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REVIEW OF THE STATE OF THE ENVIRONMENT IN ASIA AND THE PACIFIC

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Note by the secretariat

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INTRODUCTION AND OVERVIEW

1. This review of the state of the environment outlines a number of key issues and problems concerning the environment and development in the Asian and the Pacific region. It could serve in the elaboration of the challenges which the region now faces, and assist in identifying steps to formulate a regional action programme on environmentally sound and sustainable development that could arrest the pace of environmental degradation.

2. The Asian and the Pacific region, which accommodates 58 per cent of the global population over 23 per cent of the total world land area, contains a vast and diverse range of ecosystems comprising deserts, forests, rivers, lakes and seas. Deserts extend over large areas in Central Asia and South Asia, as well as the interior of Australia. The forest ecosystem of the region occupies a total of 661 million hectares, of which 57 per cent is biologically rich tropical forest. More than two-thirds of the world's coral reefs and one-third of the more than 24 million hectares of the world's mangrove areas are also located in the region. The land, rivers and lakes, as well as seas, islands, coral reefs, estuaries and mangroves provide a major resource base to the economies of the region.

3. The region also has great geographical and biological diversity. It encompasses segments of the three of the world's eight biogeographic divisions, the Palaearctic, Indo-Malayan and the Oceanic regions, as well as the Indian and Pacific oceans. It also has the world's most fragile and vulnerable areas including the highest mountain systems, land-locked Central Asian countries and small island developing States. Numerous factors account for the extreme vulnerability of the small island developing States. These include extreme isolation, heavy dependence upon external trade and finance, high transport costs, exposure to frequent natural disasters and great pressures by increasing human intervention in the extremely fragile physical environment.

4. During the past few years, three trends have contributed most directly to the excessive pressure now being placed on the environment and natural system of the Asian and Pacific region. These include doubling of the region's population in the last 35 years,¹ the almost tripling of the region's economic output in the last 20 years and the persistence of pervasive poverty. The environmental impact of an ever-increasing population to meet the basic needs have been multiplied by the chasm of inequity between rich and poor. The rich at the top of the income ladder, because of their affluence, have a high level of consumption of energy, raw materials and manufactured goods. The poor at the other end of the scale are deprived of basic resources and forced to cutting trees, growing crops on fragile lands and mining resources to meet their survival needs.

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¹ A recent assessment suggests that the regional population increased by about 270 million between 1990 and 1995, an increment larger than the current population of the United States of America.

5. In terms of economic output and growth rate, the region sets an example that most countries in the developing world, and indeed in the developed world, may well want to emulate. The developing nations of the region have gained the reputation of comprising the fastest growing group of countries in the world, with an average growth rate in gross domestic product (GDP) of 7 per cent during the period 1991-1994 compared with the world economic growth of 1.1 per cent during the same period. This rate is much higher than the average rate for all developing countries (4.5 per cent). The fact that the world's most populous country, China, could double its per capita output in 10 years (1977 to 1987) and that the Republic of Korea achieved this feat in slightly over a decade (1966 to 1977) is highly commendable. This growth has assisted in reducing poverty, particularly in East Asia where the level of poverty fell from one third of the population in 1970 to one fifth in 1980 and one tenth in 1990.² However, it has also been accompanied by the emergence of serious environmental problems in the region.

6. Although the extent and nature of the pressure on the environment varies depending on the style of development and resource endowment in different parts of the region, a continuously deteriorating trend has been observed as the most common denominator during the past few years. This is a matter of serious concern, as the environmental problems are no longer localized in scale and scope. Problems such as the greenhouse effect, ozone layer depletion, biodiversity loss and acid rain clearly demonstrate spill-over effects. The underlying complexities of such issues invariably call for intercountry and inter-agency cooperation. Without such cooperation and a common framework of action, the efficacy of individual efforts towards combating these will be, at best, marginal. Promoting regional cooperation to address these issues is therefore a cornerstone in framing a regional programme of action for environmentally sound and sustainable development.

I. ASSESSMENT OF ENVIRONMENTAL CONDITIONS AND TRENDS

7. The environmental conditions in the Asian and Pacific region are continuously being transformed through natural processes and human interventions. This section examines the conditions and trends affecting land, forest, biodiversity, inland water, marine environment and atmosphere.

A. Land

8. There is increasing pressure on land resources in the region to provide the basic needs of the region's fast-expanding population. This has led to unsustainable land-use practices such as clearance of forest land for crop production, expansion of agriculture into marginal lands, widespread use

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² The World Bank, *Poverty Reduction and the World Bank* (Washington DC, 1993).

of annual crops in farming systems, bare fallowing, overgrazing, logging and removal of wood for meeting energy needs (figure 1). In addition, inefficient irrigation practices, such as overwatering without the provision of outlets for excess water, and mining and industrial waste dumping have also contributed to land degradation. Mining and radioactive pollution in particular have contributed substantially to land degradation in the Pacific and Central Asian subregion. In Kazakhstan alone, over 100 million hectares of land have been polluted or degraded through anthropogenic desertification and radioactive contamination.

