban population across all sub-regions and groups is declining, mainly because of decreases in population growth. By 2020, the annual rate of change of urban populations will be highest in South Asia (2.8 percent) and lowest in the Pacific Islands (1.1 percent). Likewise, annual rates of change of urban population will be highest in Developing countries (2.4 percent) and lowest in Developed countries (0.3 percent) by 2020. Nevertheless, these urban population growth rates far exceed the population growth rate of their respective sub-regions and groups.

The urban population growth rate far exceeds the rural population growth rate across all sub-regions and groups, and this is likely to continue till 2020. East Asia and South East Asia will have negative rural population growth from 2005 onwards whereas South Asia and the Pacific Islands will have rural population growth of less than one percent per annum. Rural population will decline in Developing and Developed countries whereas it will increase marginally in Small Island countries. However, regional figures mask enormous variations at the country level (see Annex 6 and Annex 7).

Between 1980 and 2000, the region's urban population has almost doubled, from 609 million (or one fourth, 25.9 percent, of the population in 1980) to 1202 million and is likely to reach 1 949 million by 2020, nearly half of the population (48.6 percent).

Figure 6 presents the percentage of urban population in the region. In 1980, over 70 percent of the Pacific Islands' population was living in urban areas whereas this was less than one fourth in all other sub-regions. By 2020, urban areas will provide homes for more than half of the population across all the sub-regions except South Asia. South Asia will have the lowest proportion of urban population (35 percent) whereas the Pacific Islands will still have the highest (74.8 percent). If sub-regions are classified on the basis of their stage of urbanization, South Asia will be still in the primitive or first stage of urbanization by 2020, where a large majority of the population is predominately rural and agrarian society. South East Asia and East Asia will be in the acceleration stage of urbanization till 2020. The Pacific Islands will be in the terminal stage of urbanization, where over 70 percent of the population will be living in urban areas and annual rates of change are minimal.

	1980	1990	2000	2005	2010	2020
East Asia	25.7	33.0	40.4	44.5	48.6	56.2
South East Asia	25.6	31.7	39.7	43.9	47.9	55.0
South Asia	22.4	25.1	27.5	28.6	30.3	35.0
Pacific Island	71.5	70.3	72.8	73.6	74.0	74.8
Asia and pacific	24.9	30.1	35.4	38.1	41.0	46.8

Figure 6. Percent of urban population by sub-region
Source: Computed from United Nations Statistics Division, 2007.

The majority of Developing countries and Small Island countries are still in the primitive stage of urbanization. More than one third of the population of Small Island (38.4 percent) and Developing countries (35.9 percent) was living in urban areas in 2005, which will reach nearly half of the population by 2020 (45.1 percent in Developed and 45.3 percent in Small Island countries). The rate of urbanization is quite high in Developing countries compared to Small Island countries, which is mainly because of China. In Developed countries, nearly two thirds of the population (61.7 percent) was living in urban areas in 1980 which increased to 72.5 percent in 2005 and is likely to reach 76.3 percent by 2020. Demand for housing and

wood products will increase in Developing countries as more people will move to urban areas.

As the urban population is growing rapidly, direct dependency on forests may decrease and forests might be preserved for ecological functions such as soil conservation, carbon sequestration and recreational uses.

Rural populations of the region will decrease by 16.3 million in 2020 compared to 2005 (see Annex 7). From 2005 up to 2020, the rural population in East and South East Asia will decrease by 129.7 and 16.8 million respectively, whereas it will increase by 129.1 and 1.1 million in South Asia and the Pacific Islands. Decreases in rural population in East Asia can be attributed to China, where the rate of urbanization is quite high. Rural populations will still increase in South Asia since five countries (Bhutan, Bangladesh, Nepal, Maldives and Sri Lanka) have the highest annual rural population growth in the region.

By 2020, rural population in Developing countries will decrease by 9.2 million whereas it will decline by 7.3 million in Developed countries. However, rural populations will increase marginally (0.1 million) in Small Island countries. Decreases in rural population in Developing countries are likely to bring positive impacts on forests and forestry since the direct dependency on land and forests will decline and more land may be available for forestry purposes.

The patterns of urbanization differ in Developed and Developing countries. The urbanization process in Developed countries has stabilized. The population growth had also reduced the growth of urban population and rural people are moving to urban areas. The context of urbanization in Developing countries is different in various ways. Firstly, rapid and large scale urbanization has occurred while industrialization and technology development has fallen far behind the pace of urbanization. Secondly, Developing countries' population growth rate in cities remains high because of both natural increase and continuous immigration from rural areas. Nevertheless, in recent years, urbanization has been occurring either by implosion (see Box 2) or development of small towns (see Box 3) and counter urbanization. In the initial stages, counter urbanization may lead to forest clearance to develop new accommodation, recreational sites and infrastructures. However, there is a conscious effort to plant trees and establish greenery, including for recreational facilities.

Box 2. Urbanization by Implosion in South Asia

Urbanization has been primarily a phenomenon of the expansion of cities. Yet there is another form of urbanization that is proceeding almost unnoticed in villages and the countryside through in-place (localized) population growth. In-place population growth in rural areas is leading to the expansion of villages, multiplication of homesteads, and sprouting of homes. With this form of growth, population densities in vast rural regions exceed the threshold for defining urban settlements, i.e. 400 persons PSK. It is happening in vast stretches of rural India, Bangladesh, Pakistan, China and Indonesia. This is the phenomenon of urbanization by implosion, which builds up urban spatial organizations through the densification of human settlements.

Applying the universal criterion in the three most populous countries of the region, India, Pakistan and Bangladesh, the study found that rural population growth in these countries is producing densities that equal or surpass the urban thresholds. Rural Bangladesh has urban-level densities. Similarly, in India, from West Bengal to the outskirts of Delhi is a band of territory, about 311,200 square kilometres in area, that has rural densities exceeding the urban threshold. Also, the coastlines of Kerala and Orissa provinces are equally dense rural regions. Pakistan, largely a semi-arid but irrigated plain, has its share of the contiguous high-density rural districts, spread over 56,000 square kilometres along a north–south axis beside its eastern border with India, and another band of similar territory in the Peshawer Valley.

Population growth in large rural expanses in these countries is leading to the formation of mega rural regions that are spatially and environmentally urbanized. The transformative force is the urban-level density of population. These high-density rural areas may continue to be economically, socially and administratively rural in character, censuses may continue to classify them as rural, but their settlement patterns, residential land markets and infrastructural needs are increasingly urban in form and scope. The phenomenon of high-density rural regions is quietly building up land scarcities and infrastructural deficits, both for farming and residential uses in the rural areas of South Asia.

Source: Qadeer, 2004.

Box 3. Small Town Development and Rural Urbanization in China

China has adopted a small town development strategy to urbanize its rural areas in order to prevent surplus labor forces from moving to large cities, hence leaving rural areas underdeveloped. This has alleviated China's migration dilemmas and also improved standards of living in rural areas.

A small town in China includes three types of settlement: defined by the size of population (average small towns in China have about 31,000 people); based on administration functions (a town represents an administrative echelon below the county government); and where rural market centres exist. The Chinese government decided to expand small town construction in 1979 and supply existing small towns with modern industry, transportation, trade, service, science, technology and sanitation facilities so that they would become the base of rural development (CCCCP, 1981). In 1993, the government decided to fully utilize and reform existing small towns, construct new ones, gradually revise household registration in small towns, and let farmers move into the small towns to engage in industrial work or business, develop rural service industry, and promote the relocation of the surplus labor force in the rural areas (Xueyi Lu, 1995). This small town development strategy has gradually gained momentum.

Since 1978, small towns have developed dramatically in China. In 1979, there were 2,400 small towns which housed 55.56 million people (Zhen, 1995). In 1995, according to China's Ministry of Construction, there were more than 50,000 small towns in China. These small towns have hosted more than 60 percent of the 20 million townships and village non-agricultural enterprises and absorbed about 120 million laborers. Based on a projection, it is believed that these small towns will absorb an additional seven to eight million rural surplus laborers every year (Juan Ming Li, 1995). Small town development has been extremely impressive in coastal areas.

Since the post-Mao reform in 1978, employment growth in non-agricultural activities has exceeded that in agriculture. The shift of the labor force in Luo She, a small town in Jiangsu Province, is a good example, where 94 percent of the agricultural labor force has already transferred to industrial and service sectors (Luo She Zhen, 1995). Small towns have even attracted some urbanites to move to the rural areas. By 1995, about five million urban youth were employed by township and village enterprises (Yuan, 1995). In Guangdong Province alone, 400,000 urbanites moved to rural areas for the salary and benefits provided by the township and village enterprises (considered better than those provided by urban enterprises) (Yang, 1995).

This new way of urbanization may offer an alternative way to other Developing countries, since China has been successful in both promoting economic development and urbanization in the rural areas so far.

Source: Xiaobo, 1999.

Agricultural population

Agricultural population is defined as all persons depending on agriculture for their livelihood, hunting, fishing and forestry. It comprises all persons economically active in agriculture as well as their non-working dependents. This population may not be exclusively rural (FAO, 2007d). The agricultural population of the region has been increasing consistently over the last 20 years, rising from 1 470 million in 1980 to 1 856 million in 2000, and is expected to reach 1 869 million by 2010. The agricultural population was increasing in all sub-regions till 2000 and will continue to do so, with the exception of East Asia. The agricultural population in Developing and Small Island countries has been increasing whereas it is declining in Developed countries. Increase in the agricultural population especially in Developing countries may enhance pressure on forests, especially forest conversion for agricultural purposes.

Despite the increases in agricultural population, the annual growth rate is declining and the annual rate of change of agriculture population is lower compared to that of the population.

Increasing urbanization and rapid income growth are the main reasons for de-acceleration of the agricultural population.

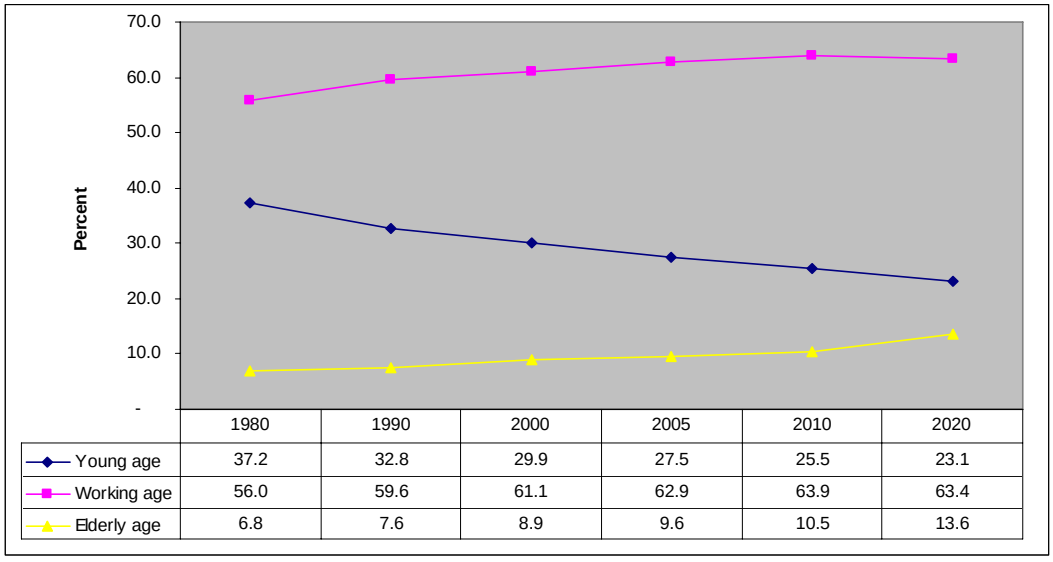
The annual growth rate of both the total and agricultural population across all sub-regions has been declining from 1980 onwards and this is expected to continue (see Annex 8). By 2010, East Asia and Developed countries will have negative agricultural population growth whereas the agricultural population growth will be almost negligible in South East Asia (0.04 percent) and Developing countries (0.1 percent). The agricultural population will grow at 0.57 percent and 0.8 percent per annum till 2010 in South Asia and the Pacific Islands respectively.

The proportional share of the agricultural population to the total population is declining at group and sub-regional levels and is likely to follow similar patterns till 2010. Yet nearly half of the population of East Asia, South East Asia, South Asia and Developing countries will depend on agriculture whereas this proportion will be less than one fifth in the Pacific Islands by 2010. Very little of the population of Developed countries (2.9 percent) will derive livelihoods from agriculture.

Population structure

Population structure generally refers to the distribution of a population by age, or the percentage of population of the young (those under age 15), the working age group (with ages between 15 to 60) and the elderly (above age 60).

The proportion of the working age population in the region increased from 56.2 percent in 1980 to 61.1 percent in 2000 (see Figure 7). It is projected to increase further to 63.4 percent by 2020. However, the share of the younger population will decline over time and the elderly population will increase.



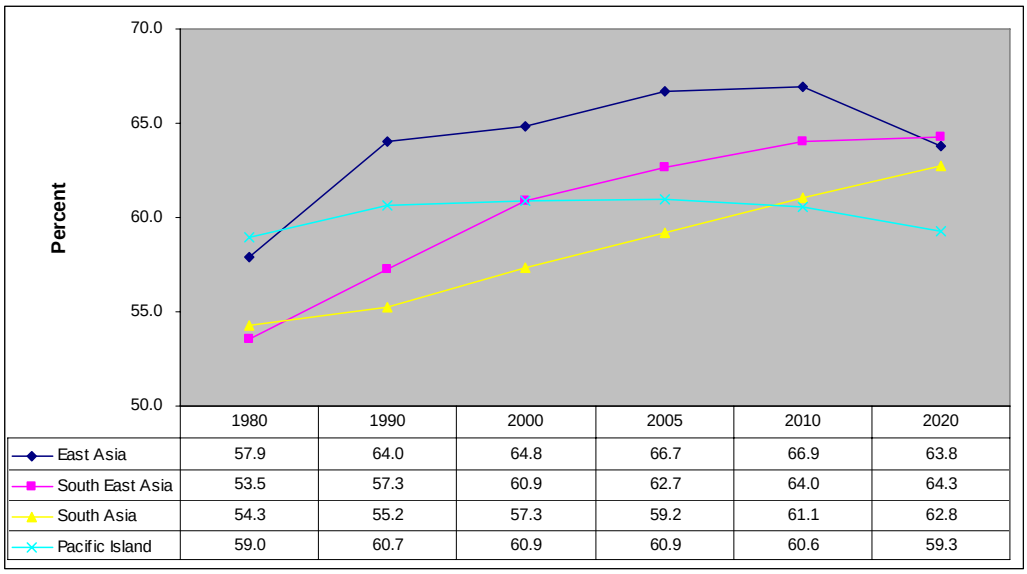
	1980	1990	2000	2005	2010	2020
Young age	37.2	32.8	29.9	27.5	25.5	23.1
Working age	56.0	59.6	61.1	62.9	63.9	63.4
Elderly age	6.8	7.6	8.9	9.6	10.5	13.6

Figure 7. Trends and projection of population structure in the region
Source: Computed from United Nations Statistics Division, 2007.

The Asia-Pacific region is leaning towards population ageing and shrinking in terms of the younger age population. The rapid decline in fertility and the increase in longevity have resulted in major changes in the age structure. The proportion of the younger age population is shrinking and will continue to fall. By 2020, the proportion of the younger age population will be lowest (17.6 percent) in East Asia whereas it will be highest in South Asia. Likewise,

Developed countries will have the lowest proportion of younger age population whereas Small Island countries will have the highest. The proportion of the younger age population across all the countries is decreasing and will follow a similar trend by 2020, which is mainly due to a decrease in the population growth rate.

There are some marked differences in the proportion of the working age population at the sub-regional level (see Figure 8). By 2020, the working age population will increase in South Asia and South East Asia and decrease in East Asia and the Pacific Islands. The working age population of East Asia is expected to rise till 2010 when it will then begin to decline, mainly because of China and Japan. Japan already has a higher proportion of old age population whereas population aging in China will start from 2015 onwards. In the Pacific Islands, Australia and New Zealand have a declining trend of working age population.



	1980	1990	2000	2005	2010	2020
East Asia	57.9	64.0	64.8	66.7	66.9	63.8
South East Asia	53.5	57.3	60.9	62.7	64.0	64.3
South Asia	54.3	55.2	57.3	59.2	61.1	62.8
Pacific Island	59.0	60.7	60.9	60.9	60.6	59.3

Figure 8. Working age population within the sub-region of the Asia-Pacific region
Source: Computed from United Nations Statistics Division, 2007.

The working age population in Developing countries and Small Island countries will increase till 2020 whereas it will decline in Developed countries. Demand for housing is likely to increase in Developing and Small Island countries with an increasing proportion of working age population; this may affect the demand for forest products and services in Developed countries because of changes in preferences and behaviours with age and income levels. The countries within the Asia-Pacific region show two distinct patterns of age structure change by 2020. The Working population will continue to increase in all the countries except Australia, Hong Kong SAR, Japan, Republic of Korea, New Zealand, Sri Lanka and Thailand. All these countries have industrialized economies except Sri Lanka and Thailand.

The proportion of the elderly population will continue to increase among all sub-regions and groups. However the rate of increase is quite high in East Asia and the Pacific Islands and relatively slow in South Asia. By 2020, nearly one fifth of the population of East Asia (18.6 percent) and the Pacific Islands (19 percent) will fall under the old age group.

By 2020, population aging will be quite visible in Developed countries. More than one fifth (21.8 percent) of the population belonged to the elderly age group in 2005 and this will increase to 29.8 percent in 2020. The elderly populations in Developing and Small Island countries are also increasing, however the rate of increase is quite high in Developing countries.

The elderly age population is increasing in all countries, however rates of change vary based on their level of economic development. By 2020, more than one fifth of the population of Japan (34.3 percent), Singapore (26.4 percent), Hong Kong SAR (25.7 percent), Australia (23.9 percent), Republic of Korea (23.1 percent), New Zealand (22.5 percent), Thailand (18.5 percent), Sri Lanka (17.2 percent) and China (17.1 percent) will belong to the elderly age group. An increasing proportion of elderly age populations will have an impact on design, layout, use and construction of houses, which may reduce consumption of wood and hence have positive impacts on forests and forestry.

3. IMPACTS ON FORESTS AND FORESTRY

Major demographic changes are occurring in the Asia-Pacific region. The impacts of demographic changes on forests and forestry are assessed in terms of forest and land use changes, demand and consumption of wood products and environmental concerns such as urban greening/forestry, recreational demand and water issues etc.

Socio-economic development in Asia-Pacific countries varies significantly (see Table 4). Analysis of demographic impacts at group or sub-region levels may not give complete pictures since impacts of demographic changes are slow and countries are in different stages of demographic transition. This may also dilute the extent of the impact, for example the Asia Pacific region gained 4 million ha of forests during last five years led by China, as well as contributions from India, New Zealand, Vietnam and Bhutan contributed. However the rest of the countries lost forests. Likewise demographic changes in conjunction with other factors impact forests and forestry. Hence, impacts are discussed at country level within a group to have a broader perspective on how the situation is evolving and its likely impact on forests and forestry by 2020 in combination with other factors.

Table 4. Range of characteristics of the Asia-Pacific region

Characteristics	Range
Land area under forests (%)	2.5-77.6
Population density (Person/sq km)	2-6549
Annual population growth rate (%)	(2.5)-2.2
Urbanization ((%)	9.1-100
Agricultural population (%)	0.1-93.8
GNI per capita (US$)	290-38410
Annual rate of forests change	(2.1)-2.2

Source: Annex 1.