9. The pressure on land for food production can be discerned from figure 2 which indicates three distinct phases over time. A moderate growth over 1850-1930 was followed by an exponential growth in cropland during the period 1930-1970. The rate of expansion somewhat slackened in the third or levelling-off phase. During this phase, some 5 million hectares of the net increase of 6 million hectares in arable land in developing countries of Asia and the Pacific, occurred in Indonesia, India and Thailand. In these countries potential for such expansion is limited, particularly in Thailand where arable land has already been overutilized to 135 per cent of its potential capacity.³ Obviously any further expansion of arable land could therefore take place only in the marginal areas, further aggravating the problem of land degradation.

10. According to the Global Assessment of Human-induced Soil Degradation (GLASOD), of the world's 1.9 billion hectares land affected by soil degradation, the largest area (850 million hectares) is in the Asian and Pacific region (figure 3). Overall, 86 million hectares of precious land which includes 70 million hectares of rain-fed area and 16 million hectares of irrigated croplands have been affected by desertification. More than 50 per cent of the world's irrigated land affected by waterlogging and salinization is located in the Asian and Pacific region. Altogether, 35 per cent of the productive land in Asia is now affected by desertification compared with 18 per cent in Africa, 28 per cent in North America and 17 per cent in South America. The region has the largest population in the world affected by desertification.

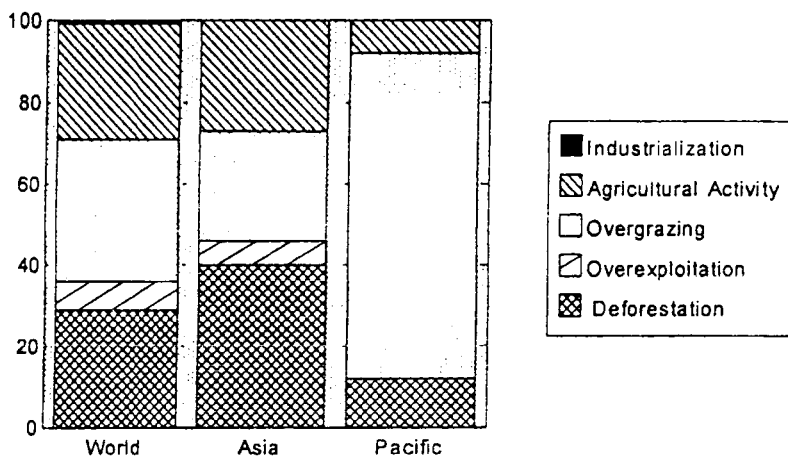
11. Land degradation is a significant problem across virtually all agro-ecological zones in Asia, the nature and scale of this problem vary widely among and even within countries of the region. The most intensive effect relative to the size of States has taken place in Central Asia.⁴ Both water and wind erosion are major processes contributing to land degradation (figure 4). Wind erosion is mainly restricted to Mongolia, western China, Central Asian republics, and the drier parts of India

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³ Actual arable land used in the country is 22.1 million hectares (ha) against the potentially available 16.4 million ha. See, United Nations Environment Programme, *Environment Data Report 1993-94*, (Oxford, Basil Blackwell, 1993).

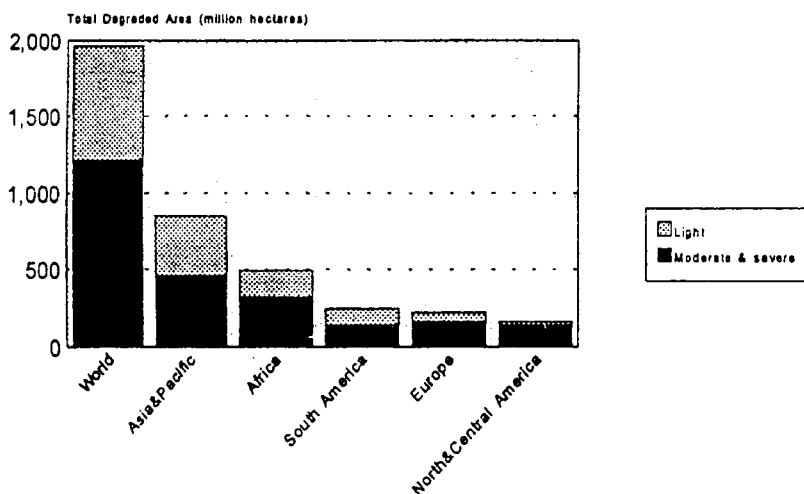
⁴ N.F. Glazovsky and N.S. Orlovsky, *Desertification and Drought Problems in the CIS and the Ways of Their Solution* (Almaty, 1995).

Figure 1. Causes of land degradation



International Soil Reference and Information Centre, Wageningen, the Netherlands, 1990.

Figure 3. Human-induced soil degradation, 1945-90



Source: L.R. Oldeman, V.W.P. van Englen, and J.H.M. Pulles, The Extent of Human-induced Soil Degradation World Map of the Status of Human-induced Soil Degradation: An Explanatory note, rev. 2d ed. (International Soil Reference and Information centre, Wageningen, the Netherlands, 1990)

Figure 2. Trend of cropland expansion in the Asia-Pacific region (1850-1990)

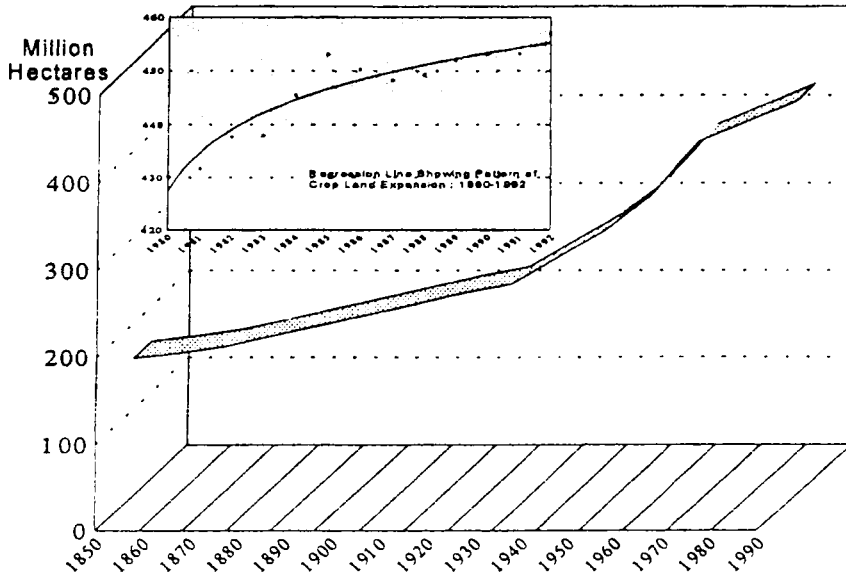
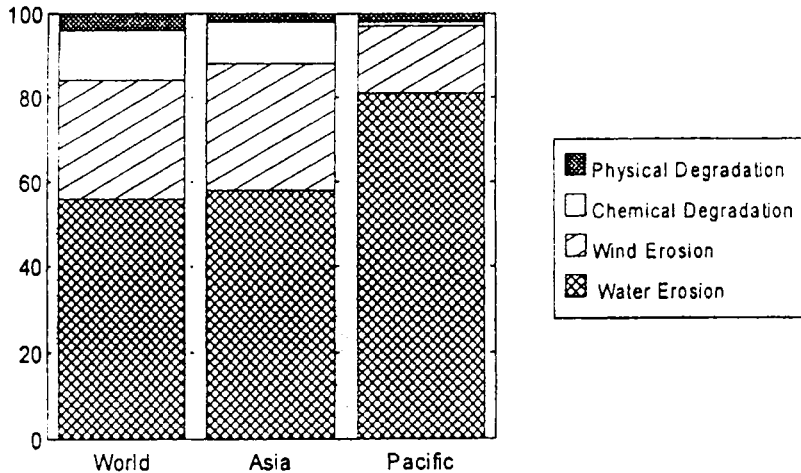


Figure 4. Contribution of physical and chemical processes to land degradation in Asia-Pacific and the world



and Pakistan; water erosion is the most widespread hazard throughout the region due to unsustainable land-use practices and improper management of watershed. The higher rates of erosion in some parts of the region are due to the existence of highly erodible soils, such as loess in China, limestone-derived soils in Malaysia, southern Thailand and small island developing States of the Pacific, and dispersible soils such as those associated with the Pelambang formation in eastern Sumatra, and geologically young soil in Nepal and Bhutan.

B. Forests

12. Deforestation is one of the most serious problems in the Asian and Pacific region. Findings of the Food and Agriculture Organization of the United Nations (FAO) indicate that the annual deforestation rate in the region increased from 2 million hectares during the period 1976-1981 to 3.9 million hectares in 1981-1990.⁵ Among the tropical regions of the world, the Asian and Pacific region has the fastest rate (1.2 per cent/year) of deforestation, the fastest rate of commercial logging, the highest volume of fuelwood removals, as well as the fastest rates of species extinctions. Among subregions, South-East Asia had the highest deforestation rate followed by South Asia, Central Asia and the Pacific. The situation is also serious in countries like Bangladesh and Pakistan, which have high deforestation rates with low per capita forest availability (figure 5). In the past, land clearing for cultivation has been the principal cause of deforestation. However, more recently commercial logging, and fuelwood production have become the major causes of deforestation (figure 6). Between the 1981 and 1990, an estimated one third of the global net area of deforestation occurred in the Asian region, even though the region accounted for only 13 per cent of the world's forest resources. At the current rates of harvesting, the remaining timber reserves in the region will last only for about 40 years.