Forests and land

Population pressure is often cited as a primary reason for land use changes, forest encroachment and conversion to crop lands and built up areas. However, there is no “linear relationship” that increases in population will put more pressure on land and forests. It depends on the stage of development of the country. Singapore, a densely populated country with a high population growth rate (2.8 percent per annum), has not only maintained forest cover but also emerged as the “garden city” of the world. On the other hand, Mongolia which has the lowest population density in the region and an annual population growth rate of 0.7 percent (just above the stabilizing level) has lost forests at 0.8 percent per annum during the last five years (2000-2005). Both of these countries have low forest cover but the demographic impacts are completely different, mainly influenced by their dependency on land (agricultural population), extent of urbanization and level of income. The priority of the government to conserve existing resources is equally important, for example Indonesia’s plan to raze millions of hectares of forests for the plantation of oil crops. China on the other hand is protecting forests for ecological integrity. Considering this, impacts on land and forests are analyzed at the country level by assessing combinations of different factors such as area under forests, extent of socio-economic development and the demographic situation.

Developing countries

Population pressure on land is decreasing in Developing countries (see Annex 9). During the last five years (2000-2005), arable land increased by 7 million ha (0.3 percent per annum) whereas forests increased by 4 million ha (0.2 percent per annum) although their population

increased by 200 million (1.22 percent per annum). Likewise, the area under permanent crops increased by 15 million ha and wood land area decreased by more than 9 million ha. Some of the factors which have reduced population pressure on land include economic growth, agricultural mechanization and intensification, technological advancement, decreasing availability of labour force for agriculture, urbanization and broader national land use policies. Likewise, many countries have increased their agricultural production substantially.

However, the situation varies significantly at the country level, depending upon the extent of forest cover, population growth and income. There is growing concern about protection of forests in low forest cover countries, but increasing demand for land has often resulted in agricultural related forest clearance or depletion of existing stocks. On the other hand, countries with high forest cover often view "forests as an asset" that need to be utilized for the development of the nation which leads to (a) large-scale clearance for agricultural development, including resettlement of people; (b) generating income from logging; and (c) use of forest land to grow commercially important crops such as oil palm. In countries with moderate forest cover, there are both positive and negative impacts on land and forests influenced by their economic growth and dependency on agriculture.

In low forest cover Developing countries, the impact of demographic changes is influenced by population density and income (Table 5). Countries like Pakistan and Bangladesh, which have low income and high population density, population growth has exerted high pressure on existing forests (Box 4). Clearance of forests for agricultural purposes is quite likely in these countries, since more than half of the population still depends on agriculture for livelihoods (see Annex 1 and Annex 10). Firewood is still used as a primary source of energy in these countries and economic development is not strong enough for a shift from traditional to modern fuels (see Figure 9) despite increasing momentum of planting trees on farm land, road sides and canal banks.

Table 5. Impacts on land and forests in low forest cover developing countries

Countries	Characteristic	Demographics	Others
Pakistan, Bangladesh	Low income, high population density	• Encroachment, • Deforestation, degradation • Conversion for agricultural and built up areas • Plantations	
Mongolia	Low income and low population density	• Resource degradation due to grazing and logging • Resource scarcity resulting in plantations	• Revenue generation • Forest fires • Desertification and droughts

Box 4. Population Growth and Forests, Pakistan

Pakistan has low forest cover and is the fourth most populated country in the region with an annual population growth rate of 2.4 percent per annum (2000-2005). The total area of forests in Pakistan is 1.9 million ha, which is 2.5 percent of the total land area. The deforestation rate is quite alarming, estimated at 2.1 percent per annum (FAO, 2007 c). Woody biomass is declining at 4-6 percent per year. Almost 7,000 to 9,000 ha are deforested every year and this rate is especially severe in the north where the per capita consumption for fuelwood is 10 times higher due to the ruthless winters (Siddiqui and Amjad 1993 cited in Ali and Benjaminsen, 2004).

It has also been estimated that 70–79 percent of Pakistani households use fuelwood as a main source of energy (Hafeez 2000; Siddiqui 2000 cited in Ali & Benjaminsen, 2004). Consumption of firewood is increasing by nearly 3 percent per annum. Pakistan's woody biomass may be totally consumed within the next 10-15 years. The lopping of trees for commercial purposes has also accelerated forest depletion. Unrestricted livestock grazing is also a severe threat.

The existing forest cover is unable to meet the growing demand for wood. In order to combat these situations, significant efforts have been made to plant trees on farmlands, roadsides, canal sides and railway banks. Nearly one million (0.78 million) ha of forests are in farm land or private forests and the wood lot area expanded from 1.1 million ha in 1990 to 1.4 million ha in 2005. The farm land tree growing stocks are increasing at 3.86 percent per annum. Privately owned farmlands supply 50 percent of the demand for timber, imports 36 percent and state forests only 14 percent (Ali & Benjaminsen, 2004).

This reliance on fuelwood is expected to remain high in Pakistan in the foreseeable future, mainly because the country's economic development is not strong enough for a shift from traditional to modern fuels (Siddiqui and Amjad 1993 cited in Ali and Benjaminsen, 2004). The high demand for domestic fuelwood is believed to be the cause of Pakistan's rapid depletion of forests.

In low population density/low income countries like Mongolia, not only population pressure but climatic factors and the desire of the country to use forests for the development of the nation have also resulted in land use changes. Both the arable land and forests have declined (Annex 10) whereas the area under permanent crops has increased. This is exacerbated by uncontrolled migration and settlement in forests. People's dependency on firewood and grazing is quite high and high levels of extraction (see Figure 9) may further degrade forests. Nevertheless, "green wall" programmes implemented from 2005 onwards aim to build about 220,000 ha of green belts in the next 30 years; this may reduce the dependency of people on public forests.

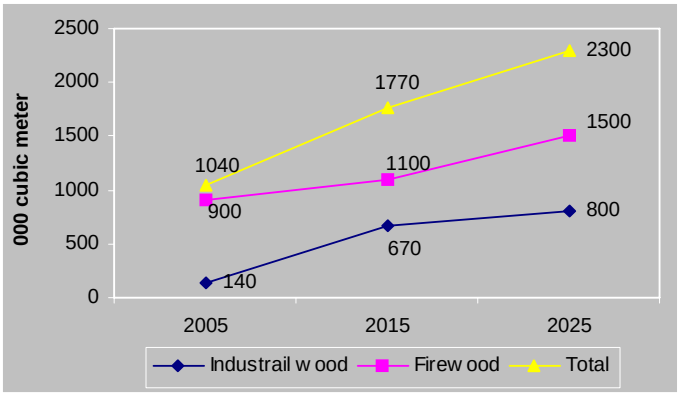


Figure 9. Forest harvesting projections in Mongolia
Source: FAO, 2007f.

Forest fire and droughts are also equally responsible for diversion of forests to other land uses. In the last 10 years, Mongolia's arid area extended by 3.4 percent and land affected by desertification extended 5.4 times. Nearly 6.47 million ha of forests have been damaged by

fire since 1990 (FAO, 2007f). Mongolia intends to enhance the contribution of the wood sector on GDP by 1 percent in 2008 and 2 percent by 2020 (FAO, 2007d), which may further increase pressure on forests.

There exists a large variation among the impacts of demographic changes on land uses in moderate forest cover countries (Table 6). Land use changes in these countries are often influenced by their extent of urbanization, structure, size and growth of economy and their broader land use policies. Increase of population in poor countries experiencing slow economic transformations like Nepal will exert more pressure on forests and land whereas countries with booming economies such as China, India and Viet Nam have experienced forest transition and their population pressure is being transferred to other countries.

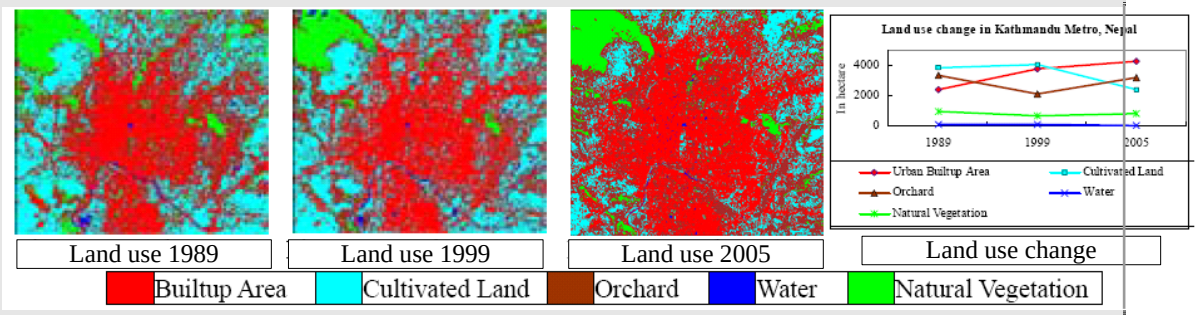
Table 6. Demographic impacts on land and forests in moderate forest cover Developing countries

Countries	Characteristics	Demographic impacts	Others
Nepal	Low income, high population density	• Conversion for agriculture • Forest degradation • Fringe encroachment • Built up areas expansion • Shifting cultivation	
Sri Lanka, Philippines, Thailand	Middle income, high population density	• Conversion for agriculture • Shifting cultivation • Built up areas expansion • Tree planting	• Conflicts/ reconstruction efforts (Sri Lanka)
China, India, Viet Nam	Growing economy, high population density	• Forest transition • Arable land diverted to forests • Built up area expansion • Tree planting outside forests	• Mediated by economic growth and policy processes • **Impacts shifted to other countries**

In low income and high population density countries where fuelwood and agricultural land are in high demand (see Annex 1 and Annex 10), other livelihood options are limited and the economic transformation process is slow; the growing population has increased pressure on forests. Apart from this, rural to urban migration has resulted in the expansion of built up areas (see Box 5) at the cost of arable land.

Box 5. Land Use Changes in Kathmandu Metropolitan Region, Nepal

The population density of Kathmandu increased from 8,370 persons/km^2 in 1990 to 13,235 persons/km^2 in 2001. High population influx has caused significant pressure on the limited resources in the valley. Cultivated land has been replaced by urban built up area as well as orchard activities. Urban areas accounted for 23 percent of the total land in 1989; this increased by 17 percent until 2005 whereas cultivated land decreased from 36 percent to 22 percent in the same period. The overall result shows rapid expansion of urban built up area and shrinkage of cultivated land.



Source: Thapa and Murayama, 2006.

In middle income and high population density countries like Sri Lanka, Philippines and Thailand, population growth has resulted in an expansion of agricultural land and conversion of forests to non-forestry uses. For example in Sri Lanka, population growth and poverty drove the conversion of public forests to agricultural land whereas in Philippines, forests were converted into built up areas and other non-forestry purposes (see Box 6) especially in urban areas. Urban population expansion and the high proportion of agricultural population (more than 40%) increased pressure on forests (see Annex 1 and Annex 10). Nevertheless, these countries have strong programmes to grow trees outside forests, which is likely to meet wood demands from plantation areas in the coming years.

Box 6. Land Use Changes in the Philippines

High dependency on wood extraction from natural forests contributes greatly to continued forest degradation in Philippines. Overexploitation and conversion to other land uses (mainly upland agriculture) have been the main reasons for natural forest depletion.

Large reforestation and tree plantation efforts have been initiated in partnership with community and private corporate sectors for forest land development. Community-based forest programmes are given top priority and the area under this management spans 4,276 million hectares, nearly four fifths (78 percent) of the areas managed by the Department of Environment and Natural Resources. Likewise, Caraga Forest Plantation Corridor (CFPC) was established in 1999, with 684,503 hectares of public forestland, and is being managed in partnership with the private corporate sector. Much of timber production in the future will come from areas managed under tenure by communities.

Though the conversion of forests for agricultural purposes has decreased recently, about 27,834 hectares have been recorded as being converted to other non-forest uses, principally settlements and infrastructure, during the last five years. Some areas classified as forestlands are being used for non-forestry purposes, especially those in urbanized areas already developed for human settlement, commercial, and industrial uses. About 40 percent of the public forests are used for other purposes.

Source: Condeno, 2005; DENR Philippines, 2003.

Economic booms have resulted in major land use changes in China, India and Viet Nam. Arable land is shrinking and these countries are experiencing forest transitions, i.e. from net deforestation to net reforestation. When other non-farm based economic opportunities are available, population growth may not exert pressure on land and forests. During the last 15 years (1980-2005), India lost more than 3.1 million hectares of arable land, of which 0.9

million ha (27 percent) has declined in the last 5 years (2000-2005) (see Annex 9). Not only economic growth but land fragmentation is also equally responsible for diversion of arable land for other purposes. In India, the average area operated per holding in 2002-2003 was 1.06 hectares compared to 1.34 hectares during 1991-1992 and 1.67 hectares in 1981-1982. Farming has now become unprofitable for business, due to shortages of labour and inputs like irrigation and electricity. Given the opportunity, some 40 percent of farmers have expressed the desire to quit farming (Ramanna, 2006).

Forest area has not only recovered but has expanded in these countries despite demographic changes. Many studies attributed forest transitions as a result of economic growth and structural changes in the economy. However forest transition in these countries is not simply a function of income or level of economic development but is a result of policy reforms, which aim at expanding forest area and curbing deforestation. Natural Forest Protection Programs in China, Joint Forest Management and Social Forestry Programs in India and devolution of forestlands in Viet Nam (Mather, 2007) are some examples of the major policy reforms (see Box 7) in these countries.

Box 7. Major Policies and Programmes in Forest Transition Countries

China. It is a basic national policy of China to plant trees, protect forests and improve the ecosystem. Attaching greater importance to ecological development since the beginning of the new century, the Chinese Government has decided to invest several hundred billion yuan in initiating the following programmes:

- The natural forest protection programme: aims to rehabilitate and develop natural forests. It includes protecting existing forest resources by banning commercial logging in natural forests, accelerating the fostering of forest resources and diverting and relocating forest workers
- The return farmland to forests programme: plans to return 14.66 million hectares of farmland to forests and afforest 17.33 million hectares of barren hills and wasteland suited to afforestation by 2010
- The shelterbelt construction programme: attempts to reduce the hazard of sandstorms in areas surrounding the capital city. This programme plans to return 2.63 million hectares of farmland into forests and afforest 4.94 million hectares of land, with supporting water conservancy facilities
- The sandstorm-control programme: intends to combat and control desertification through afforestation, shelter belt construction, protection and rehabilitation of degraded land
- The wildlife conservation and nature reserve development programme: plans to resolve problems related to the protection of species, nature and wetlands
- The fast-growing and high-yielding timber base construction programme: aspires to ease the shortage of timber supply and reduce the pressure of timber demands on forest resources

The six key forestry programmes cover more than 97 percent of China's counties, with plans to afforest 76 million hectares of land. Implementation of these six key programs will pay a significant role in improving the ecosystem and achieving sustainable development in China, but also make great contributions to safeguarding global ecological security.

Source: FAO, 2003.

India. India introduced a new forest policy in 1988. One of the objectives of the policy was to increase forest/tree cover 'through massive afforestation and social forestry programmes, especially on all denuded, degraded and unproductive lands'. Goals were set of having one third of the total land area and two thirds of hills and mountains under forest cover. Two programs largely contributed to the improvement of forest cover in India:

The joint forest management programme: The Forest Department works out joint forest management (JFM) agreements with local communities for management of forests.
The social forestry programme: implemented since 1976, this has resulted in extensive tree planting. While the initial objective was to provide for local needs for forest products, planting became

increasingly associated with commercial industrial objectives and increasingly involved larger farmers who planted for commercial reasons.

Viet Nam. Radical measures have been implemented over the last 10-15 years, and there is little doubt that they have played significant roles in relation to forest trends. With the enactment of a new Land Law in 1993, forest management was devolved from the central state to households, villages and communes. Allocation of land to households for periods of 50 years allows households to enjoy (and to transfer) use rights, but certain constraints remain in place. The state retains the right to land classification, and if an area is classed as forestry land it has to remain so. Also natural forests and forests in some critical watersheds are not allocated to households, but to communes, districts or other entities which can enter into contracts with households to ensure approved forms of management. These might include payments but also restrictions on forest use for the extraction of minor forest products.

Source: Mather, 2007.

Urbanization and industrialization is expanding built up areas in these countries, converting large amounts of forest and agricultural land into housing, infrastructure and industrial estates (See Box 8).

Box 8. Urbanization and Land Use Changes in Mumbai Metropolitan Region, India

The Mumbai Metropolitan Region (MMR) is the largest and fastest growing metropolitan region in India and has an extra demand of 586 000 residential housing units. The rapid population growth and urbanization have resulted in major land use changes.

The population of the MMR increased from 7.7 million in 1971 to 18.3 million in 2001 and is projected to reach 22.4 million by 2011. The population density of the MMR was 1 989 persons PSK in 1971, which increased to 3,743 in 1991 and is expected to be 5 774 persons PSK by 2011.

The metropolitan region is experiencing fast growth. The total built-up and industrial area in the MMR increased from 4.9 percent in 1971 to 12 percent in 1991 and is projected to constitute 31 percent of the total area by 2011. On the other hand, area under forest cover and green land increased from 27 percent in 1971 to 38 percent in 1991 but is expected to decline to 22 percent by 2011.

The increase in built-up area is likely to come from agricultural land, forest land and wetland. The built up area in the region would increase by 717 km^2 of which more than four fifths (592 km^2) would come from conversions of forests and green cover.

Source: Acharya and Nagina, 2004.

With their growing economy and high priority on protection of forests, these countries have shifted their population pressure to other countries. The annual increase in production of round wood is very marginal but imports remain high and are increasing (see Table 7). China and India are the world's largest importers of tropical logs and main sources of imports are other forest rich countries in the region, including Malaysia, Papua New Guinea and Myanmar along with Africa and the Russian Federation (see Box 9).

Table 7. Annual rate of change (percent) of production, import and consumption of round wood, 1990-2005 (source FAO, 2007)

Country	Production	Import	Consumption
China	0.1	10	0.6
India	0.6	8.6	0.7
Viet Nam	0.1	NA	0.1

Box 9. Import of Tropical Logs in China and India

China, the world's largest importer of tropical logs, imported over 7.3 million m^3 in 2005, 6.8 million in 2006, and is expected to import about 6.5 million m^3 in 2007. China's tropical log imports rose steeply from the mid-1990s to their 2004 peak, with Malaysia, PNG, Gabon, Myanmar and Republic of Congo being the main sources. China's import of non-tropical logs is also large, with the Russian Federation providing the bulk. China's total log imports from all sources reached 31 million m^3 in 2006, far exceeding those of all other countries, and the country's total log import volume is projected to rise further in 2007, to almost 33 million m^3.

India is the second largest tropical log importer, with over 3.2 million m^3 imported in 2005 and over 3.4 million m^3 imported in 2006; imports are set to exceed 3.6 million m^3 in 2007. Imports have been mostly from Malaysia and Myanmar but with an increasing amount from Africa.

Source: ITTO, 2006.

This trade is exacerbating the problems of deforestation, unsustainable harvesting practices and illegal logging (see Box 10) in other timber exporting countries. There are serious concerns about the rapid decline of natural forests in the countries that export forest products to China and their ability to supply products in the future, both for local needs and for export (White et al., 2006). India is also likely to follow similar patterns to China (see Box 11) by 2020.

Box 10. China's National Forest Protection Programme and Its impacts on other Countries

Domestic supply of industrial wood has failed to keep up with China's growing demand. This is a reflection of the spectacular increase in growth in domestic consumption and the demand for exports on the one hand, and the government's decision to protect the country's forests. The Natural Forest Protection Programme (often referred to as the logging ban) was introduced in 1998 after floods devastated the middle reaches of the Yangtze River; deforestation in the upper reaches of the Yangtze River was thought to be partly responsible and led to a dramatic decrease in domestic production.

The number of countries supplying China with forest products has steadily risen, with the number of countries exporting over a half million US dollars in value to China rising from 54 in 1997 to 84 in 2005. Nonetheless, some two thirds of total forest product imports, when measured by volume, still come from the Asia-Pacific region.