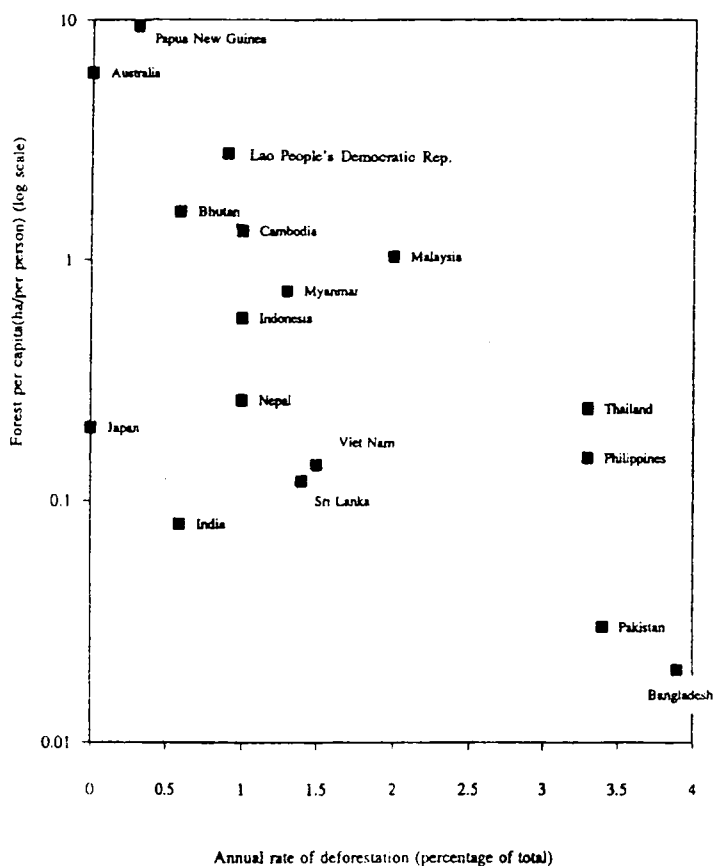
13. Excessive depletion and degradation of forest areas have serious environmental implications. This is the primary cause of land degradation, low soil fertility, loss of biodiversity, unfavourable climatic change, increased emission of greenhouse gases and a trigger of disasters such as floods and droughts, all of which result in considerable economic losses and which pose a serious threat to the well-being of humanity.

14. On the positive side, the Asian and Pacific region has experienced a faster rate of plantation establishment than any other tropical region (increasing plantation area by 2.1 million hectares, or 11.2 per cent, per year). In some temperate countries, such as Japan and the Republic of Korea, the natural forests that had earlier been degraded or converted to other land uses for decanting,

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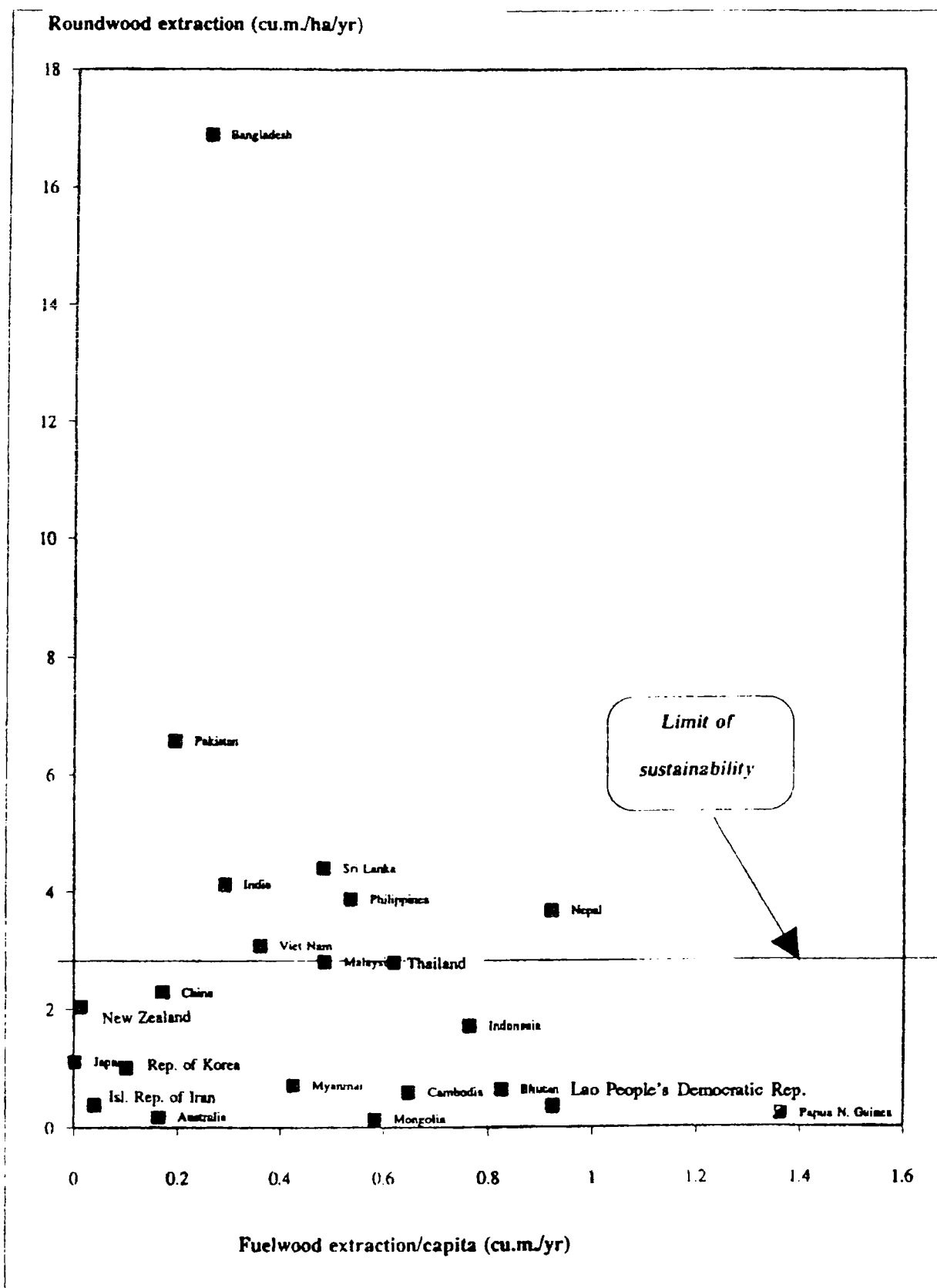
⁵ Food and Agriculture Organization of the United Nations (FAO), Forest Resource Assessment 1990, FAO Forestry Paper 112 (Rome, 1993).

Figure 5. Per capita vs annual rate of deforestation in selected countries of the Asian and Pacific region



Data source: Food and Agriculture Organization of the United Nations (1994). Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1983-93, Bangkok

Figure 6. Roundwood and fuelwood extraction in selected countries of the Asia-Pacific region in 1992



industrialization, and leisure and recreational facility development, have been rehabilitated and maintained through continuous tree-planting efforts over a long period. Among the countries of the region the highest annual afforestation rate is in China. With some 4 million hectares of afforestation per annum, the total forest area in China had reached 129 million hectares in 1991, accounting for 13.63 per cent of total land area, compared with 12.98 per cent in 1989. Afforestation rates are also relatively high in India and Kazakhstan.

C. Biodiversity

15. The Asian and Pacific region is rich in biodiversity. However, this is also a region in which biodiversity is under serious threat from a variety of causes. The growing loss of habitats, species and genetic diversity are some of the major indicators of the threat to biodiversity in the region. The shrinkage in natural habitat is evident from the situation in the Indo-Malayan region (figure 7), where the major ecosystems are estimated to have lost almost 70 per cent of their original vegetation. Dry and moist forests have suffered 73 per cent and 60 per cent losses, respectively, while 55 per cent of wetlands, marshes and mangroves have disappeared. Overall habitat losses have been most acute in the countries of the Indian subcontinent and China.

16. It is not known how many species of plants and animals have already become extinct, because even in those countries that have listings of flora and fauna species, the figures have often not been revised since they were first prepared, which may have been 50 years ago in some cases. However, the World Conservation Monitoring Centre (WCMC) has reported that 6,608 plant species are threatened in Asia, while another 2,673 plant species are threatened in the Pacific.⁶ This could be a gross underestimate, as in the Philippines alone half of the endemic plant species may have become extinct.⁷ The listed number of plants in that country is 159 species, which is estimated to be about one tenth of the number that may now be extinct.

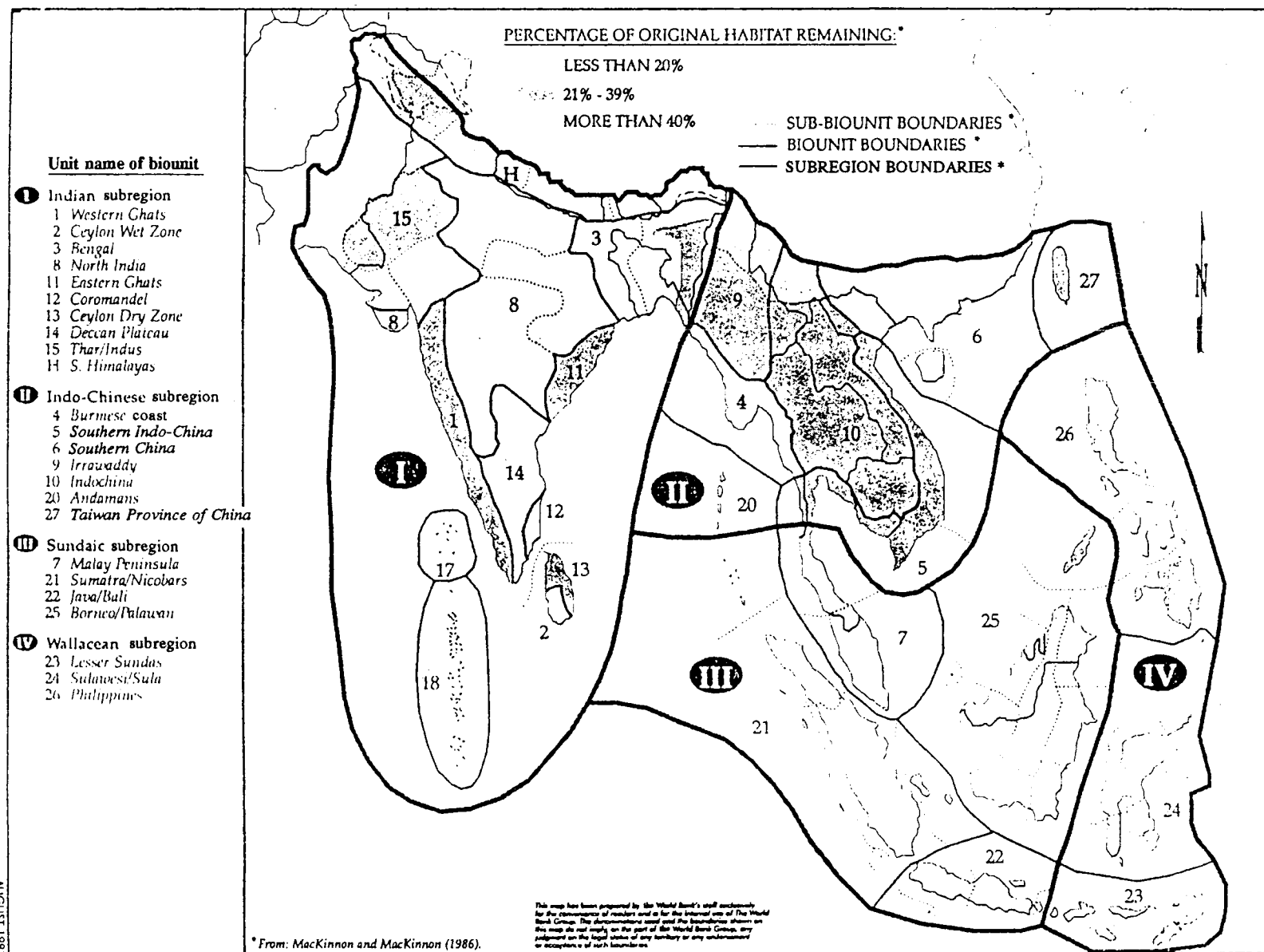
17. According to the World Conservation Union (IUCN) Red List of endangered species of mammals, the carnivores (for example, tigers) and the primates (for example, the orang utangs) are the most endangered. The tiger is close to extinction in China and South-East Asia where poaching, the reduction of habitat and the fragmentation of their population are common. The situation with respect to primates is even more serious, with half of their species listed as endangered, mainly due to habitat loss as a result of land-use changes. A 1993 report by Trade Record Analysis of Flora