While many countries in Asia have ambitious plantation programmes, many plantations are under-performing or are not expected to come on-line for many years. It is estimated that at present cutting rates, the natural forests in Papua New Guinea will be logged out in 13-16 years. The equivalent figure for Indonesia is 10 years and 4-9 years for Cambodia. The situation in Myanmar is no better, and forests will be logged out in 10-15 years. The Philippines and Thailand have already logged out most of their natural forests and have given high priority to raising plantations.

Source: White et al., 2006.

Box 11. India Might Be the Next China

By 2020, India's population will reach some 1.4 billion people, of which 63 percent will be in the age range of 16-65 years. It will have the world's largest working and consuming population. The outlook for economic growth is in the range of 6 to 7 percent a year.

Combining these forecasts with the predicted continued rise in per capita income and the growth of the middle class, there will be significant increases in consumption. Within the next 20 years, India will probably overtake China in growth status, as its workforce continues to expand. It is estimated that industrial log consumption is currently 50 million cubic metres and could grow to 90-120 million cubic metres by 2020. Given the available information on the domestic wood supply, which is admittedly uncertain, there could be a deficit in India of 20-70 million cubic meters by 2020.

Source: Nilsion and Bull 2005 cited in White et al., 2006.

There is evidence of both continued clearance of forests for agriculture and trade-driven clearances such as logging and plantation of commercial crops in high forest cover Developing countries (see Table 8). However this situation varies by country depending on their priority towards the utilization of forests, level of income and dependency of people on land.

Table 8. Impacts on land and forests in high forest cover Developing countries

Characteristics	Countries	Demographic	Others
Low forest cover (Less than 10%)	Kiribati, Maldives, Tonga	• Agricultural expansion • Forest degradation • Built up areas expansion	• Tourism • Coconut and permanent crop cultivation
Moderate forest cover (10-40%)	New Caledonia, Vanuatu	• Agricultural expansion • Forest degradation	• Fire (New Caledonia) • Logging
High forest cover (> 40%)	Cook Islands, Fiji, Samoa, Solomon Islands	• Shifting cultivation • Fringe encroachment • Forest degradation	• Palm and coconut plantation (Solomon Islands) • Plantations • Logging

In low income and low population density countries like Laos and Papua New Guinea shifts towards a market-oriented economy are increasing pressure on forests and resulting in land use changes. Shifting cultivation is widely practiced in Laos and increasing population has resulted in forest fragmentation and resource degradation. However, forests and the shifting cultivation area have been converted into cash crop plantations in recent years, which are linked to incentives for foreign demand.

The situation in Papua New Guinea is completely different. Commercial logging much more than population pressure poses major threats on land uses by clearing forests, disrupting ecological processes and endangering both biological diversity and people's livelihoods. In many cases, annual allowable harvesting levels in individual projects have been set too high and forest areas are effectively being 'logged out.' The average concession life between 1993 and 2000 was just 11 years, a fraction of the 40-year cutting cycle required by law, implying that cutting rates are far in excess of sustainable harvest levels (Forest Trend, 2006). Slash-and-burn agriculture which often follows in the footsteps of loggers has completely changed whatever remnant forests the loggers have left behind. Development of oil palm estates is also affecting forests.

In low income and high population density countries like DPRK, Myanmar and Cambodia, diversion of forests for agricultural purposes, commercial plantation and logging are the main causes of land use changes (see Box 12). High dependency of people on firewood may further degrade forest resources. Nevertheless, high priority has been given to reforestation and afforestation programmes which may reduce pressure on natural forests.

Box 12. Reasons for Land Use Changes in Myanmar

Demographic related

- Forests converted for agricultural expansion, specifically for paddy fields in central Myanmar
- Shrimp farms established at the expense of mangrove forests in the coastal zones
- Shifting cultivation by indigenous ethnic groups still a major cause of forest loss in the mountain zones, where pressures are increasing for land by the growing population
- Increasing urbanization becoming a more common driver for forest change

Market and trade related

- Intensive, (selective) logging activities in production forests seen as a reason for change of forest canopies and structure in central Myanmar
- Illegal logging activities identified as a main reason for change along the northern border zone of Myanmar and China
- Establishment of cash crop plantations, specifically for palm oil, emerging as driver of land use change

Source: Stibig et al. 2007.

In middle income and low population density country like Bhutan, forest transition started in the late 1990s despite high population growth (1.9 percent per annum during 2000-2005) and high dependency of people on agriculture (93.8 percent). Bhutan gained 54 000 ha of forests during 2000-2005 at a rate of 0.3 percent annum. Less than 10 percent of the population lives in urban areas and dependency on forests for timber, fuel wood, fodder, leaf litter and water is quite high. Likewise forests are also utilized for cattle grazing. As a result of this, forest degradation is increasing.

In high population density and middle income countries like Indonesia and Malaysia land use change is quite high. Main reasons for changes in these countries include (a) the timber industry; (b) shifting cultivation; (c) agricultural conversion to permanent cultivation of cash crops; and (d) government-funded land development schemes.

Small Island countries

In Small Island countries, major changes in land use have been observed during the last fifteen years, with arable land expanding and forests shrinking. Forest area has declined by more than 500 000 ha, which is mainly due to a combination of population pressure, loss of traditional control on land, shifting cultivation, pasture development, and mining and logging activities.

Small Island countries are classified into three sub-groups based on the extent of forest cover. Impacts on land use changes are presented in Table 9. In Small Island countries, income and population densities are taken into consideration during analysis because population is confined in certain geographical areas such as the forests, so the effective population density might be higher than estimated. Likewise, data on the income of many countries are not available (see Annex 1).

In low forest cover countries, increasing population is putting tremendous pressure on scarce resources, both on land and forests. Forests are being diverted for agricultural uses due to increasing demand for land.

Table 9. Impacts on land and forests in Small Island countries

Characteristics	Countries	Demographic	Others
Low forest cover (less than 10%)	Kiribati, Maldives, Tonga	• Agricultural expansion • Forest degradation • Built up areas expansion	• Tourism • Coconut and permanent crop cultivation
Moderate forest cover (10-40%)	New Caledonia, Vanuatu	• Agricultural expansion • Forest degradation	• Fire (New Caledonia) • Logging
High forest cover (> 40%)	Cook Islands, Fiji, Samoa, Solomon Islands	• Shifting cultivation • Fringe encroachment • Forest degradation	• Palm and coconut plantation (Solomon islands) • Plantation • Logging

In Maldives, land clearance for housing and clearance of natural vegetation for agriculture are increasing (UNEP 2002). Likewise, strong demand for locally grown agricultural products, both from tourist resorts and growing population (ibid) is also exerting pressure on land and forests.

Forests are being exploited both for subsistence living and commercial activities in medium cover forest and high cover forest countries. An increased population, coupled with plantation crops and logging operations is increasing pressure on limited land resources (Box 13).

Box 13. Population Growth, Logging and Its Impact on Forests, Solomon Islands

The Solomon Islands consist of a double chain of over 900 islands, extending for 1,600 kilometres. The majority (86 percent) of people live in clan groups in over 4,000 small villages around the islands' coastlines. Gardening and fishing contribute to a mixed subsistence-cash economy. The population of the Solomon Islands, growing at approximately 2.8 percent per annum during 2000-2005, is expected to double in about 23-25 years.

Coastal lowland rainforest belts are coming under intense pressure from further clearance. Local villagers are extending their practice of shifting cultivation to forest not previously cleared, including those opened up by 'selective' logging. In areas previously cleared for agriculture there is a reduction in the fallow period and/or an extension in the period of cultivation.

Large-scale commercial development projects, such as mining, oil palm and logging, are also contributing to forest loss. Cultivation of forests for oil palm has also resulted in the clearance of large areas of lowland forests. Large-scale oil palm development is expected to impact seriously on the marine ecosystems with a consequent loss of biodiversity and available resources for traditional harvesting by local communities.

Many thousands of hectares of forest have been acquired from landowners for logging. If present cutting rates are maintained, areas in which logging is viable will be exhausted within ten years. Commercial logging in the Solomon Islands is a recent development, which began in the 1990s. Logging in places like the Russell Islands (Central Solomons) was prohibited throughout the 1980s, but was open to foreign logging firms and logging licenses were provided in previously restricted areas. The government took some steps to regain control over logging concessions with export restrictions on logs in 1997 and the nationalization of the timber industry in 1998, but the rate of forest loss has still increased by 17 percent. Very little of the Solomon Islands is protected and logging has brought few benefits to the native population.

Source: WWF, 2008; Mongabay, 2006.

Developed countries

During the last 15 years (1990-2005), arable land area decreased from 57.3 million ha in 1990 to 56.9 million ha in 2005 whereas forests declined by nearly 4 million ha during the same period. Industrialization and urbanization are the main causes of land use changes in most of the Developed countries. Nevertheless, land use changes are also determined by climatic factors like drought, water availability, fire etc.

Population growth may not have any significant impact on land use changes (Table 10) since populations are stabilizing and are in the terminal stage of urbanization, with low levels of land dependency. Agriculture provides employment for less than five percent of the population and the contribution of the agricultural sector to GDP is minimal.

Table 10. Impacts on land and forests in Developed countries

Countries	Characteristics	Demographic	Others
Singapore	High income, high population density and **low forest cover**	• Less dependency on land • High environmental consciousness • Recreational demand	
Australia, New Zealand	High income, low population density and **moderate forest cover**	• Land consolidation • Agricultural land and other area converted into forests • Forest fragmentation' • Recreational demand	• Technological adaptations • Climatic factors • High environmental consciousness
Japan, Republic of Korea, Brunei Darussalam	High population density, high income and **high forest cover**	• Recreational demand • Impact shifted to other countries (Japan) • Land consolidation	• Impact mediated by economic development and technological adaptations

In Developed countries, arable land is declining mainly because of ageing population, high rural to urban migration and a decrease in farming population and diversion of arable land for built-up areas or other kinds of land uses. Yet average farm size is increasing, for example farm sizes in Republic of Korea, around 0.9 hectares in 1965, increased to around 1.4 hectares in 2005 (Abare, 2007). In low population density Developed countries like Australia and New Zealand, arable land is being diverted for forestry purposes (see Box 14) to rehabilitate degraded environments and meet demand for forest products. In high population density countries like Japan and the Republic of Korea, urban and industrial developments have encroached upon arable land (UNEP, 1999).

Box 14. Diversion of Agricultural Land for Forestry Purposes in Australia

Australia's overall population growth comes roughly equally from natural increase (births) and migration from overseas. Rural areas are generally declining while larger cities continue to grow in area and population. Historically, almost all clearing of forests in Australia has been for agricultural production. Clearing for commercial plantation forestry has also been significant. The plantation estate is still expanding from 1.66 million hectares in 2003 to 1.72 million hectares in 2004, to meet the growing demand for forest products. Over the last 11 years, most of these plantations have been established on former agricultural land rather than on native forests. In southwestern Australia, eucalyptus plantations currently occupy about 150,000 hectares of agricultural land and the rate of planting is escalating (Grove et al., 2001). Land that was classified as agricultural in the early 1990s is now classed as plantation forestry. Plantation on agricultural land area is generally carried out for land rehabilitation, shelter and shade for stock, conservation of biota, and for the production of sawlogs, pulpwood and non-wood forest products. By far the largest motives for tree planting on farms has been to rehabilitate degraded environments and meet the growing demand for forest products.

Source: Australia State of Environment Committee, 2006.

In Developed countries, population growth may not have a larger impact on forest conversion for agricultural purposes. However, urban growth and concentration of people in urban areas have resulted in the growth of urban sprawl, loss of natural vegetation and open space, and a general decline in the extent and connectivity of wetlands and wildlife habitat. For example continued urbanization of the Australian coastline has resulted in continued urban clearing for housing and infrastructure in biologically rich habitats along the Australian coast. Clearing in these areas is of concern because it has occurred in already fragmented habitats, some of which are quite small in extent, and many of which were ice age species, refugia, which have high conservation value (Australia State of Environment Committee, 2006).

In Developed countries, forests are largely used for recreational purposes and ecological functions. The recreational demands from forests are increasing with the growing urban population. The increasing population will put more demand on forest products, which are largely met through imports especially in high population density countries (Table 11) like Japan, Singapore Brunei Darussalam and Republic of Korea. Developing countries are the leading exporters of forest products. This may result in deforestation and other land use changes in Developing countries, especially in those countries which still have a large proportion of land under forests. Rapid conversion of forests in Indonesia, Malaysia and Myanmar for palm oil and biofuel is some evidence of this.

Table 11. Production of round wood as percent of consumption in Developed countries

Country	1990	2000	2005
Australia	100.1	108.2	104.7
Brunei Darussalam	-	-	-
Japan	53.9	54.3	60.5
Korea, Republic of	22.7	25.5	30.3
New Zealand	116.5	145.0	137.9
Singapore	-	-	-

Source: FAO, 2007e.

Forest resource conditions

Forest degradation

The rising human population has resulted in a dramatic increase in the demand for wood products. This had led to overexploitation and harvest beyond sustainable yields, which has resulted in forest degradation in many countries without affecting the forest area.

In Developed countries like Japan and Republic of Korea, forest condition have improved compared to the past, mainly because of realization of the environmental values of forests. Rapid urbanization and industrialization further support this. Plantation forests in Japan have been left without proper care and management due to difficulties in timber production as they lost competitive advantage, especially due to low profitability and shortage of workers (Iwamoto, 2002). New Zealand, Australia, and Republic of Korea have been promoting massive plantation programmes to improve the resource base situation.

Higher populations in Developing countries will not necessarily force the conversion of forests to non-forest areas. Yet high dependency on forests often leads to forest degradation, even in countries like India which has gained forest area (see Box 15).

Box 15. Forest degradation in India

India gained 28 million ha of forests during 2001 and 2003 and 70 million ha of scrub land were converted into forest area. However the dense forests (crown cover 40 percent or more) decreased by 262 million ha and were converted into open forests (crown cover less than 10 percent). The increase in forest cover is mainly due to the afforestation programme and protection efforts by the state government and local communities; the extent of decrease in forest cover is mainly due to grazing, forest fire, shifting cultivation, illegal felling and encroachment. Nearly 5.4 million ha of forests were lost due to shifting cultivation in India during 2001-2003.

Assessment year	Dense forest	Open forests	Total tree cover	Scrub
2001	4168	2587	6754	473
2003	3906	2877	6783	403
Change	-262	290	28	70

Source: FSI, 2003.

Figure 10 presents the ratio of consumption of wood fuel to potential supply in Developing countries. Estimated consumption was below the potential supply in many Developing countries (less than 100 percent) like Cambodia, Bhutan, Indonesia, Laos, Myanmar, and Malaysia. These countries had large areas under forests and deforestation and commercial logging were quite high. Countries which gained forest cover like Viet Nam, China and India have less consumption than potential supply.

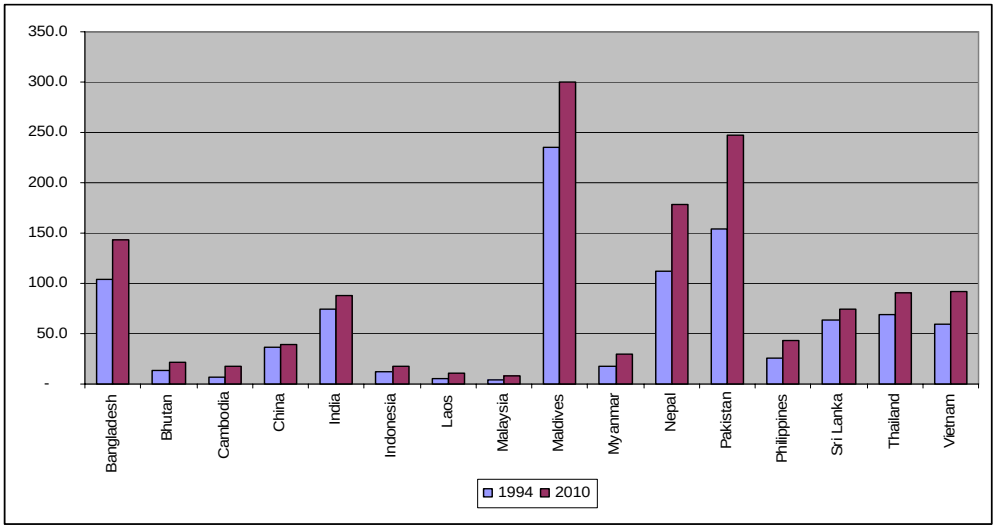


Figure 10. Ratio of estimated consumption to the potential supply of wood fuel in 1994 and 2010 in Developing countries (percent)
Source: FAO, 1997.

However, many South Asian countries like Bangladesh, Maldives, Pakistan and Nepal consumed more than double the wood fuel compared to its potential sustainable supply from forests. These countries have high dependency on forests for firewood, which resulted in forest degradation. Forest degradation will continue to accelerate in most of these South Asian countries unless energy alternatives to firewood are found, as well as alternative sources of income for those people whose lives depend on forest consumption.

Forest degradation is also taking place in Small Island countries since most of the countries are still dependent on traditional forms of biomass based energy (fuelwood from natural forests, coconut shells, husks and stem wood, residues from crops such as coffee, cocoa, for

cooking purposes). Samoa, Solomon Islands and Tonga are among countries with high rates of forest degradation due to overexploitation of merchantable timber resources. Forest degradation due to natural causes (e.g. cyclones and forest fires) is also common. (SIDSNet, 2003).

Area under primary forests

Another impact of population growth is the existence of primary forests. Primary forests are forests of native species, in which there are no clear visible indications of human activity and ecological processes are not significantly disturbed. During the last 15 years, more than 21 million ha of primary forests have been subjected to human intervention. This was largely contributed by Developing countries where the area under primary forests decreased from 132.7 million in 1990 to 105.1 million in 2005 (see Annex 15 for country-specific details). Increasing consumption and shifts from solid to engineered wood products such as wood based panel and paper and paper board are the main causes of conversion of primary forests. Likewise large scale plantation and shifting cultivations are also equally important.

The area under primary forests has remained almost stable or has improved slightly in Developed countries. This was mainly because of growing concerns about the environmental values of forests, urbanization and industrialization (see Box 16).

Box 16. Economic Growth, Urbanization and Primary Forests in Japan

Japan initiated plantation forestry in the late 17th century when demand for timber started escalating with rapid urbanization and economic expansion. Urbanization was the main factor in the emergence of plantations because of construction of the traditional Japanese style of house, which requires huge quantities of timber products. Plantation remained high until the 1960s, when the economy of Japan was booming and demand for timber was mounting. Common lands were converted into plantation forests. However, plantation started to decline and timber imports began to increase in the early 1970s as Japan lost its competitive advantages, mainly because of rising wages. Japan is now the third largest importer of tropical logs after China and India.

Plantation forests were left without proper care and management because of many difficulties with timber production, especially low profitability and a shortage of workers. On the other hand, realization of the environmental values of forests is growing and these values have been enhanced year by year. Japan is now making transitions towards environmentally oriented forestry. As a result of this, the area under primary forests increased from 3.8 million ha in 1990 to 4.6 million in 2005.

Source: Iwamoto, J. 2002.

Housing and wood demand

Quantity and type of housing units are influenced by age structure, population size, urbanization, affordability and credit availability. In Developing countries, housing demand will escalate due to the increasing proportion of working age population, rapid urbanization and increasing affordability due to high economic growth. Housing demand in India and China will be high due to population size and booming economy. Small Island countries might not have high demands for housing as they are typically constrained by the traditional customary practices of land ownership. Nevertheless, demand for housing is likely to increase across all groups, with direct impacts on demand and consumption of wood and wood products.

The housing demand in Developed countries is minimal (Table 12) compared to population size, and is likely to be sustained due to rural-urban migration, immigration of skilled workers and a decrease in household size despite lower population growth and ageing. Likewise, in

Australia the number of single person households is also increasing as divorce rates are rising and people are living longer (Australian Bureau of Statistics, 2002).