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⁶ The World Conservation Monitoring Centre, *Global Biodiversity: Status of the Earth's Living Resources* (Cambridge, United Kingdom of Great Britain and Northern Ireland, 1992).

⁷ K.M. Wong, "A tribute to Bengamin Stone 1933-1994", *Sandakanian*, vol. 4, pp. 1-29 (Forestry Department, Sabah, Malaysia, 1994).

Figure 7. Habitat remaining in the Indo-Malayan region*



* This map has been reproduced from Braatz S., Conserving Biological Diversity, World Bank Technical Paper No. 193, Washington DC, (1992).

and Fauna in Commerce (TRAFFIC) International, a non-governmental organization (NGO) that monitors the trade in endangered species, shows that despite the ban on endangered species, their trafficking still remains very high in the region. Taiwan Province of China has been listed as the most important importer and consumer of products of endangered species in the East Asian subregion.

18. Genetic diversity is also under threat in the wake of the introduction of high-yielding modern varieties of crops and livestock. One example of the increasing genetic uniformity is rice, which is the most important crop in the region. The semi-dwarf rice varieties, such as IR8, enabled an average rise in rice yield in the region by 42 per cent during the 1960s and the 1970s. Total production increased by 77 per cent at a time when the land area devoted to rice cultivation rose by only 25 per cent. However, this success was not without cost. It was mainly achieved by replacing many traditional varieties. For example, in India the production of rice in the past used to come from an extraordinary 30,000 traditional varieties adapted to local growing conditions. This has changed drastically in recent years and 75 per cent of the production now comes from less than 10 modern varieties. The reliance on modern varieties has undoubtedly led to increased output, but it has also led to reduced tolerance/resistance to diseases/pests.

19. Biodiversity in the developing countries of the Asian and Pacific region is protected through conservation, both *in situ* and otherwise. The region contains about 1,200 of the 6,940 protected areas of the world.⁸ These areas encompass some 774,000 square kilometres or 3.8 per cent of the total land area of the region (the same proportion as in the world). While some countries have higher proportions of land under protected area systems, others have either a minimum of protected areas (the Central Asian republics have only about 1 per cent of their area under protection), or none at all. Just three countries — China, India and Indonesia — account for about 80 per cent of the total protected land in the region. In many other countries, protected area systems remain incomplete, particularly in the Pacific island nations and Indo-China. Moreover, many important habitats, such as the moist forest areas of Sri Lanka, are either unrepresented or underrepresented in the systems. The coverage of wetlands and marine areas is particularly very limited throughout the region. In addition, protected area systems in many cases are ill-defined; for example, boundaries are frequently unmarked and are unclear to local people, who may even be unaware that a protected area exists. In addition, infrastructure for management is sometimes non-existent, staffing is insufficient, and fauna and flora have not been surveyed. Further, there is a dearth of conservation/management plans, and in many cases human activities incompatible with conservation continue unchecked in the protected areas.⁹

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⁸ Op. cit.

⁹ S. Braatz, "Conserving Biological Diversity", World Bank Technical Paper No. 193 (The World Bank, Washington DC, 1992).

D. Inland water

20. The most important problems facing freshwater resources are: (a) a growing trend towards water scarcity; (b) deteriorating quality; and (c) sectoral conflicts in water allocation. These problems are clear evidence of the strains placed on water resources of the Asian and Pacific region by rapid population, and urban and industrial growth. Countries with less than 1,700 cubic metres per person per year experience water stress and those with less than 1,000 cubic metres face water scarcity.¹⁰ By this standard, Singapore is already in a water-scarce situation, while the Islamic Republic of Iran and India are heading towards a similar situation (figure 8). The rates of population growth could make the difference between potentially manageable water-stress and outright water scarcity in 2025. In Sri Lanka, for example (figure 9), the population trend will determine whether the threshold is crossed from relative water abundance to stress. Among the countries projected to fall into the water-stress category before 2025 is India (1990 annual per capita water availability — 2,464 cubic metres). China, today's most populous nation (1990 annual per capita water availability — 2,427 cubic metres), will only narrowly miss the water stress benchmark in 2025, according to all three United Nations projections. In that year, according to the median scenario, each of China's projected 1.5 billion citizens will have 1,818 cubic metres of water available. In the north China plain, however, water shortages are already acute, and demand is expected to outstrip supply by the turn of the century.¹¹ The overuse of groundwater in China's northern provinces has led to drop in the water table by as much as one metre a year in wells serving Beijing, Xian and Tianjin. Likewise, over-exploitation of groundwater in Bangkok is causing the city to sink two to four inches a year, leading to cracked pavements, broken sewers and water pipes, sea-water intrusion and flooding.¹² Lakes and rivers have also proven vulnerable to unsustainable use. For example, the diversion for irrigation of the rivers that feed the Aral Sea in Central Asia has reduced its size to 40 per cent of its former surface area.

21. Deteriorating water quality is evident in accelerated siltation, toxic contamination and increasing acidification. A recent United Nations Environment Programme/International Lake Environment Preservation Committee (UNEP/ILEC) survey¹³ shows that the percentage of lakes and reservoirs with eutrophication problems is the highest in Asia-Pacific (54 per cent) compared with Europe (53 per cent), Africa (28 per cent), North America (48 per cent) and South America

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¹⁰ R. Engelman and P. LeRoy, "Sustaining Water: Population and Future of Renewable Water Supplies" (Washington DC, Population Action International, 1993)

¹¹ World Resources Institute, *World Resources 1992-93* (New York, Oxford University Press, 1993).

¹² J. Young, "Asia's Rapid Urbanization Brings Economic Fruits", *The Christian Science Monitor*, 20 April 1993.

¹³ United Nations Environment Programme/International Lake Environment Preservation Committee, *Survey of the State of the World Lakes* (1990).

Figure 8. Annual renewable freshwater available (cu.m. per capita) in selected countries

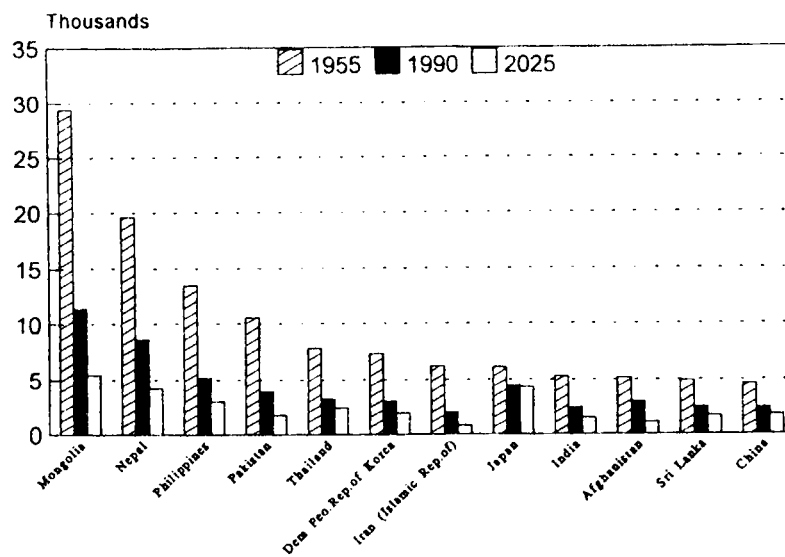
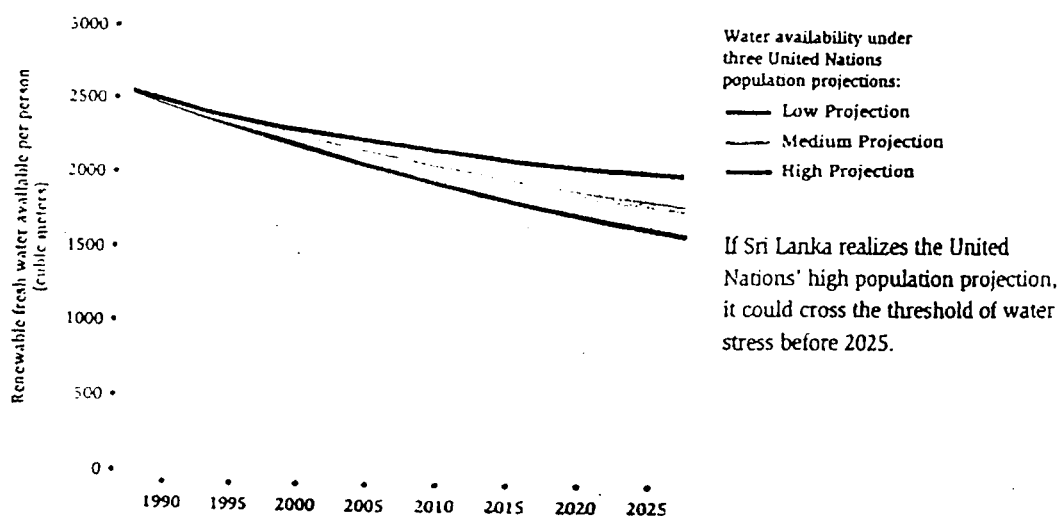