Table 12. Annual housing demand/construction in Developed countries

Country	Demand (in '000 units)
Australia	150-170
New Zealand	19-22
Republic of Korea	200

Source: Compiled from various sources.

In Singapore and Brunei Darussalam housing supply is adequate as most people have their own houses. Home ownership in Singapore is over 90 percent (Statistics Singapore, 2008). The population and housing census 2001 of Brunei Darussalam shows that 96.7 percent (53,878 dwellings out of 55,696) of households have their own houses (UNCTAD, ITU and UNESCAP, 2006). Though need for housing is largely satisfied in Brunei and Singapore, housing demand is likely to increase at a marginal rate due to immigration, better employment opportunities, demand for a second home and a propensity to upgrade the existing one with changing life styles and preferences. Housing demand in New Zealand is projected to increase at 19-22 000 per annum, which will create pressures on land supply for further residential development (DTZ New Zealand, 2007).

In Japan, the dependency ratio increased from about 0.4 dependents to each person of working age in 1993, to 0.5 in 2004. It is projected to reach 0.67 by 2023. The number of people aged 20-39, the principal home buying segment, is expected to decline by 9 million from 1990–2020. Despite this, housing demand of Japan is likely to increase at 0.9 percent per annum, which is mainly due to decline in household size (Box 17) and demand for replacement houses. The average life of houses in Japan varies from 25-30 years and most of the houses constructed during the 1970s are now being replaced (ING Real Estate, 2005).

Box 17. Housing Demand of Japan and Australia

Japan: The population of Japan is expected to decline by about -0.1% per annum. This will lead to a reduction of about 0.9 million people in the period 2003-2013. Despite this, the number of households is expected to increase by almost 5 million (0.9% per annum). This is because of the decline in the average household size from 2.6 persons in 2003 to 2.3 in 2023. This will sustain the demand for housing in urban areas. Likewise replacement of old houses will further help.

Australia: Australia already has one of Asia Pacific's older populations, behind Japan. The population is ageing and the elderly population is expected to increase by 68 percent from 3.2 million in 2002 to 5.5 million in 2023. Despite this, the number of households is likely to increase by about 800,000 (1.1% per annum) from 2003 to 2013. This faster growth rate of households compared to population is mainly due to a decline in the average household size from about 2.6 persons in 2002 to 2.4 in 2022.

Source: ING Real Estate, 2005.

Demand for housing in Developing countries will increase rapidly since most of the population will be of working age and more people will move to urban areas. Likewise, the number of people living under one roof is expected to decline, which will boost the need for housing. Employment opportunities in Developed countries or the Middle East have attracted immigration and migrant workers from Developing countries, especially India, Indonesia, Pakistan, the Philippines and Nepal etc. Their remittances may also increase housing demand.

Table 13 presents annual demand for housing in a few Developing countries of the region. Demands for housing range from a low of 60 000 in Thailand to a high of 20 million in China. There is large demand for housing units in urban areas to accommodate the growing urban population. At the same time, housing demand is likely to increase with increased job

opportunities, higher incomes and consumer-oriented demand from the young population as seen in Vietnam (see Box 18).

Table 13. Annual housing demand/construction in developing countries

Country	Demand (in 000)
China	10000-20000
India	7000-10000
Indonesia	800
Vietnam	450-500
Thailand	60
Philippines	751-805
Bangladesh	4000
Pakistan	1100-1500
Sri Lanka	70

Source: Compiled from various sources.

Box 18. Urban Housing Demand in Vietnam

Several changes have led to an increase in the demand for housing in the urban areas of Vietnam. The table below provides the government's estimates for housing demand in urban areas. As the economy has improved and incomes have increased, young professionals are seeking to move out of their family homes and purchase a condominium in urban areas or small houses outside of the major cities. Average per capita income levels are growing steadily. In 2005, the average per capita income was US$636. ADB's CSP (2007–2010) projects an average per capita income of US$1,050–1,100 by 2010.

	2003	2005	2010
Urban population (millions)	21.7	22.9	29.2
Housing area (000 ha)	223.8	250	438
Housing unit (millions)	4.4	5.2	7.7

Source: ADB, 2007a.

Rapid urbanization, increasing proportions of working age population along with booming economies and decreasing household sizes in China and India show high prospects for housing demand, with larger impacts on demand and consumption of wood products. Annual housing demand in China will be between 10-20 million per year and from 7 to 10 million in India. It is more likely that India will surpass China in housing demand by 2015 since population ageing will be observed in China whereas India will still have an increasing working age population.

Housing demand in Small Island countries has increased due to rapid urbanization, tourism and income from remittances. However, it has been constrained by traditional land use customary practices in the Pacific Island countries. This has led to uncontrolled growth of spontaneous settlements around urban areas. The housing needs of most urban populations have traditionally been met either by the extended family (resulting in increased dwelling occupancy and household size) or kinship group (resulting in increased density as extensions are added to buildings). Housing is thus largely an issue of land supply (World Bank, 2000).

Housing needs in Maldives are increasing due to natural population growth and the continuing in-migration from the islands. The Ministry of Housing and Urban Development of Maldives intends to supply 1500 housing units by 2009 and build 250 units of housing per year from 2010 onwards in order to cater to the increasing demand.

Residential building construction is one of the most important drivers of demand for wood products, especially for sawn timber, even in highly urbanized countries like Australia. With

increasing housing demand in Developed countries, demand for wood products will increase. Use of wood as interior decoration is quite high in Developed countries, which furthers demand.

More than half of housing in Japan is constructed with wood; the share of wooden structure houses for 2005 was 43.9 percent (ITTO, 2006). Building construction accounts for consumption of about 70 percent of sawn lumber and most of the plywood. Stable populations and an increasing proportion of the elderly in Japan will have an impact on design, layout, use and construction of houses by 2020. There are already signs of this important demographic shift, for example, barrier-free access, elevators, low-rise stairs and larger bathrooms to accommodate wheelchairs. This will ultimately have a positive impact on the use of wood and the types of wood products imported (UNECE, 2000).

In many Developing countries like China and India, wood is not a major structural material for housing construction, but it still accounts for a significant portion of total wood consumption. Wood is used in housing construction in two main ways: (a) as a structural building material in construction as well as beams, rafters, and joists in rural housing, and (b) as interior decoration such as flooring, moulding, wall panels as well as windows and doors.

In China total wood consumption in residential housing construction was estimated to be 44 million m^3 in 1998. Use of wood in the internal decoration of houses is also emerging as a wood consuming industry, due to increasing affordability and changing preferences. Demand for wood is increasing rapidly though some of the recent policy reforms discourage the use of wood as building materials. The demand for wood products in China was increasing in the late 1990s and is likely to continue to increase for three main reasons: (a) economic development and related increases in housing construction and in production of paper: (b) reductions in tariffs and changes in regulations on import of forest products, related to accession to the WTO; and (c) increasing Chinese exports of wood-derived products, particularly furniture (Cohen et al. 2002).

In Small Island countries, demand for wood is likely to increase in domestic building activity. Wood is still a major product for housing construction although there is strong competition from non-wood products (see Box 19), especially for flooring. The more buildings are made the more natural resources such as wood are likely to be exploited for housing materials.

Box 19. Population and Housing Resources in Samoa

Population increase will lead to an increase in demand for shelter and better housing. The Housing Census in 2001 clearly indicated a 26 percent increase in the total number of buildings people had in 2001 compared to the total buildings in 1991. With more buildings being constructed, more natural resources such as wood, stones, earth, soil, and sand, become exploited for housing materials.

Particulars	1991 Number	Percent*	2001 Number	Percent	Percent change during 1991-20001
Total buildings	36,136		45,606		26.2
Wooded floor houses	13,499	37.4	15,052	33.0	11.5
Wooden walls	11,873	22.9	14,596	32.0	22.9

* of total buildings

The table shows that the number of buildings using wood for housing floors and outer walls has increased by 11.5 percent and 22.9 percent respectively. This shows the increasing pressure of housing demands on forests.

Source: Taaloga, 2003.

Demography and environmental concerns

Urbanization and urban greening

Undergoing rapid urbanization, cities in the Asia-Pacific region are also expanding their green zones to enhance their appearance, preserve their ecosystems and to fight global warming. However, this situation varies by country based on their stage of economic development. In Developed countries, urban greening was initiated a century ago, whereas it is still emerging in many Developing countries. Nevertheless, urban greening is likely to expand with the increasing affluent and health conscious society.

Japan started urban greening on treeless areas more than a century ago. This occurred especially in Tokyo when the natural vegetation was destroyed during the Second World War. Tokyo now has 21,630 ha of forests conserved for multi-storied management, though initially they were protected to improve water conservation. Takatsuki city near the big western city of Osaka has a population of about 400,000 and forests cover half the city area, about 5,000 ha. The city has a "Bank for Forest" programme whose purpose is to keep and manage the individual forests rather than selling them. Most of the major cities of Japan have maintained high levels of urban greening, for example Sapporo in northern Japan has 1,594 ha of forests and Hanoi City, one hour from Tokyo, has maintained 84 percent of its area under forests with a rich average stock volume of 287 m^3/ha in 1990 (Uozumi, 1995).

Likewise, Republic of Korea enhances the living environment by developing urban forests and a green network, with the help of the central government, corporations and citizens. In this pursuit, Korean Forest Services intends to increase Chungcheong and Gyeonggi cities' forest space per capita from 6.56 square meters to 10 square meters by 2017, higher than the World Health Organization's standard of nine square meters. On the other hand, Australia is emphasizing the urban greening programme to restore the fragmented habitat, protect biodiversity and improve its environment (see Box 20).

Box 20. Urban Forest – One Million Tree Programme, South Australia

Two-thirds of the birds, a third of the mammals and plants and a fifth of all freshwater fish, frogs and reptiles of South Australia were originally found in the Adelaide region. Today less than 3 percent of the original bush land from the Adelaide Plains remains.

Realizing this, the South Australia government implemented "Urban Forests One Million Trees Program" with a vision for a more sustainable Adelaide with improved amenities for all its residents. It aims to repair the loss of local native biodiversity across metropolitan Adelaide and to plant three million local native trees and associated understorey species across the Adelaide Metropolitan area by 2014, restoring approximately 2,000 hectares of native vegetation and off-setting carbon emissions. The program engages non-government organizations, government agencies, local government, community groups and educational institutions.

In 2006 around 300 000 local native seedlings were planted at over 100 project sites around Adelaide, ranging from large-scale habitat reconstruction within the reserve system to local amenity and education projects including streetscapes, schools and local parks. For 2007 more than 450,000 seedlings will be established across 100 sites.

Source: Kneebone, 2004.

A fully urbanized, densely populated country, Singapore has given due emphasis to urban greening either by land based or roof top activities. During 1998, Singapore launched an urban forestry programme with a view to re-introducing various indigenous trees and plants which were once found in Singapore. But recently, Singapore is taking a quantum leap to try and become the greenest urban landscape from rooftops, since land is constrained (see Box

21). The government has recently announced incentives for such initiatives and some ambitious projects are already in implementation.

Box 21. Rooftop Greening in Singapore

Singapore's first major initiative in rooftop greening came in the early 1990s from the Changi General Hospital, which now meets most of its fresh food needs from its own rooftop hydroponics farm. This movement has gained momentum since 2004. With an estimated 8 million square metres of roof space available in the city, the green movement sees a big future. The government has launched a Green Mark incentive programme offering private developers grants to meet part of the cost of going green.

Treetops@Punggol is a new project under construction in Punggol district of Singapore. The project will comprise seven 16-storey towers set in lush landscaped gardens on a 2.9 hectare plot and arranged around an "eco-deck." This deck will be an extensive, elevated community garden on top of the complex's car park and serve as a green lung for the proposed 712-unit precinct. It is expected to reduce temperatures within the precinct by at least three to four degrees, and thus the use of air-conditioning, and to be completed by 2011.

Source: Roy, 2007.

Urban forestry is either unknown or underdeveloped in many cities of Developing countries. In general, cities and towns are either unplanned or unregulated and most of them have hardly implemented any programmes like urban greening or urban forestry for beautification of cities and reducing the effect of pollution. Nevertheless, tree planting along the roadside is quite common in many Developing countries like Nepal, India, China, Bangladesh and Malaysia. Systematic planting of street trees for timber production is widely practiced in China and Malaysia, which provide construction material for housing and other buildings (Webb, 1999).

Nevertheless, there has been increasing emphasis on urban greening at the country or city level. Malaysia has an ambitious greenway programme, which aims to turn all underutilized land like drainage reserves, road reserves and foreshores into green corridors (see Box 22).

Box 22. Making Malaysia a "Garden Nation"

Making Malaysia a "Garden Nation" by the year 2005 was launched in March 1997 to safeguard and refurbish the environment through plantation programmes. A nationwide tree planting campaign was emphasized on open-spaces such as roadsides and highways, railways, riverbanks, near beaches, residential areas, public parks, buildings, parking lots, industrial estates, cemetery grounds, and countryside. The campaign was carried out with a long-term target of planting three million trees by the year 2000 and another 20 million trees by the year 2020. As of 2006, more than 400 000 trees and 6 million shrubs have been planted. Approximately 40 percent of these have been planted along roads.

The greening of urban Malaysia has focused primarily on beautification and planting a Kuala Lumpur street with coconut palms (*Cocos nucifera*) to foster a tropical image.

Source: Sreetheran et al., 2006.

India has given great emphasis to urban forestry, made visible when the 74th amendment in the Constitution of India gave powers, functions, and jurisdictions to urban local bodies, which among many others includes development of urban forestry, protection of the environment, and promotion of ecological aspects. In India, not only road side plantation, green avenues and urban parks were created but also natural habitats were conserved in urban cities. India's financial capital, Mumbai, has maintained one of the world's largest national parks, Sanjay Gandhi National Park, which not only provides home to about 20 adult leopards and hundreds of kinds of animals and birds but also to about 200,000 people, many of whom derive their livelihoods from it. Likewise, India's biggest urban forest is being nurtured in the heart of Bangalore on 400 acres of land.

China's urban landscapes change dramatically as the economy grows and rural migration to cities continues at an unprecedented rate. This has created tremendous strain on the urban environment. Considering this, China plans to expand the cover of urban forests and trees to 45 percent in 70 percent of its cities by the year 2050. Today, several Chinese cities, e.g. Changchun, Nanjing and Guangzhou have forest cover of more than 40 percent. Urban forests are managed for multiple purposes, including recreation, protection of water sources, biodiversity conservation, atmospheric carbon sequestration, air pollution reduction, and others. Cities located in different parts of the country may emphasize different urban forest functions (ETFRN, 2006).

In the Philippines, public-private partnership on urban forestry has been initiated in the name of "Green Philippines" with a view to increasing the country's forest cover and heightening public awareness on the importance of forest including reforestation and the supply of raw materials to forest-based industries. Box 23 presents the major highlights of Green Philippines initiatives with a focus on the urban environment.

Box 23. Green Philippines Initiatives

The Department of Environment and Natural Resources (DENR) and the Philippine Wood Producers Association (PWPA) have jointly undertaken projects to address the growing problem of deforestation in the country. Model projects include urban greening, watershed rehabilitation, eco-tourism, community forestry and commercial/industrial large scale tree plantation, including:

Urban greening in Smokey Mountain, Tanauan City in Batangas and the Roosevelt National Park in Bataan for watershed rehabilitation and ecotourism purposes.

Planting trees along Taal Lake creeks and gullies, including the San Juan river in partnership with Laguna Lake Development Authority and private companies.

Urban greening aims to demonstrate proper establishment, maintenance and management of forest, fruit and ornamental tree nurseries. They will serve as sources of planting materials for establishing greenbelts along main roads, principal waterways, such as rivers, creeks and gulleys and critical slopes and also in schools and community grounds and parks. The projects also hope to promote public awareness, particularly for city dwellers, on the value of trees and forests in urban landscapes.

Source: Philippines Forestry Development Forum, 2005.

Urban forestry or urban greening is underdeveloped and virtually non-existent in the Small Island countries. However, "urban agroforestry" is a well-established practice in all Pacific island towns and trees still dominate the landscape even with increasing urbanization.

Recreational demand

Recreation demands on forests are growing in the Asia-Pacific region with rapid urbanization and age structure changes. Other important factors that influence recreational use of forests include family status, income, career stage, physical capacity, and education; many of these are related to the age of the people. People are likely to have less direct contact with commodity production from the land because of migration to urban areas and a decline in agricultural population. This may increase interest in non-consumptive uses of the forest such as conservation of wildlife habitat, dispersed recreation, or simply management as natural areas for ecological services. Increasing environmental awareness due to improvement in adult literacy may also increase recreational demand from forests.

Recreations are set to play an increasing role in the future of forests, especially in Developed countries. Most of the public forests in Australia are available for recreation and tourism,

regardless of whether being primarily managed for conservation, environmental protection or wood production. Both native and plantation forests provide a wide range of recreational opportunities, which include walking and running, camping, fishing, cycling, picnicking and playing, climbing, swimming and water sports, motor vehicle use, riding and walking animals, caving, cultural heritage appreciation and nature study sites (Department of Agriculture, Forests and Fishery, 2007).

The ageing phenomenon will particularly influence demand for recreational uses. The case of New Zealand is presented below. It draws some important implications from demographic changes, especially population growth and age structure, on recreational demand. The study shows that facilities which are more closely associated with older age groups, such as golf and use of walking tracks will be in higher demand by 2050.

Demographic and outdoor recreation demand in New Zealand

The study used the gross demand and cross-sectional analysis to estimate the effect of demographic change on outdoor recreation demands in New Zealand. The gross demand approach projects the relational demand on the basis of predicted growth in the overall population, assuming no change in the rate of participation per head of population. Cross-sectional analysis relies on examination of variation across the community and the extent to which this is related to some underlying, change factor, such as education, income, age structure, or mobility. The variable chosen for this study as the basis of the analysis is the age structure of the population. This is because participation varies quite markedly with age and projections of the future age-structure of the New Zealand population are readily available.

Table 14. New Zealand changing age structure, 1991-2051

Age groups	1991 census	2051 projection	Change per annum	Percent change
15-18	227,412	226,210	-20	-0.5
19-24	340,833	334,930	-98	-1.7
25-44	1,050,195	1,137,400	1,453	8.3
45-64	639,774	1,221,990	9,703	91
65+	388,680	1,181,960	13,221	204.1
Total	**2,646,894**	**4,102,490**	**24,259**	**55**

On the basis of Statistics New Zealand (1997) medium (Series 4) projections, it is estimated that New Zealand's adult (15 years and over) population will grow by some 24 million between 1991 and 2051 or by 55 per cent. This means that if there were no change in participation rates over that period, other things being equal, an increase in demand for all outdoor recreation of 55 percent could be expected by the year 2051. Demand is likely, however, to be affected by the changes in age structure within that overall level of change. Dramatic increases are expected in the numbers of middle aged and older people (Table 14) while the younger population (under 25) will be virtually static. If outdoor recreation participation varies with age, then the dramatic changes in age structure of the population indicated in Table 14 are likely to result in significant changes in outdoor recreation participation demand. Any activities participated in particularly by middle-aged or older people, for example, are likely to experience significantly increased demand, while activities participated in particularly by younger age groups can be expected to be static or have a relatively slow rate of growth. Table 15 shows that use of outdoor recreation facilities does vary considerably by age. The working age population tends to use facilities available from forests more compared to older people.

Table 15. Use of outdoor recreation facilities by age (percent)

Facilities	15-18	19-24	25-44	45-64	65	Total
Beach/river/lake	67	59	56	41	28	51
Golf course	10	10	9	16	9	11
Forests	**20**	**21**	**19**	**15**	**8**	**17**
Walking track	21	22	25	25	14	23
Park, play ground	20	29	32	13	9	23

By putting together the population data (Table 14) and use of outdoor recreation facilities (Table 15), the effects of demographic change on likely outdoor recreation demand are presented in Table 16. It can be seen that the aggregate growth in facility use is 39.9 percent. This is less than the overall growth of the population of 55 percent. This reflects the dominance of the young in many of the facilities included. While the percentage growth levels may appear modest compared to the growth in the population, they represent substantial, absolute totals — an additional 1.3 million people participating in the listed facilities per four weeks. The facilities which are more closely associated with older age groups, such as golf and use of walking tracks show a higher growth than the average.

Table 16. Demand projections 1991-2051 (millions of participants for four week period)

Facilities	1991 (millions)	1991 (millions)	Change	Percent change
Beach, river, lake	1312.7	1818.1	505.4	38.5
Golf course	288.7	460.4	171.7	59.5
National forests	443.6	609.5	165.9	37.4
Walking track	599.6	876.5	276.9	46.2
Park, play ground	598.5	771.6	173.1	28.9
Sum of facilities	3243.3	4536.0	1292	39.9

Source: Cushman, 1997.

In Japan, public interest towards forests has become more diversified and specific in recent years. People's expectations on the conservation of the natural environment, recreation and mitigation of global warming as well as concerns about water resources and flood control are growing rapidly. The forest policy has been reformed towards the fulfilment of a multifunctional role of forests and management is being shifted towards social benefit-oriented forest management and 50 to 80 percent of the forests are primarily managed for social objectives such as water resource, soil conservation, recreation use and environmental projection (Maita, 2002).

Recreational demand from forests and greenery in Republic of Korea has substantially increased due to the five-day work week and economic development. There are 20 national parks and 67 recreational forests, which are major destinations for forest recreation. The area of recreational forests is about 117 000 hectares and more than 26 million people have visited since it was established. This figure comprises nearly half of the population.

The Republic of Korea is providing subsidies to forest owners who develop a recreational forest to internalize the social benefits. In recent years there has been an increasing number of people participating in eco-tour trips involving forests. Smaller forests are also being developed near urban areas (Suh, 2007). Likewise, production-oriented forest management paradigms are now converting to sustainable forest management principles that focus on the multiple beneficial values of forest such as ecosystem protection, forest recreation and culture. The economic value of forest ecosystem services (see Table 17) including recreation, air purification, water conservation, soil outflow prevention, soil collapse prevention and wildlife habitat provision is higher compared to that of forest products.

Table 17. Valuation of goods and services from forests in Republic of Korea

Values of forests	1990	1995	2000
Recreation values (100 million Won)	42,660	44,800	48,300
Other services (100 million Won)	233,700	346,110	499,510
Tangible forest products (100 million Won)	7,314	9,798	17,268
Total (100 million Won)	**241,014**	**355,908**	**516,778**
% of recreation service to other services	18.3	12.9	9.7
% of recreation service to tangible forest products	583.3	457.2	279.7
% of recreation services as a total value of forests	17.7	12.6	9.3

Source: Kim and Kim, no date.

Very little work has been done on estimating the recreational demand in Developing countries. However, increasing population is likely to have more demand for recreation activities, as seen in the case of Beijing China. Not only the city population but people from neighbouring areas also visited urban forest gardens.

In Indonesia demand for recreational activities is quite high. As a result of which many recreational projects are being undertaken in large cities as well as new tourist destinations such as Bali and Batam. Likewise, recreational demand is quite high in cities of India due to high environmental and health consciousness and changing lifestyle patterns. Demand for forest based recreation is also high in Vietnam. Many of the national parks and protected areas are providing forest based recreation to both residents and foreigners and such demand is likely to grow in coming years.

Recreational demand is likely to increase in Developing countries in upcoming years, mainly because of: (a) Increasing affluent society (b) the drive to physical activity and health consciousness, (c) changing lifestyle patterns and (d) age structure.

Water availability and usages

Water availability. Water availability has decreased rapidly in the region and the world. By 2020, per capita availability of fresh water in the region will reach 3829 m^3/year against 4425 m^3 in 2000. Nevertheless, the Asia-Pacific region will have abundant water availability, since its availability exceeds 1700 m^3 per person per year (WRI, 2007).

The amount of renewable water resources and per capita availability of fresh water varies by group (Table 18) and country. For example renewable water resources range from 0.03 billion m^3/year in Maldives to 2838 billion m^3/year year in Indonesia. Maldives and Singapore have the lowest per capita availability of fresh water in the region where as Bhutan, Papua New Guinea and Solomon Islands have the highest. However, this per capita water availability does not take account of the coping capabilities of different countries to deal with water shortages and their water withdrawal amounts. For example, Singapore currently meets its freshwater demands by importing some of its supply from Malaysia and has also adopted the 'Four Taps' water policy, which sources from the sea, and a high-tech wastewater recycling plant, NEWater, which supplies some of the city-state's drinking water. The other two 'taps' are the traditional local reservoirs, and the supply from Malaysia.

Table 18. Total renewal water resources and per capita availability

Countries	Water (10^9 m^3/yr)	Per capita availability (2005)
Developing (18)	34.8-2838	1,409-131,967
Developed (6)	69.7-492	1,456-79,812
Small Island (3)	0.03-58.6	102-94,619
Region	0.03-2,838	102-131,967

Note: Figures in parentheses denotes number of countries whose data were available.
Source: FAO, 2007g.

According to the World Resource Institute, a country is said to be in a water crisis if renewable water resource availability is less than 1,000 m^3 per person per year, and a country is said to be suffering water stress if water supplies ranges between 1,000 and 1,700 m^3 per person per year. Anything above 1700 m^3 per year is considered as water abundant. Table 19 classifies countries into three categories namely on the basis of per capita availability of fresh water.

Table 19. Classification of countries based on per capita availability of water

Classification	1980	2000	2020
Water crisis	Maldives, Singapore	Maldives, Singapore	Maldives, Singapore
Water stress	-	Republic of Korea,	Republic of Korea, India, Pakistan
Water abundant	Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Japan, DPRK, Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Thailand, Viet Nam	Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Japan, DPRK, Republic of Korea, Laos, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Thailand, Viet Nam	Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Japan, DPRK, Laos, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Thailand, Viet Nam

Source: FAO**,** 2007g.

Even countries that have sufficient renewable water resources, overuse and inadequate management of water resources have increased the water stress situation. Australia falls under this category although it has abundant per capita availability of water resources (see Box 24).

Box 24. Water Crisis in Australia

Of the water available for Australians to use, one quarter of the rivers and lakes has already been taken for drinking, industry and agriculture, and a staggering one third of the underground water supply has been pumped to the surface and used for the same purposes. Many of the areas where the water has not been already claimed are in remote places that are largely uninhabited. But where humans are found, water has almost all been earmarked and, in some cases, more than the available water has already been allocated to various users.

As Australia's population grows, this overallocation of water is only likely to get worse. Already 75 percent of the water used by Australians goes toward agriculture. Just 16 percent of the total 24,909 gigalitres (24,058 billion litres) used in Australia ended up in the cities in 2000-2001. The Water Services Association of Australia predicts that if no water conservation measures are taken, and climate change and population growth continue as forecast, Australia's 10 largest cities will be consuming 854 gigalitres (GL) more water by 2030 than they use currently. This is a monumental increase in demand.

Hundreds of millions of litres of wastewater flow into the sea from the Australian coast every day. The federal government's 2001 State of the Environment report calculated that the Sydney Water Corporation released 548 GL of wastewater and 420 GL of storm water to the sea in one year. If the utility had reused this water completely, it would have been able to supply Sydney with enough water for 18 months.

Source: Phillips, 2006.

Water usage. While water availability is decreasing, water demand for agriculture, industry and households is increasing in the region as a result of population growth and economic development. Water withdrawals vary across groups and countries based on the availability of fresh water (Table 20).

Table 20. Total withdrawals and per capita availability (2000)

Countries	Amount (10^9 m^3/yr)	Percent of fresh water availability
Developing (18)	0.4-645.8	0.4-76.1
Developed (4)	2.11-88.4	0.6-26.7
Small Island (4)	Less than 1 %	Less than 0.1%

Note: Figures in parentheses denotes number of countries whose data were available.
Source: FAO, 2007g.

Extraction of water is quite high in the countries where availability is lower. Countries such as Bhutan, Cambodia, Fiji, Laos, New Zealand and Papua New Guinea are withdrawing less than one percent of their fresh water annually whereas Pakistan is withdrawing more than two thirds of available fresh water annually. India, Republic of Korea, and Sri Lanka had withdrawn more than one fourth of available fresh water in 2000. Except for Sri Lanka, all are water stressed countries.

Large amounts of water are still used for agricultural and irrigation purposes in the Asia-Pacific region, and the proportion of people with access to drinking water is low (see Figure 11). Of the total amount of the water drawn in 2000, more than 80 percent is used for agricultural purposes followed by industrial (12.5 percent) and domestic purposes (6 percent).

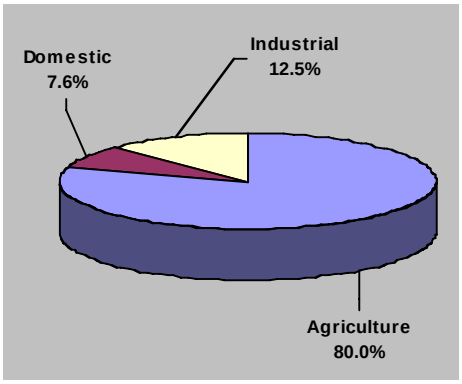


Figure 11. Water usage by sector in the region, 2000
Source: FAO, 2007g.

Even in the Developed countries like Australia and Japan, more than two thirds of water is used for agricultural purposes (Table 21). More than ninety percent of water is withdrawn for agricultural purposes in most of the Developing countries with a few exceptions like Malysia, DPR Korea, China, Vietnam and Mongolia. Nevertheless, agricultural use largely dominates all other sectors. Water use in the agricultural sector has been declining steadily in recent years in Asia and industrial water use has been increasing. However, agricultural water uses in most Asian countries have been increasing (ADB, 2007b) in absolute quantitative terms.

Table 21. Water use by sectors in selected countries of the Asia-Pacific region

Countries	Agriculture	Domestic	Industry	Countries	Agriculture	Domestic	Industry
Developed							
Australia	75.3	14.7	10.0	Republic of Korea	48.0	35.6	16.4
Japan	62.4	19.7	17.9	New Zealand	42.2	48.3	9.5
Developing							
Bang'desh	96.2	3.2	0.7	Mongolia	52.3	20.5	27.3
Bhutan	94.1	4.7	1.2	Myanmar	98.2	1.2	0.5
Cambodia	98.0	1.5	0.5	Nepal	96.5	2.9	0.6
China	67.7	6.6	25.7	Pakistan	96.0	1.9	2.0
India	86.5	8.1	5.5	Philippines	74.0	16.6	9.4
Indonesia	91.3	8.0	0.7	Sri Lanka	95.2	2.4	2.5
DPRK	55.0	19.8	25.2	Thailand	95.0	2.5	2.5
Laos	90.0	4.3	5.7	Viet Nam	68.1	7.8	24.1
Malaysia	62.1	16.9	21.1	Papua New Guinea	1.4	56.3	42.3
Small Island							
Fiji Islands	71.4	14.3	14.3				

Many Asian countries have been overextracting water and cultivating high water demanding crops (see Box 25). Farmers often pump more groundwater than needed for crop production. This is resulting in a steady decline of groundwater levels (ADB, 2007b). Currently, about 40 percent of Asia's cropland is irrigated which is the source of about 70 percent of food (ADB, 2001). Asia has 70 percent of the world's irrigated areas, and three countries namely China, India and Indonesia have the largest areas of irrigated land in the world. Water availability in the future largely depends on the degree to which irrigated agriculture will expand (Kataoka, 2002) in the region.

Box 25. Challenges in Water Management, Pakistan

Water shortage in Pakistan is severe, and the long-term forecast is even bleaker. It is projected that food production in Pakistan will face a shortfall of 11 millions tonnes by 2010, largely due to water scarcity (Kataoka, 2002). With prevailing consumption rates and a population growth of 4 million people a year, one out of three people in Pakistan will face critical shortages of water, threatening their very survival. Already the current drought conditions have devastated livelihoods in semi-arid regions and left four million people in Karachi with no option but to drink brackish water. Environmental experts suggest that Baluchistan's underground aquifers are dropping at 3.5 metres annually, and will run out in 15 years. Massive internal displacement is expected.

The drought has highlighted the lack of any definitive water policy in the country and has exposed unsustainable practices. In Baluchistan, drought has demonstrated that communities have overgrazed marginal lands, and sown crops, such as rice and sugar cane, which require large amounts of water.

Pakistan currently has 17 million acre-feet of storage capacity and an annual demand for over 100 million acre-feet of irrigation water. No major dams have been built in the last 27 years, with Pakistan lagging behind neighbouring countries such as Iran, India, Nepal and Turkey in this regard. Apart from this, outdated irrigation techniques have resulted in water logging and increased soil salinity, while the unequal distribution of water for agriculture has strained tensions at community and regional levels. Good management of the water system is a major challenge to Pakistan and effort is needed in the areas of improving available water resources, reducing wastage and ensuring water availability.

Source: IRIN, 2001.

As economies grow, people's lifestyles typically begin to include overuse of water, and people's attitude increases the domestic water demand. Production processes of industries consume much water unless water saving and recycling technologies are introduced (Kataoka, 2002). Water consumption needs have been increasing in China, India, Indonesia, Malaysia, Philippines and Viet Nam due to industrial progress (ADB, 2001). Considering the high prospects of economic growth in the region, industrial water demand may increase rapidly. Water stress will become more severe in urban areas of Asian countries by 2030 (ADB, 2007b). As water resources are limited, increasing water demand in all sectors is expected to create conflicts within and between sectors.

Otherwise, biofuel plantations will eat up cropland and trigger food and water crises in many parts of the world, especially in India and China (Box 26). Asian biofuel production will require more and more water if this subsector expands, as expected, which will have implications on quality and quantity of water. However, as of now, virtually no Asian country has carefully analyzed the water, land and social implications of increasing biofuel production and made appropriate policy decisions. These are important issues that need to be carefully analyzed in the future to make coordinated policies in terms of energy, land, water, the environment, and poverty reduction (ADB, 2007b).

Box 26. Biofuel Plantations and Likely Impacts on Water

India and China will account for almost 70 percent of the projected global growth in fuel requirement, between now and 2030. If their governments continue to promote biofuel at the current pace, it is likely to replace 7.5 percent of fuels. This will also require 30 million ha more of cropland and 180 km^3 of irrigation water. Crop production for biofuels in China and India will threaten sustainable water use and affect irrigated production of food crops, including cereals and vegetables, which would then need to be imported in larger quantities to meet the demand.

China is already facing severe shortage of land and water. Considering the current demand for biofuel, it will have to import 20 million tonnes of maize, the chief biofuel crop, to meet domestic demand. '

Irrigation water in India will be impacted and an additional 30 km^3 of water will be required to produce the 100 million tonnes of sugarcane to meet the demand. This will affect food crops, necessitating their import. Over 40 million ha were set apart to grow the oilseed plant jatropha in the country in 2005.

Source: Rastogi, 2007.

The ability of Pacific Island countries to manage the water sector effectively is constrained by their small size, fragility, natural vulnerability, and limited human and financial resource base (ADB, 2007b).

4. SUMMARY AND CONCLUSIONS

Population size. The population of the Asia-Pacific region is increasing and will continue to increase further. The population grew from 2,446 million in 1980 to 3,604 million in 2005, which is projected to increase further to 4,164 million by 2020. This will add 560 million people as compared to 2005. The increase is not only large in absolute numbers but also unevenly distributed across sub-regions and groups. Of the total increase in population, nearly two thirds of the increase in population will be in South Asia (61.6 percent) followed by East Asia (19.4 percent) and South East Asia (17.9 percent). This increase is quite noticeable in South Asia because India, Pakistan and Bangladesh have high annual population growth rate. Almost all of the above population increases will be in Developing countries; the population of Developed countries has almost stabilized, mainly due to low population growth rates even below the replacement level.

Population density on land. As the amount of land is fixed, increases in population will control the person to land ratio. The population density of the region will reach to 146 people PSK by 2020 compared to 86 in 1980. Population density ranges from 2 persons PSK in Mongolia to 6281 in Singapore. Population density will increase rapidly in South Asia and Developing countries whereas it will remain stable in the Pacific Islands, which is mainly due to Australia and New Zealand. These countries have very low population density in the region. Population density will remain stable in Developed countries. The population densities across all the countries are increasing except in the Cook Islands and Japan because of their negative population growth.

Population density on arable land. The population density on arable land in the region has increased from 598 PSK in 1980 to 777 in 2005. The number of PSK of arable land is increasing across all sub-regions and groups except in East Asia, where it decreased from 1093 persons PSK in 1980 to 989 in 2005, mainly due to a slow population growth rate (0.8 percent per annum) and high annual rate of expansion of arable land (0.9 percent per annum) during the last 15 years (1990-2005). Population density on arable land has increased significantly in South Asia and South East Asia, since the rate of expansion of arable land is quite low compared to the population change. There is a marginal increase of population density PSK of arable land in the Pacific Islands which is mainly due to Australia. Australia has a low population density PSK of arable land (41 persons) and possesses more than 95 percent of the arable land in the sub-region. Population density on arable land has increased across all the groups, since the rate of expansion of arable land has declined considerably in Developing and Small Island countries whereas it has virtually stopped in Developed countries. However, increases in population density in Developed countries may not add pressure on land because a lower proportion of people is dependent on farming, and the contribution of the agricultural sector to the GDP is also minimal.

Population density in forests. Population density PSK of forest in the Asia-Pacific region increased from 394 persons in 1990 to 491 in 2020, mainly due to increase in population and deforestation. Population pressure on the forests is extremely high in South Asia and low in the Pacific Islands. Population density PSK of forests has increased in all the sub-region except East Asia, where it declined from 643 persons in 1990 to 619 persons in 2005. This is mainly due to increase in forest cover in China, which has gained more than 40 million ha of forests during last the 15 years (1990-2005). Population density on forests has increased in all groups despite forests transitions in some Developing countries like India, China, Bhutan and Vietnam and Developed countries like New Zealand. However, population pressure on forests will differ by country depending upon the extent of forests cover, dependency on forests and level of economic development.

Urbanization. Urbanization is increasing rapidly in the Asia-Pacific region, mainly due to natural increases in current urban populations, rural-urban migration and reclassification of

certain rural areas (including boundary adjustments) as urban. In recent years, urbanization by implosion and counter urbanization is also occurring in some Developing countries, especially in China. The Asia-Pacific region is at the acceleration stage of urbanization, though the rate of change of urban population has slowed down compared to past decades. Nevertheless, the region will have negative rural population growth by 2010 and hence all increased population will be confined to urban areas.

Annual rates of change of urban and rural populations are on a declining trend across all the sub-regions and groups, however annual rates of change of urban populations are higher than population growth rates. East Asia and South East Asia will have negative rural population growth by 2020 whereas it will be less than one percent per annum in South Asia and the Pacific Islands. However, rural population in absolute numbers will increase in South Asia since five countries, namely Bhutan, Bangladesh, Nepal, Maldives and Sri Lanka, have the highest annual rural population growth. Nevertheless, South Asia will have high annual urban population growth whereas it will be lowest in the Pacific Islands and Developed Countries by 2020. The rural population will decrease in Developed and Developing countries whereas it will increase marginally in Small Island countries by 2020. Decrease in rural population in Developing countries is likely to bring positive impacts on forests and forestry since the direct dependency of people on land and forests will decline and more land may be available for forestry purposes, as in many Developed countries and in China, which has already started to convert its arable land for forestry purposes.

By 2020, nearly half of the region's population will live in urban areas. The proportion of urban population across all the sub-regions and group is increasing but there exists large variation in the sub-regions and groups. By 2020, urban areas will provide a home for more than half of the population across all the sub-regions except South Asia. South Asia will have the lowest proportion of urban population (35 percent) whereas the Pacific Islands will have highest proportion (74.8 percent). South Asia is in the first stage of urbanization, where most of the population is predominately rural and agrarian society. South East Asia and East Asia are in the acceleration stage of urbanization. The Pacific Islands are in the terminal stage of urbanization, with more than 70 percent of the population living in urban areas and the rate of change of urban population is very slow. The proportion of urban population is growing faster in Developing countries and Small Island countries and nearly half of the population will be living in urban areas (45.1 percent in Developed and 45.3 percent in Small Island countries) by 2020. More than two thirds (76.3 percent) of the population of Developed countries will be living in urban areas by 2020.

Agricultural population. The agricultural population of the Asia-Pacific region has been increasing consistently over the last 20 years, from 1470 million in 1980 to 1856 million in 2000, and is expected to reach 1869 million by 2010. The agricultural population was increasing in all sub-regions till 2000 but then it started declining in East Asia, although in the rest of the sub-regions it continued to rise. The agricultural population will continue to increase in Developing and Small Island countries by 2010 whereas it will decrease in Developed countries. By 2010, East Asia and Developed countries will have negative agricultural population growth whereas agricultural population growth will be almost negligible in South East Asia and Developing countries. The agricultural population will grow at a very low rate in South Asia and the Pacific Islands. Declining interests in traditional occupations, especially agriculture may pave the way for forest re-growth.

Age structure. The proportion of working age group population in the region increased from 56.2 percent in 1980 to 61.1 percent in 2000, which will further rise to 63.4 percent by 2020. However, the younger age population will decline during this period and the elderly population will increase. The proportion of younger age people is shrinking and it will continue to fall further across all the sub-regions and groups. There are some marked differences on proportion of working age population at the sub-regional and group level. By

2020 the working age population of South Asia and South East Asia will increase whereas it will decline in East Asia and the Pacific Islands. Decline of the working age population in East Asia can be largely attributed to China and Japan. Japan already has a higher proportion of old age population whereas population ageing in China will start from 2015 onwards. The working age population in Developing countries and Small Island countries will increase till 2020 whereas it will decline in Developed countries. The proportion of elderly people will continue to increase among all the sub-regions and groups. However the rate of increase will be quite high in East Asia and the Pacific Islands whereas it will be relatively slow in South Asia. This will have impact on demand for wood products and services from the forests.

The Asia-Pacific region is leaning towards population ageing mainly because of decreases in fertility rates, low birth rates and increases in longevity. The countries within the region show two distinct patterns of age structure change by 2020. The Developed countries such as Japan, Singapore, Australia, Republic of Korea, New Zealand, Singapore and Brunei Darussalam will increase their proportion of elderly population whereas the working age population is likely to increase with a decrease in younger age population in Small Islands and Developing countries. Population ageing will also be evident in some of the Developing countries, especially in China, Thailand and Sri Lanka by 2020.

The impact of demographic changes on forests and forestry is assessed in terms of (a) forests and land use changes; (b) resource degradation; (c) housing demand and its implications on wood products; and (d) environmental concerns such as urban greening/forestry, recreational demand and water issues.

Forests and land use. Population pressure is often cited as a primary reason for land use changes, forest encroachment and conversion to crop lands and built up areas. However, there is no "linear relationship" that increases in population will put more pressure on land and forests as argued by different studies. It depends on the stage of development of the country which is influenced by its dependency on land (agricultural population), extent of urbanization and level of income. Apart from this, improvements in agricultural technology along with decreasing farming population have slowed conversion of forests to other purposes. Increased use of tractors, irrigation, chemical fertilizers and high yielding crops has reduced pressures on forests even though population has increased continuously. Whether technological advances can keep pace with rising food demand will affect the future of forests.

The pressure on land will increase in Developing countries with the growing population and rapid urbanization. However, this situation largely varies at the country level.

- Countries with relatively low forest cover: There is growing concern for the protection of forest cover. But increasing demand for land especially from agricultural populations and urbanization has resulted in forest clearances. Nevertheless, these countries have strong programmes of growing trees outside forests by farmers and the private sector.

- Countries with moderate forest cover: In moderate forest cover countries, there are both positive and negative impacts on forests and land use influenced by economic growth. Some of the countries like India, China and Vietnam have gained forest cover due to growing economies and their priority towards conservation of forests. Demand has grown for construction materials and imports have increased substantially, due to limited domestic supply, hence population pressure is transformed to other countries, especially in the case of India and China. In the case of low and middle income and agriculturally dependent countries such as Nepal, Sri Lanka, Philippines and Thailand there is continued forest clearance for agricultural purposes and expansion of built up areas. While public forests are on the decline, resource scarcity is increasing tree cultivation in farm lands.

- Countries with high forest cover: Countries with high forest cover often view "forests as an asset" that need to be utilized for the development of the nation which leads to (a) large scale clearance for agricultural development, including resettlement of people; (b) generating income from logging; and (c) use of forest land to grow commercially important crops. Population has a smaller role in land use changes and market and trade are more important in most of these countries.

In Small Island countries, major land use changes have been observed during the last fifteen years. Forests have declined by more than 500 000 ha, mainly due to a combination of population pressure, loss of traditional controls on land, shifting cultivation, pasture development, mining and logging activities. However, this situation varies by country depending on the extent of forest cover.

- In low forest cover countries, increasing population is putting tremendous pressure on scarce resource, both on land and forests. Forests are being diverted for agricultural uses due to growing demand for land. Strong demand for locally grown agricultural products, both from tourist resorts and escalating population is also exerting pressure on land and forests as evident in the case of Maldives.

- In medium forested and high forested countries, forests are being exploited both for subsistence living and commercial activities. An increased population, coupled with plantation crops and logging operations is increasing pressures on land and forests.

In Developed countries, both the arable land and forest area have declined during the last 15 years (1990-2005). Industrialization and urbanization are the main causes of land use changes, however climatic factors such as drought, water availability, fire etc are also equally important. Arable lands are either converted into built up areas or diverted for forestry purposes in most of the Developed countries.

Demographic change may not have any direct impact on land use changes since it is in the terminal stage of urbanization; population is stabilizing and has less dependency with land. However, growing demand for housing has resulted in the growth of urban sprawl, loss of natural vegetation and open space, and a general decline in the extent and connectivity of wetlands and wildlife habitat. Most of the Developed countries have shifted their population pressure to other countries, where imports have increased substantially except in Australia and New Zealand. Rapid conversion of forests in Indonesia, Malaysia and Myanmar for palm oil and biofuel are some evidence of this.

Forests resource conditions. The rising human population has resulted in a dramatic increase in the demand for wood products, which has led to overexploitation or harvesting beyond their sustained yield. This has led to forest degradation in many Developing countries. In Developed countries like Japan and Republic of Korea, forest conditions have improved compared to the past, mainly because of realization of the environmental values of forests. In Developing countries, high dependency on forests for firewood and grazing has led to forest degradation even in countries like India which has gained forest cover. Forest degradation will continue to accelerate in most Developing countries unless energy alternatives to firewood are found, as well as alternative sources of income for those people whose lives depend on forests. Forest degradation is also taking place in Small Island countries since large masses of the population still depend on traditional forms of energy.

More than 21 million ha of primary forests have been subjected to human interventions during the last 15 years (1990-2005). This was largely contributed by Developing countries. Increasing consumption and shifts from solid to engineered wood products such as wood based panel and paper and paper board are the main cause of conversion of primary forests.

Apart from this, large scale plantation and shifting cultivation are also equally important. The area under primary forests has remained almost stable or has improved slightly in Developed counties, mainly because of increasing awareness of the role of forests in providing environmental services.

Housing and wood demand. Quantity and type of housing unit requirements are influenced by age structure, population size, urbanization, affordability and housing finance. Housing demand is likely sustain or increase at a lower rate in Developed countries due to high rates of household formation, declining household size and rural to urban migration, despite low population growth and population ageing.

In Developing countries, housing demand will be escalating due to the increasing proportion of the working age population, rapid urbanization and increasing affordability. Housing demand in India and China will be quite high, which will have a larger impact on demand and consumption of wood products. Annual housing demand in China is between 10-20 million units per year whereas it ranges from 7 to 10 million in India. It is more likely that India will surpass China in housing demand by 2015 since population aging will be observed in China.

Small Island countries may not have high demand for housing, which is constrained by traditional customary practices of land ownership. The housing needs of most urban populations have traditionally been met either by the extended family (resulting in increased dwelling occupancy and household size) or kinship group (resulting in increased density as extensions are added to buildings). Housing is thus largely an issue of land supply.

The residential building construction sector is one of the most important drivers of demand for wood products, especially for sawn timber. With increasing housing demand in Developed countries, demand for wood products is likely to increase. Use of wood in interior decoration is quite high, which will further lead to high demand for wood and wood products. Nevertheless, an increasing proportion of the elderly population will have an impact on design, layout, use and construction of houses. This will ultimately have a positive impact on the use of wood and the types of wood products.

Wood demand is likely to grow in Developing countries as demand for housing is escalating and economies are booming especially in China and India. Though wood is not a major structural material for housing construction in many Developing countries, it still accounts for a significant portion of wood consumption. Wood is used in two main ways: (a) as a structural building material in construction as well as beams, rafters, and joists in rural housing, and (b) as interior decoration such as flooring, moulding, wall panels and windows and doors. Likewise the use of wood in interior decoration of houses is emerging as one of the new wood consuming industries due to its increasing affordability and changing preferences. In Small Island countries, demand for wood is likely to increase in domestic building construction, where use of wood in flooring and wall construction is quite common.

Urban greening. Cities of the Asia-Pacific region are expanding their green zones to enhance their appearance, preserve ecosystems and to combat global warming. However, this situation varies by country based on the stage of development. In Developed countries, realization and practice of urban greening was initiated a century ago whereas it is still emerging in many Developing countries. Nevertheless, urban greening is likely to expand with the increasingly affluent and health conscious society in the region.

Japan started urban greening on treeless areas more than a century ago, especially in Tokyo when its natural vegetation was destroyed during the Second World War. Republic of Korea has enhanced the living environment by developing urban forests and a green network whereas Australia is emphasizing the urban greening programme to restore the fragmented habitat and diversify the number of animal and plant species and improve its environment.

Singapore, which has a fully urbanized, highly dense population has given due emphasis to urban greening either through land based or roof top activities.

Urban forestry is either unknown or underdeveloped in many cities of the Developing countries. In general, cities and towns are either unplanned or unregulated and most of them have hardly implemented any programmes like urban greening or urban forestry for beautification purposes or to reduce the effect of pollution. Nevertheless, tree planting along the roadside is quite common in many Developing countries like Nepal, India, China, Bangladesh and Malaysia etc. There has been an increasing emphasis on urban greening at the country and city levels. Malaysia has an ambitious greenway programme, whereas India has given high emphasis to urban forestry. China's urban landscapes are changing dramatically as the economy grows and rural migration to cities continues at an unprecedented rate. Philippines has implemented the “Green Philippines” programme, a public-private partnership for the development of urban forestry.

Urban forestry or urban greening is underdeveloped and virtually non-existent in the Small Island countries. However, "urban agroforestry" is a well-established practice in all Pacific Island towns and trees still dominate the landscape even with increasing urbanization.

Recreational demand. Recreational demand from forests is growing in the region along with rapid urbanization and changes in age structure. People are likely to have less direct contact with commodity production from the land because of migration to urban areas and a decline of agricultural population. This may increase interest in non-consumptive uses of the forests such as conservation of wildlife habitat, dispersed recreation, or simply management as natural areas for ecological services. Increasing environmental awareness due to improvements in adult literacy may also increase recreational demand of forests.

Recreations are set to play an increasing role in the future of forests, especially in Developed countries. Most of the public forest in Australia is available for recreation and tourism, whereas in Japan, public interests towards forests have become more diversified and specific in recent years, which include growing expectations for conservation of the natural environment, recreation and mitigation of global warming as well as concerns about water resources and flood control. Likewise, recreational demand in Republic of Korea from forests and greenery has substantially increased due to the five-day week and economic development, whereas in New Zealand, the ageing phenomenon has increased demand for recreational uses and facilities which are more closely associated with older age groups, such as golf and use of walking tracks which are in higher demand. Urban greening and roof-top gardening is quite common in Singapore.

Very little work has been done on estimating the recreational demand in Developing countries. Recreational demand is likely to increase in Developing countries in upcoming years, mainly because of: (a) increasingly affluent societies; (b) desires to raise physical activity and rising health consciousness; (c) changing lifestyle patterns; and (d) age structure, as evident from different country level case studies. As Beijing's population becomes more economically independent, urbanites are taking more leisure time to enjoy green spaces. Recreational demand is quite high in cities of India due to health consciousness and changing life style patterns. Likewise demand for recreation is quite high in Indonesia and Vietnam and they are making substantial investments to improve the greenery of the urban environment. Many protected areas are providing forest based recreation in Developing countries and such demand is likely to grow in upcoming years with improvements in the adult literacy rate and the increased interest in non-consumptive uses of the forests.

Water use and scarcity. The Asia-Pacific region will have abundant water availability by 2020. The amount of renewable water resources and per capita availability of fresh water varies significantly within the region. By 2020, Maldives and Singapore will be in a water

crisis situation whereas the Republic of Korea, India and Pakistan will be in a water stress situation. Even in countries that have sufficient renewable water resources, overuse and inadequate management of water resources have increased water stress, as seen in Australia.

While water availability is decreasing, water demand for agriculture, industry and households is increasing as a result of population growth and economic development. Demand or extraction of water is quite high in those countries where availability is lower. Large amounts of water are still used for agricultural and irrigation purposes in the region and the proportion of people with access to drinking water is still low. Of the total amount of water drawn in 2000, more than 80 percent is used for agricultural purposes followed by industrial (12.5 percent) and domestic purposes (6 percent). Even in Developed countries like Australia and Japan, more than two thirds of water is consumed for agricultural purposes. More than ninety percent of water withdrawn is used for agricultural purposes in most of Developing countries. However, this percentage has been declining steadily in recent years and industrial water use has been increasing. Nevertheless, in absolute quantitative terms, agricultural water uses in most Asian countries have been increasing. A major problem with agricultural water use has been that many Asian countries have been overextracting water and cultivation of high water demanding crops. Studies show biofuel plantations will eat up cropland, and trigger food and water crises in many parts of the world, especially in India and China.

Likely impacts of demographic changes to 2020

Table 22 summarizes likely impacts of demographic changes on forests and forestry in the Asia Pacific region by 2020. The direct population pressure on forests and land will decline in both the Developed and Developing countries whereas it may still increase in Small Island countries. Land use intensity will change as people move from rural to urban areas and this has the potential to slow the conversion of forests. Increasing urbanization will increase demand for green spaces, especially for amenities and recreation in Developed and Developing countries.

Table 22. Potential impacts on forests and forestry by 2020

Groups	Likely impacts
Developed countries	• Reduction in direct pressure on land and forest resources • Diversion of arable land for forestry activities • Forest fragmentation • Increased demand for urban amenities such as urban forestry and recreation • High awareness on forest roles and conservation of forests for ecological functions • Shortage of labour for forestry activities due to population ageing and high urban population • Demand of wood products likely to remain stable but changes in type of wood product demand • Decline in population tends to reduce pressure on forests and other resources
Developing countries	• Reduction in pressure on land and forest resources, however varies by country depending on other factors • Forest clearance for agricultural purposes, shifting cultivation and built up area expansion • Forest degradation due to high dependency on forests for firewood and other forest products • Increasing demand for employment and better living conditions, declining interest in traditional occupations, especially agriculture • Increased demand for urban amenities such as urban forestry and recreational activity • Labour availability for forestry activities may increase as a larger proportion of the population is moving towards the working age group and many countries are predominately rural

Groups	Likely impacts
	• Escalating demand for wood products due to increase in housing demand and changing preferences such as wood flooring and furnishing • Increasing awareness on role of forests due to improvement in literacy rate
Small Island countries	• Increased pressure on land and forest resources • Forest conversions for agricultural purposes, shifting cultivation and built up area expansion • Labour availability for forestry activities may increase as a larger proportion is moving towards the working age group

The influence of demographic changes on forests and forestry largely depends on interactions among several factors. The above impacts tend to be localized and vary from country to country, depending on extent of development. Table 23 classifies countries into four groups on the basis of likely impacts of predicted demographic changes on forestry and forestry by 2020 in association with other factors.

Table 23. Grouping of countries where demographic changes are likely to impact forests and forestry by 2020 in association with other factors

Demographic impacts	Countries	Characteristics
More likely	Pakistan and Bangladesh	Low income, high population densities, low forest cover, high dependency on agriculture
	Sri Lanka, Philippines, Thailand	Medium income, high density, high agricultural population and land is still the basis for livelihoods, medium forest cover
	Nepal	Low income, high population density, high population growth rate and predominately rural, medium forest cover
	DPRK, Cambodia	Low income, high population densities and high forest cover, high dependency on agriculture
	Kiribati, Maldives, Tonga	Low forest cover
Visible but role of other factors high	Mongolia	Middle income and low population density, forest clearance for economic development
	Laos, Papua New Guinea, Myanmar	High population density, high forest cover, low income and high dependency on agriculture, **economic driven forest clearances**
	Indonesia, Malaysia,	High population density, medium income, high forest cover, **economic driven forest clearances**
	New Caledonia, Vanuatu	Moderate forest cover
	Cook Islands, Fiji, Samoa, Solomon Islands	High forest cover
Shifted to other countries	China, India	**Developing country,** growing economy and high population densities, impact on forests mediated by economic growth and policy processes
	Singapore	**Developed country,** high income, low forest cover and high population density
	Japan, Republic of Korea	**Developed country,** high population density, high income, moderate forest cover
Less demographic impact	Bhutan	**Developing country,** low income and low population density, forest transitions
	Vietnam	**Developing country,** Growing economy and high population densities, impact mediated by economic growth and policy processes

	Australia, New Zealand	**Developed country,** high income, low population density, moderate forest cover, less dependency on agriculture

Demographic impacts are more likely to occur in countries where most people are still dependent on agriculture, where firewood is a primary source of energy and in those with agrarian economies. Forests in these countries will be further encroached, degraded or deforested. As the structure and size of economies are unlikely to change and large masses of people will be predominately rural, demographic changes will exert more pressure on forests and forestry by 2020.

Demographic impacts will be visible in Mongolia, Laos, Papua New Guinea, Myanmar, Indonesia, Malaysia, New Caledonia, Vanuatu, Cook Islands, Fiji, Samoa, and Solomon Islands. However, impacts on forests and forestry will be governed more by the commercial value of forests, trading opportunities and utilization of forests for development. Population growth cannot be attributed to impacts on forests in these countries; market and trade are more important.

China, India, Singapore, Japan, Republic of Korea, and Brunei Darussalam will shift their population pressure to other countries. Impacts on forests will be mediated by their economic development and demand for wood products of the growing population will be largely fulfilled through imports.

Vietnam, Bhutan Australia, and New Zealand will have less demographic impact on forests and forestry by 2020. Australia and New Zealand are highly developed countries with large scale commercial plantations and agriculture land is being diverted for forestry activities. In Vietnam and Bhutan, forest transitions have begun as a result of large scale plantations. However forest resource degradation will be high. With the growing economy, Vietnam may shift its population pressure to other countries by 2020.

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6. ANNEXES

Annex 1. Characteristic features of countries in the Asia-Pacific region

Characteristics	Region	Groups	Forests as a percent of land area (%) – 2005[1]	Population density- 2005[2]	Population growth rate (%)-2000-05[3]	Urbanization (%) – 2005[3]	Annul Urban population growth rate (%) -2000-05[3]	Per capita GNI (US$) – 2008[4]	GNI growth rate (%) -2008[4]	Agricultural share of GDP (%) -2008[4]	Agricultural population (%) – 2000[5]	Agricultural population growth rate (%) -2000[5]
Australia	PIC	Developed	21.3	3	1.1	92.7	1.82	35,990	1.4	3	4.6	-0.7
Bangladesh	SA	Developing	6.7	1,178	2.0	25	3.75	480	4.9	20	51.5	0.6
Bhutan	SA	Developing	68	14	1.9	9.1	6	1410	5.8		93.8	0.2
Brunei	SEA	Developed	52.8	71	2.5	77.6	3.58	..	..		0.9	-5.1
Cambodia	SEA	Developing	59.2	79	2.3	19.7	6.25	480	8.4	34	69.9	2.2
China	EA	Developing	21.2	141	0.9	40.5	3.53	2,010	10.1	12	67.2	0.2
Cook Islands	PIC	SIC	66.7	58	-2.5	73.3	1.41		..	..	37.5	-2.9
Fiji	PIC	SIC	54.7	45	0.9	53.2	2.82		3,300	2.7	40.4	-0.2
India	SA	Developing	22.8	382	1.8	28.7	2.54	820	7.7	18	52.4	1
Indonesia	SEA	Developing	48.8	125	1.4	47.9	4.74	1,420	5.8	12	43.6	0
Japan	EA	Developed	68.2	351	0.2	65.7	0.42	38,410	2.4	2	3.9	-5.6
Kiribati	PIC	SIC	2.7	114	1.7	50.2	4.88	1,230	4.2		28.6	0.9
Korea, DPR	EA	Developing	51.4	196	1.1	61.7	1.2				28.7	-1.3
Korea, Republic of	EA	Developed	63.5	485	0.8	80.8	1.13	17,690	4.7	3	8.8	-5.2
Laos	SEA	Developing	69.9	25	2.1	21.6	4.64	500	5.8	46.8	77.3	2.2
Malaysia	SEA	Developing	63.6	78	2.4	65.1	4.54	5,490	4.2	8	17.5	-1.3
Maldives	SA	SIC	3.3	984	1.9	29.7	4.45	2,680	16		28.9	-0.4
Mongolia	EA	Developing	6.5	2	0.7	57	0.81	880	7.1	21	24.5	-1.6
Myanmar	SEA	Developing	49	73	1.2	30.6	2.91	..	..		73	1.2
Nepal	SA	Developing	25.4	189	2.4	15.8	6.68	290	-0.1	39	93.2	2.4
New Caledonia	PIC	SIC	39.2	13	2.2	61.6	2.36				36.7	0.7
New Zealand	PIC	Developed	31	15	1	86	1.05	27,250	1.1	..	8.7	-0.3
Pakistan	SA	Developing	2.5	205	2.4	34.8	3.41	770	4.1	20	50.2	1.5
Papua New Guinea	PIC	Developing	65	13	2.7	13.2	2.56	770	1.8	41.9	76	2

Characteristics	Region	Groups	Forests as a percent of land area (%) – 2005[1]	Population density- 2005[2]	Population growth rate (%)-2000-05[3]	Urbanization (%) – 2005[3]	Annul Urban population growth rate (%) -2000-05[3]	Per capita GNI (US$) – 2008[4]	GNI growth rate (%) -2008[4]	Agricultural share of GDP (%) -2008[4]	Agricultural population (%) – 2000[5]	Agricultural population growth rate (%) -2000[5]
Philippines	SEA	Developing	24	284	2.1	62.6	3.64	1,420	3.5	14	39.1	0.7
Samoa	PIC	SIC	60.4	65	1.1	22.5	1.19	2,270	2		34.4	-1.2
Singapore	SEA	Developed	3	6281	2.9	100	2.88	29,320	6.6	0	0.1	-6.1
Solomon Islands	PIC	SIC	77.6	17	2.8	2.8	4.49	680	2.8		73.7	2.3
Sri Lanka	SA	Developing	29.9	296	0.7	21	0.81	1,300	6.6	16	49.1	0.5
Thailand	SEA	Developing	28.4	123	1.1	32.5	1.61	2,990	4.2	10	49.6	-0.3
Tonga	PIC	SIC	5.6	138	0.1	34	0.77	2,170	1.8		34.7	-1.6
Vanuatu	PIC	SIC	36.1	18	1.9	23.7	4.23	1,710	3.6		37.4	0.9
Vietnam	SEA	Developing	39.7	274	1.5	26.7	3.22	690	8.5	21	67	1.2

Note"SIC: Small Island Countries, SEA: South East Asia, SA: South Asia, PIC: Pacific Island Countries, EA: East Asia.

Sources:
1 Computed from FAO, 2007 (b) and FAO, 2007 (d)
2 Computed from FAO, 2007 (b) and United Nation Statistics Division, 2007
3 United Nation Statistics Division, 2007
4 World Bank, 2007
5. FAO, 2007 (e)

Annex 2. Population of countries in the Asia-Pacific region from 1980 to 2020 (unit: population in thousands)

SN	Country	1980	1990	2000	2010	2020
		000	000	000	000	000
1	Australia	14,638	16,873	19,139	21,362	23,418
2	Bangladesh	88,855	113,049	139,434	166,638	193,333
3	Bhutan	423	547	559	684	780
4	Brunei Darussalam	193	257	333	414	491
5	Cambodia	6,748	9,698	12,780	15,224	18,102
6	China	998,877	1,149,069	1,269,962	1,351,512	1,421,260
7	China, Hong Kong SAR	5,039	5,704	6,662	7,419	8,040
8	Cook Islands	18	18	16	13	11
9	Fiji	634	724	802	854	888
10	India	688,575	860,195	1,046,235	1,220,182	1,379,198
11	Indonesia	151,108	182,847	211,693	239,600	261,868
12	Japan	116,807	123,537	127,034	127,758	124,489
13	Kiribati	55	72	84	100	115
14	Korea, Democratic People's Republic of	17,239	20,143	22,946	24,015	24,838
15	Korea, Republic of	38,124	42,869	46,780	48,673	49,221
16	Lao People's Democratic Republic	3,103	4,076	5,224	6,173	7,223
17	Malaysia	13,763	18,103	23,274	27,920	32,020
18	Maldives	158	216	273	323	383
19	Mongolia	1,663	2,216	2,470	2,707	2,997
20	Myanmar	33,294	40,147	45,884	50,051	53,780
21	Nepal	15,159	19,114	24,419	29,898	35,868
22	New Caledonia	143	171	215	253	287
23	New Zealand	3,113	3,411	3,854	4,285	4,616
24	Pakistan	79,222	112,991	144,360	173,351	208,315
25	Papua New Guinea	3,199	4,131	5,381	6,708	7,937
26	Philippines	48,088	61,226	76,213	93,001	108,748
27	Samoa	155	161	177	192	204
28	Singapore	2,415	3,016	4,017	4,592	4,965
29	Solomon Islands	229	314	415	531	647
30	Sri Lanka	14,941	17,114	18,714	19,576	20,229
31	Thailand	46,809	54,291	60,666	65,125	67,990
32	Tonga	97	95	98	102	108
33	Vanuatu	117	149	190	243	299
34	Viet Nam	53,005	66,173	79,094	90,845	101,656
	Total region	**2,446,004**	**2,932,717**	**3,399,398**	**3,800,322**	**4,164,323**
Sub-regions						
	East Asia	1,177,749	1,343,539	1,475,854	1,562,086	1,630,845
	South East Asia	358,525	439,834	519,178	592,943	656,841
	South Asia	887,333	1,123,225	1,373,995	1,610,653	1,838,106
	Pacific Island	22,397	26,118	30,371	34,641	38,530
						Groups
	Developing	2,264,070	2,735,129	3,189,308	3,583,210	3,946,141
	Small Island	1,605	1,919	2,270	2,609	2,943
	Developed	180,329	195,669	207,820	214,504	215,239

Source: United Nation Statistics Division, 2007.

Annex 3. Population growth rate by countries from 1980-2020

	Country Name	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15	2015-20
1	Australia	1.4	1.4	1.5	1.4	1.1	1.2	*1*	*0.9*
2	Bangladesh	2.4	2.5	2.3	2.2	2.0	1.9	1.7	1.6
3	Bhutan	3.3	2.6	2.6	-1.5	1.9	2.6	1.4	1.5
4	Brunei Darussalam	3.7	2.9	2.8	2.8	2.5	2.3	2.1	1.8
5	Cambodia	-1	3.7	3.6	3.2	2.3	1.8	1.7	1.8
6	China	1.5	1.3	1.5	1.1	0.9	0.7	0.6	0.5
7	China, Hong Kong SAR	2.7	1.6	0.9	1.7	1.4	1.2	1	0.9
8	Cook Islands	-2.8	0.1	-0.1	0.3	-2.5	-2.7	-2.2	-1.5
9	Fiji	1.9	2.2	0.4	1.2	0.9	0.6	0.6	0.5
10	India	2.3	2.3	2.2	2.1	1.8	1.6	1.5	1.3
11	Indonesia	2.2	2	1.8	1.5	1.4	1.3	1.2	1
12	Japan	0.9	0.7	0.4	0.3	0.2	0.1	0	-0.2
13	Kiribati	2.4	2.7	2.7	1.5	1.7	1.8	1.6	1.5
14	Korea, DPR	1.4	1.6	1.5	1.5	1.1	0.6	0.3	0.3
15	Korea, Republic of	1.6	1.4	1	1	0.8	0.5	0.30	0.20
16	Laos	1.3	2.5	3	2.8	2.1	1.6	1.7	1.6
17	Malaysia	2.3	2.6	2.9	2.6	2.4	1.9	1.7	1.5
18	Maldives	2.8	3	3.2	2.8	1.9	1.6	1.8	1.8
19	Mongolia	2.8	2.8	3	1.5	0.7	0.9	1	1.1
20	Myanmar	2.2	2	1.7	1.4	1.2	0.9	0.9	0.8
21	Nepal	2.2	2.3	2.3	2.5	2.4	2.1	2	1.9
22	New Caledonia	2	1.7	1.9	2.4	2.2	1.7	1.5	1.3
23	New Zealand	0.2	0.8	1	1.5	1	1.2	0.9	0.8
24	Pakistan	3	3.6	3.5	2.5	2.4	1.8	1.8	1.9
25	Papua New Guinea	2.2	2.6	2.5	2.6	2.7	2.4	2	1.7
26	Philippines	2.7	2.4	2.4	2.3	2.1	2.1	1.9	1.7
27	Samoa	0.6	0.2	0.6	0.8	1.1	0.7	0.9	0.6
28	Singapore	1.3	2.3	2.2	2.8	2.9	1.5	1.2	0.9
29	Solomon Islands	3.4	3.4	2.9	2.9	2.8	2.6	2.3	2.1
30	Sri Lanka	1.8	1.4	1.3	1.1	0.7	0.4	0.5	0.4
31	Thailand	2.1	1.6	1.3	1.2	1.1	0.8	0.7	0.5
32	Tonga	0.7	-0.9	0.4	0.6	0.1	0.3	0.5	0.4
33	Vanuatu	3	2.4	2.5	2.8	1.9	2.5	2.4	2.2
34	Viet Nam	2	2.2	2.3	2.1	1.5	1.4	1.3	1.2
	Asia Pacific	**1.81**	**1.82**	**1.57**	**1.38**	**1.17**	**1.06**	**0.97**	**0.86**
Sub-regions									
	East Asia	1.26	1.37	1.03	0.85	0.62	0.52	0.47	0.39
	South East Asia	2.12	1.97	1.77	1.55	1.39	1.26	1.10	0.94
	South Asia	2.40	2.32	2.12	1.91	1.66	1.52	1.40	1.24
	Pacific Islands	1.51	1.57	1.61	1.41	1.43	1.20	1.10	1.03
Groups									
	Developing	1.88	1.90	1.63	1.44	1.22	1.11	1.02	0.91
	Small Island	2.09	1.48	1.84	1.52	1.40	1.38	1.26	1.16
	Developed	0.93	0.70	0.66	0.55	0.39	0.24	0.10	-0.03

Source: United Nation Statistics Division, 2007.

Annex 4. Population density per land area in the Asia-Pacific Region by country

Countries	Land area*		Population density**					
	000 ha	%	1980	1990	2000	2005	2010	2020
Australia	768230	27.0	2	2	2	3	3	3
Bangladesh	13017	0.5	683	868	1,071	1,178	1,280	1,485
Bhutan	4700	0.2	9	12	12	14	15	17
Brunei Darussalam	527	0.0	37	49	63	71	79	93
Cambodia	17652	0.6	38	55	72	79	86	103
China	932749	32.8	107	123	136	141	145	152
Cook Islands	24	0.0	74	74	67	58	52	48
Fiji	1827	0.1	35	40	44	45	47	49
India	297319	10.5	232	289	352	382	410	464
Indonesia	181157	6.4	83	101	117	125	132	145
Japan	36450	1.3	320	339	349	351	351	342
Kiribati	81	0.0	68	89	104	114	123	142
Korea (DPRK)	12041	0.4	143	167	191	196	199	206
Korea, Republic of	9873	0.3	386	434	474	485	493	499
Lao People's Democratic Republic	23080	0.8	13	18	23	25	27	31
Malaysia	32855	1.2	42	55	71	78	85	97
Maldives	30	0.0	527	719	910	984	1,075	1,278
Mongolia	156650	5.5	1	1	2	2	2	2
Myanmar	65755	2.3	51	61	70	73	76	82
Nepal	14300	0.5	106	134	171	189	209	251
New Caledonia	1828	0.1	8	9	12	13	14	16
New Zealand	26771	0.9	12	13	14	15	16	17
Pakistan	77088	2.7	103	147	187	205	225	270
Papua New Guinea	45286	1.6	7	9	12	13	15	18
Philippines	29817	1.0	161	205	256	284	312	365
Samoa	283	0.0	55	57	63	65	68	72
Singapore	68.9	0.0	3,504	4,378	5,831	6,281	6,665	7,206
Solomon Islands	2799	0.1	8	11	15	17	19	23
Sri Lanka	6463	0.2	231	265	290	296	303	313
Thailand	51089	1.8	92	106	119	123	127	133
Tonga	72	0.0	135	131	136	138	142	150
Vanuatu	1219	0.0	10	12	16	18	20	25
Viet Nam	31007	1.1	171	213	255	274	293	328
Asia and Pacific	**2843661**	**100**	**86**	**103**	**120**	**127**	**134**	**146**
Sub-regions								
East Asia	1147763	40.4	102	117	128	132	135	141
South East Asia	433008	15.2	83	102	120	129	137	152
South Asia	412917	14.5	215	272	333	362	390	445
Pacific Islands	848420	29.9	3	3	4	4	4	5
Groups								
Developing	1992025	70.1	114	137	160	170	180	198
Small Island	8163	0.3	20	24	28	30	32	36
Developed	841920	29.6	21	23	24	24	25	25

* FAO 2007(b)

** Population density computed by taking population projection (medium variant) from United Nation Statistics Division, 2007

Annex 5. Forest area and population density by country, group and region

Country	Forest area (000 ha)*			Population density on forests**		
	1990	2000	2005	1990	2000	2005
Australia	167,904	164,645	163,678	10	12	12
Bangladesh	882	884	871	12,817	15,778	17,590
Bhutan	3,035	3,141	3,195	18	18	20
Brunei Darussalam	313	288	278	82	116	134
Cambodia	12,946	11,541	10,447	75	111	134
China	157,141	177,001	197,290	731	717	666
Cook Islands	15	16	16	119	103	90
Fiji	979	1,000	1,000	74	80	83
India	63,939	67,554	67,701	1,345	1,549	1,676
Indonesia	116,567	97,852	88,495	157	216	255
Japan	24,950	24,876	24,868	495	511	514
Kiribati	2	2	2	3,266	3,819	4,182
Korea, Democratic People's Republic of	8,201	6,821	6,187	246	336	382
Korea, Republic of	6,371	6,300	6,265	673	743	764
Lao People's Democratic Republic	17,314	16,532	16,142	24	32	35
Malaysia	22,376	21,591	20,890	81	108	123
Maldives	1	1	1	23,963	30,331	32,811
Mongolia	11,492	10,665	10,252	19	23	25
Myanmar	39,219	34,554	32,222	102	133	149
Nepal	4,817	3,900	3,636	397	626	745
New Caledonia	717	717	717	24	30	33
New Zealand	7,720	8,226	8,309	44	47	49
Pakistan	2,527	2,116	1,902	4,471	6,822	8,311
Papua New Guinea	31,523	30,133	29,437	13	18	21
Philippines	10,574	7,949	7,162	579	959	1,181
Samoa	130	171	171	124	104	108
Singapore	2	2	2	131,147	174,671	188,151
Solomon Islands	2,768	2,371	2,172	11	18	22
Sri Lanka	2,350	2,082	1,933	728	899	989
Thailand	15,965	14,814	14,520	340	410	434
Tonga	4	4	4	2,626	2,725	2,760
Vanuatu	440	440	440	34	43	49
Viet Nam	9,363	11,725	12,931	707	675	658
Asia Pacific	**742,546**	**729,912**	**733,135**	**394**	**465**	**491**
Sub-regions						
East Asia	208,155	225,663	244,862	643	651	619
South East Asia	244,639	216,848	203,089	180	239	274
South Asia	77,551	79,678	79,239	1,448	1,724	1,884
Pacific Islands	212,201	207,723	205,945	12	15	16
Groups						
Developing	530,231	520,854	525,213	516	612	645
Small Island	5,055	4,721	4,522	38	48	54
Developed	207,260	204,337	203,400	92	98	101

* FAO 2007 (b)

** Population density computed by taking population projection (medium variant) from United Nations Statistics Division 2007

Annex 6. Annual rate of change of urban population by countries from 1980 to 2020

SN	Country	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15	2015-20
1	Australia	0.9	1.35	1.45	1.98	1.82	1.39	1.11	0.93
2	Bangladesh	10.7	5.8	4.92	4.08	3.75	3.51	3.45	3.37
3	Bhutan	4.95	5.35	5.87	4.8	6	6.33	5.83	5.55
4	Brunei Darussalam	2.96	3.66	3.96	3.99	3.58	3.23	2.78	2.36
5	Cambodia	2.25	4.47	3.65	5.62	6.25	5.5	5.18	4.77
6	China	3.9	4.53	5.04	3.78	3.53	3.22	2.79	2.39
7	Hong Kong SAR	3.12	1.91	2.26	1.71	1.92	1.07	0.97	0.87
8	Cook Islands	-0.96	0.06	1.51	1.02	1.41	2.49	1.61	1
9	Fiji	2.47	2.63	1.96	2.98	2.82	2.45	2.11	1.78
10	India	3.66	3.14	3.02	2.73	2.54	2.28	2.38	2.47
11	Indonesia	4.9	5.35	5	4.61	4.74	3.88	3.22	2.64
12	Japan	1.87	1.01	1.26	0.8	0.42	0.29	0.27	0.24
13	Kiribati	2.73	3.12	2.9	2.59	4.88	4.51	3.67	2.96
14	Korea, DPR	1.49	1.76	1.74	1.62	1.2	1.03	0.93	1.04
15	Korea, Republic of	4.92	4	3.57	2.14	1.13	0.85	0.65	0.51
16	Laos	3.38	4.62	4.88	4.7	4.64	4.59	4.5	4.35
17	Malaysia	4.52	4.36	4.23	4.84	4.54	2.96	2.6	2.25
18	Maldives	7.08	5.84	3.27	2.76	4.45	4.53	4.56	4.42
19	Mongolia	4.14	3.86	3.7	1.45	0.81	1.43	1.74	1.83
20	Myanmar	2.31	2.03	2.27	2.68	2.91	3.07	3.16	2.88
21	Nepal	7.53	5.55	5.18	6.49	6.68	5.15	4.64	4.41
22	New Caledonia	3.48	2.57	2.17	2.61	2.36	2.24	2.12	2.03
23	New Zealand	0.35	0.9	0.94	1.54	1.05	0.84	0.73	0.68
24	Pakistan	4.01	4.16	3.88	3.22	3.41	3.44	3.6	3.72
25	Papua New Guinea	4.25	2.52	2.4	2.71	2.56	2.26	2.56	2.96
26	Philippines	3.75	5.19	4.87	4.3	3.64	3.12	2.7	2.34
27	Samoa	0.81	0.34	0.51	0.92	1.19	1.29	1.82	2.29
28	Singapore	1.3	2.3	2.15	2.85	2.88	1.69	0.9	0.57
29	Solomon Islands	6.42	6.72	5.1	4.6	4.49	4.52	4.48	4.43
30	Sri Lanka	1.08	1.27	1.4	1.01	0.81	0.73	1.13	1.54
31	Thailand	4.71	2.72	2.36	1.8	1.61	1.86	1.99	2.12
32	Tonga	2.87	2.02	1.33	0.48	0.77	1.72	1.9	2
33	Vanuatu	5.53	2.6	3.01	4.43	4.23	4.15	4.09	3.99
34	Viet Nam	2.56	2.39	2.85	3.79	3.22	3.23	3.21	3.17
	Asia and Pacific	**3.6**	**3.8**	**3.2**	**3.0**	**2.7**	**2.5**	**2.3**	**2.2**
Sub-regions									
	East Asia	3.6	4.0	3.1	2.8	2.5	2.3	2.0	1.8
	South East Asia	4.2	4.1	4.0	3.9	3.4	3.0	2.6	2.2
	South Asia	3.6	3.4	3.0	2.8	2.5	2.7	2.7	2.8
	Pacific Islands	1.3	1.4	2.0	1.7	1.6	1.3	1.2	1.1
Groups									
	Developing	4.0	4.2	3.5	3.3	2.9	2.8	2.5	2.4
	Small Island	2.9	2.3	2.8	2.7	2.5	2.5	2.3	2.3

SN	Country	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15	2015-20
	Developed	1.7	1.8	1.3	0.9	0.7	0.5	0.4	0.3

Annex 7. Average rate of change of rural population by countries from 1980 onwards to 2020

SN	Country	1980-85	1985-90	1990-95	1995-2000	200-05	2005-10	2001 0-15	2015 -020
1	Australia	1.17	1.84	2.04	-2.66	-4.31	-3.79	-3.12	-2.35
2	Bangladesh	1.31	1.94	1.92	1.97	1.79	1.54	1.25	0.95
3	Bhutan	2.15	2.26	2.48	1.12	2.31	2.65	2.15	1.87
4	Brunei Darussalam	4.73	1.67	0.84	0.21	-0.39	-0.73	-0.74	-0.71
5	Cambodia	-1.88	4.05	3.65	2.93	2.05	1.71	1.49	1.19
6	China	0.93	0.53	0.35	-0.04	-0.44	-0.81	-0.98	-1.12
7	Hong Kong China, SAR	-1.07	-2.11	-52.81	0	0	0	0	0
8	Cook Islands	-1.53	-0.6	-0.25	0.22	-4.11	-5.11	-4.84	-4.31
9	Fiji	1.57	1.99	-0.62	-0.19	-0.35	-0.57	-0.77	-0.97
10	India	1.63	1.75	1.72	1.63	1.47	1.21	0.92	0.62
11	Indonesia	1.5	0.99	0.57	0.11	-0.71	-0.88	-1.01	-1.07
12	Japan	-0.39	0.18	-0.88	-0.55	-0.07	-0.15	-0.49	-0.85
13	Kiribati	1.26	1.47	1.93	1.06	-0.63	-1.29	-1.47	-1.51
14	Korea, DPR	1.33	1.15	1.13	1.01	0.27	-0.23	-0.65	-0.86
15	Korea, Republic of	-2.17	-2.76	-4.9	-2.69	-0.53	-0.6	-0.85	-1.03
16	Laos	0.87	2.11	2.26	2.09	1.88	1.7	1.46	1.17
17	Malaysia	0.86	1.22	1.09	0.18	-0.56	0.13	-0.23	-0.42
18	Maldives	1.74	2.09	3.2	3.05	2.5	2.36	2.17	1.82
19	Mongolia	1.4	1.48	2.08	1.63	0.99	1.11	0.93	0.53
20	Myanmar	2.2	1.92	1.56	1.36	0.99	0.54	0.02	-0.25
21	Nepal	1.77	1.91	2.06	1.88	1.71	1.72	1.54	1.27
22	New Caledonia	0.31	0.51	1.58	2.14	1.89	1.42	0.96	0.53
23	New Zealand	-0.58	0.55	-0.67	0.61	0.5	0.32	0.02	-0.24
24	Pakistan	2.33	2.92	2.71	2.05	2.24	1.92	1.74	1.51
25	Papua New Guinea	2.2	2.39	2.36	2.67	2.51	2.21	1.84	1.56
26	Philippines	2.09	0.55	0.25	0.09	-0.04	-0.25	-0.4	-0.47
27	Samoa	0.56	0.22	0.39	0.59	0.78	0.88	0.85	0.77
28	Singapore	0	0	0	0	0	0	0	0
29	Solomon Islands	3.11	3.01	2.89	2.97	2.86	2.55	2.16	1.77
30	Sri Lanka	1.64	1.46	1.53	1.12	0.92	0.84	0.57	0.31
31	Thailand	1.49	1.41	1.06	0.98	0.79	0.62	0.32	0.03
32	Tonga	0.09	-0.77	0.04	-0.22	0.07	0.59	0.32	-0.03
33	Vanuatu	2.46	2.34	2.36	2.45	2.26	1.93	1.62	1.28
34	Viet Nam	1.86	2.12	2.08	1.45	0.85	0.7	0.53	0.35
	Asia Pacific	**1.2**	**1.0**	**0.8**	**0.6**	**0.3**	**0.1**	**-0.0**	**-0.2**
Sub-regions									
	East Asia	0.4	0.2	-0.1	-0.4	-0.8	-1.0	-1.1	-1.2
	South East Asia	1.3	1.0	0.7	0.1	-0.0	-0.2	-0.4	-0.5
	South Asia	2.0	2.0	1.8	1.6	1.3	1.0	0.8	0.5
	Pacific Islands	2.0	1.9	0.7	0.5	0.9	0.9	0.8	0.8
Groups									
	Developing	1.2	1.1	0.9	0.6	0.3	0.1	- 0.0	- 0.2
	Small Island	1.7	1.1	1.4	0.9	0.7	0.7	0.5	0.3

SN	Country	1980-85	1985-90	1990-95	1995-2000	200-05	2005-10	2001 0-15	2015 -020
	Developed	- 0.5	- 1.7	- 1.0	- 0.3	- 0.3	- 0.6	- 1.0	- 1.3

Annex 8. Average annual rate of change of agricultural population in the Asia-Pacific region by country from 1980 onwards to 2010

SN	Countries	Population growth rate		
		1980-90	1990-2000	2000-10
1	Australia	-0.2	-0.7	-0.5
2	Bangladesh	1.3	0.6	-0.1
3	Bhutan	2.6	0.2	2.0
4	Brunei Darussalam	-6.9	-5.1	-11.0
5	Cambodia	3.6	2.2	1.4
6	China	1.2	0.2	-0.3
7	Hong Kong China, SAR	-2.7	-5.6	-5.9
8	Cook Islands	-1.2	-2.9	-1.8
9	Fiji Islands	1.0	-0.2	-0.5
10	India	1.1	1.0	0.5
11	Indonesia	1.4	-0.0	-0.4
12	Japan	-3.5	-5.6	-5.9
13	Kiribati	1.0	0.9	0.4
14	Korea, Dem People's Rep	-0.3	-1.3	-2.1
15	Korea, Republic of	-6.3	-5.2	-6.1
16	Laos	2.4	2.2	2.0
17	Malaysia	-1.5	-1.3	-2.3
18	Maldives	-0.8	-0.4	-1.5
19	Mongolia	0.7	-1.6	-1.8
20	Myanmar	1.6	1.2	0.5
21	Nepal	2.3	2.4	2.0
22	New Caledonia	0.6	0.7	-0.1
23	New Zealand	0.1	-0.3	-0.5
24	Pakistan	1.6	1.5	1.0
25	Papua New Guinea	2.0	2.0	1.2
26	Philippines	1.0	0.7	0.1
27	Samoa	-1.0	-1.2	-1.8
28	Singapore	-12.4	-6.1	-6.9
29	Solomon Islands	2.9	2.3	2.0
30	Sri Lanka	0.9	0.5	0.2
31	Thailand	0.4	-0.3	-0.9
32	Tonga	-1.6	-1.6	-1.9
33	Vanuatu	1.1	0.9	-
34	Viet Nam	2.0	1.2	0.7
	Asia Pacific	**1.14**	**0.54**	**0.07**
Sub-regions				
	East Asia	1.02	0.12	-0.36
	South East Asia	1.35	0.49	0.04
	South Asia	1.22	1.06	0.57
	Pacific Islands	1.34	1.22	0.80
Groups				
	Developing	1.22	0.58	0.09
	Small Island	0.92	0.53	0.24
	Developed	-4.56	-4.97	-5.19

Annex 9. Land use and forest situation in developing countries

	Arable land (000 ha)			Permanent crops (000 ha)			Forests(000 ha)			Permanent pasture and meadows (000 ha)			Wood lands (000 ha)		
Country	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**
Bangladesh	9137	8084	7951	300	400	460	882	883.7	871.4	600	600	600	44	53	58
Bhutan	113	140	159	19	20	18	3035	3141	3195	300	415	415	566	609	611
Cambodia	3695	3700	3700	110	140	156	12946	11541	10447	650	930	1500	101,498	97,683	87,615
China	123678	137126	143296	7719	11531	13031	157141	177001	197290	400001	400001	400001	335	298	270
India	162788	160555	159650	6650	9200	10000	63939	67554	67701	11602	11040	10530	5,894	4,732	4,110
Indonesia	20253	20500	23000	11720	13100	13600	116567	97852	88495	13110	11177	11200	-	-	-
Korea, DPR	2288	2600	2800	180	200	200	8201	6821	6187	50	50	50	-	-	-
Laos	799	877	1000	61	81	81	17314	16532	16142	800	878	878	2,875	4,053	4,643
Malaysia	1700	1820	1800	5248	5785	5785	22376	21591	20890	276	285	285	-	-	-
Mongolia	1370	1174	1158	1	2	2	11492	10665	10252	124285	129294	129300	6,264	3,034	2,388
Myanmar	9567	9909	10068	502	589	888	39219	34554	32222	359	314	312	10,219	10,629	10,834
Nepal	2287	2324	2357	66	105	130	4817	3900	3636	1800	1757	1735	1,180	1,753	1,897
Pakistan	20484	21292	21275	456	658	795	2527	2116	1902	5000	5000	5000	1,191	1,323	1,389
Papua New Guinea	192	205	240	580	650	650	31523	30132.5	29437	135	175	175	4,474	4,474	4,474
Philippines	5480	5650	5700	4400	5000	5000	10574	7949	7162	1260	1500	1500	2,230	3,292	3,611
Sri Lanka	875	895	916	1025	1015	1000	2350	2082	1933	439	440	440	0	0	0
Thailand	17494	15865	14200	3109	3380	3600	15965	14814	14520	780	800	800	-	-	-
Viet Nam	5339	6200	6600	1045	1938	2350	9363	11725	12931	342	642	642	0	1,816	2,259
Total	**387539**	**398916**	**405870**	**43191**	**53794**	**57746**	**530231**	**520854**	**525213**	**561789**	**565298**	**565363**	**136770**	**133749**	**124159**

Annex 10. Annual rate of change of land uses in developing countries

	Arable land		Permanent crops		Forests		Permanent pasture and meadows		Woodlands	
	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005
Bangladesh	- 1.2	- 0.3	2.9	2.8	0.0	- 0.3	-	-	1.9	1.8
Bhutan	2.2	2.6	0.5	- 2.1	0.3	0.3	3.3	-	0.7	0.1
Cambodia	0.0	-	2.4	2.2	- 1.1	- 2.0	3.6	10.0	- 0.4	- 2.2
China	1.0	0.9	4.1	2.5	1.2	2.2	-	-	- 1.2	- 2.0
India	- 0.1	- 0.1	3.3	1.7	0.6	0.0	- 0.5	- 0.9	- 2.2	- 2.8
Indonesia	0.1	2.3	1.1	0.8	- 1.7	- 2.0	- 1.6	0.0		
Korea, DPR	1.3	1.5	1.1	-	- 1.8	- 1.9	-	-		
Laos	0.9	2.7	2.9	-	- 0.5	- 0.5	0.9	-	3.5	2.8
Malaysia	0.7	- 0.2	1.0	-	- 0.4	- 0.7	0.3	-		
Mongolia	- 1.5	- 0.3	7.2	-	- 0.7	- 0.8	0.4	0.0	- 7.0	- 4.7
Myanmar	0.4	0.3	1.6	8.6	- 1.3	- 1.4	- 1.3	- 0.1	0.4	0.4
Nepal	0.2	0.3	4.8	4.4	- 2.1	- 1.4	- 0.2	- 0.3	4.0	1.6
Pakistan	0.4	- 0.0	3.7	3.9	- 1.8	- 2.1	-	-	1.1	1.0
Papua New Guinea	0.7	3.2	1.1	-	- 0.5	- 0.5	2.6	-	-	-
Philippines	0.3	0.2	1.3	-	- 2.8	- 2.1	1.8	-	4.0	1.9
Sri Lanka	0.2	0.5	- 0.1	- 0.3	- 1.2	- 1.5	0.0	-		
Thailand	- 1.0	- 2.2	0.8	1.3	- 0.7	- 0.4	0.3	-		
Viet Nam	1.5	1.3	6.4	3.9	2.3	2.0	6.5	-		4.5
Total	**0.3**	**0.3**	**2.2**	**1.4**	**- 0.2**	**0.2**	**0.1**	**0.0**	**- 0.2**	**- 1.5**

Annex 11. Land use and forest situation in Small Island countries

Country	Arable land (000 ha)			Permanent crops (000 ha)			Forests (000 ha)			Permanent pasture and meadows (000 ha)			Wood lands (000 ha)		
	1990	2000	2005	1990	2000	2005	1990	2000	2005	1990	2000	2005	1990	2000	2005
Cook Islands	2	4	4	4	2	2	14.9	15.5	15.5				-	-	-
Fiji	160	200	200	80	85	85	979	1000	1000	170	175	175	-	-	-
Kiribati	2	2	2	37	35	35	2.2	2.2	2.2				-	-	-
Maldives	4	4	4	4	5	9	0.9	0.9	0.9	1	1	1	0	0	0
New Caledonia	9	6	6	6	4	4	717	717	717	217	234	239	787	787	787
Samoa	36	30	30	60	60	60	130	171	171	2	3	3	-	22	22
Solomon Islands	13	17	18	52	56	59	2768	2371	2172	5	7	8	-	-	-
Tonga	16	15	15	12	11	11	3.6	3.6	3.6	4	4	4	1	1	1
Vanuatu	20	20	20	85	85	85	439.5	439.5	439.5	35	42	42	476	476	476
Total	**262**	**298**	**299**	**340**	**343**	**350**	**5055.1**	**4720.7**	**4521.7**	**434**	**466**	**472**	**1264**	**1286**	**1286**

Annex 12. Annual rate of change of land use in Small Island countries

Country	Arable land		Permanent crops		Forests		Permanent pasture and meadows		Woodlands	
	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005	1990-2000	2000-2005
Cook Islands	7.2	-	- 6.7	-	0.4	-				
Fiji	2.3	-	0.6	-	0.2	-	0.3	-		
Kiribati	-	-	- 0.6	-	-	-				
Maldives	-	-	2.3	12.5	-	-	-	-		
New Caledonia	- 4.0	-	- 4.0	-	-	-	0.8	0.4	-	-
Samoa	- 1.8	-	-	-	2.8	-	4.1	-		-
Solomon Islands	2.7	1.1	0.7	1.0	- 1.5	- 1.7	3.4	2.7		
Tonga	- 0.6	-	- 0.9	-	-	-	-	-	-	-
Vanuatu	-	-	-	-	-	-	1.8	-	-	-
Total	1.3	0.1	0.1	0.4	- 0.7	- 0.9	0.7	0.3	0.2	-

Annex 13. Land use and forests situation in developed countries

	Arable land (000 ha)			Permanent crops (000 ha)			Forests(000 ha)			Permanent pasture and meadows (000 ha)			Wood lands (000 ha)		
Country	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**	**1990**	**2000**	**2005**
Australia	47900	47304	49402	181	296	340	167904	164645	163678	416400	407900	395407	-	421,590	421,590
Brunei Darussalam	3	9	14	4	4	5	313	288	278	6	6	6	142	155	160
Japan	4768	4474	4360	475	356	332	24950	24876	24868	450	428		-	-	-
Korea, Republic of	1953	1718	1624	156	200	200	6371	6300	6265	70	55	57	-	-	-
New Zealand	2645	1500	1500	1354	1841	1906	7720	8226	8309	13490	13863	13863	2,557	2,557	2,557
Singapore	1	1	0.6	1	0.2	0.2	2.3	2.3	2.3				0	0	0
Total	**57270**	**55006**	**56900.6**	**2171**	**2697.2**	**2783.2**	**207260**	**204337**	**203400**	**430416**	**422252**	**409333**	**2699**	**424302**	**424307**

Annex 14. Annual rate of change of land use in developed countries

	Arable land		Permanent crops		Forests		Permanent pasture and meadows		Woodlands	
	1990-2000	**2000-2005**	**1990-2000**	**2000-2005**	**1990-2000**	**1990-2000**	**2000-2005**	**1990-2000**	**2000-2005**	**1990-2000**
Australia	- 0.1	0.9	5.0	2.8	- 0.2	- 0.1	- 0.2	- 0.6		-
Brunei Darussalam	11.6	9.2	-	4.6	- 0.8	- 0.7	-	-	0.9	0.6
Japan	- 0.6	- 0.5	- 2.8	- 1.4	- 0.0	- 0.0	- 0.5	- 100.0		
Korea, Republic of	- 1.3	- 1.1	2.5	-	- 0.1	- 0.1	- 2.4	0.7		
New Zealand	- 5.5	-	3.1	0.7	0.6	0.2	0.3	-	-	-
Singapore	-	- 9.7	- 14.9	-	-	-				
Total	- 0.4	0.7	2.2	0.6	- 0.1	- 0.1	- 0.2	- 0.6	65.8	0.0

Annex 15. Area under primary forests by country (Unit: 000 ha)

Country	1990	2000	2005
Australia	-	5,233	5,233
Bangladesh	-	-	-
Bhutan	413	413	413
Brunei Darussalam	313	288	278
Cambodia	766	456	322
China	11,632	11,632	11,632
Cook Islands	-	-	-
Fiji	895	894	894
India	-	-	-
Indonesia	70,419	55,941	48,702
Japan	3,764	4,054	4,591
Kiribati	-	-	-
Korea, DPR	1,129	939	852
Korea, Republic of	-	-	-
Laos	1,490	1,490	1,490
Malaysia	3,820	3,820	3,820
Maldives	-	-	-
Mongolia	5,540	4,923	4,733
Myanmar	-	-	-
Nepal	391	384	349
New Caledonia	431	431	431
New Zealand	3,506	3,506	3,506
Pakistan	-	-	-
Papua New Guinea	29,210	26,462	25,211
Philippines	829	829	829
Samoa	-	n.s.	n.s.
Singapore	2	2	2
Solomon Islands	-	-	-
Sri Lanka	257	197	167
Thailand	6,451	6,451	6,451
Tonga	-	-	-
Vanuatu	-	-	-
Viet Nam	384	187	85