Figure 9. Freshwater availability in Sri Lanka under three population growth scenarios



(41 per cent). Eutrophication is primarily caused by increasing organic loads in the waterbodies from nutrients in agricultural run-off, domestic sewage and industrial effluent. The latter two categories also contribute to increasing pathogenic loads in rivers (table 1). The problems of pathogenic agents is most severe in the Indian subcontinent, the Pacific islands, South-East Asia and China. The pollution level of the Amudarya River in Central Asia has increased by between 1.5 and 2 times during the last 20 years. The salinity level has reached 3.5 to 4 g/l, while the count of suspended sediments as well as heavy metals and fertilizers has also increased. Industrialization compounds water pollution from domestic sources, because most industries are located in or near cities and discharge their wastes into the same waterbodies or rivers. As the region's industrial sector expands to accommodate more and more highly polluting manufacturing enterprises such as chemicals, electronics, electroplating and machinery, industrial effluents increasingly contain heavy metals, and non-degradable toxic and hazardous waste, thus posing high health risks. Some typical examples of polluted urban rivers and canals are the Lyari and Malir rivers in Karachi, the Kabul River in the city of Kabul, the Brantas River of East Java, the Pasig and Tenajeros-Tullahan rivers in Metro Manila and the Chao Phraya River and the numerous *khlongs* (canals) in Bangkok.

22. The quality of underground water is also being threatened, particularly in coastal areas and low-lying small island developing States, most of which have no lakes or rivers at all and which draw water from a thin layer or lens of fresh water floating on top of sea water inside the rock. Excessive pumping, and poor well design have resulted in some degree of salt-water intrusion in such situations. With the increase in domestic and agricultural water use during the past decade, water contamination has also occurred. The threat is serious because the porous limestone of atolls allows pollutants to penetrate into the ground, so materials discharged onto the surface of the island over the aquifer (including sewage, fertilizers and pesticides) rapidly contaminate the groundwater. Well water has already become unsafe to drink because of sewage pollution on some atolls where water catchments are now the major source of drinking water.

23. The increasing competition, between the urban and agricultural sectors for water use (figure 10) is a key example of growing sectoral conflicts. In India, for example, the demand for water in the city of Hyderabad is in direct conflict with irrigation during low-flow years when the authorities give priority to the water supply in the city. Similarly, in Indonesia the municipal water demands for the Jakarta region and Surabaya are in conflict with irrigation demands in the surrounding basin. In the Philippines, the water supply and power demands of Manila are beginning to have an adverse impact on irrigation in Central Luzon during drought years. Another example of users' conflict is upstream withdrawals that reduce downstream flows and promote incursion of saline water into estuaries and wetlands, leading to changes in the coastal ecology that have serious impacts on the breeding grounds of coastal fish and other marine life.

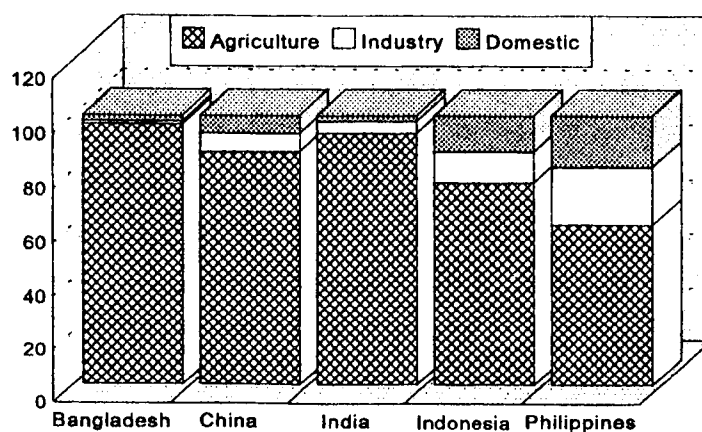
Table 1. Water quality issues in the ESCAP region

Quality issues	Indian subcontinent	South-East Asia	Pacific islands	China	Japan, Australia and New Zealand
Pathogenic agents	1-3	1-2	2-3	1-3	0-1
Organic matter	1-3	0-2	0-1	1-3	0-1
Salinization	0-1	0-1	0-3	0-2	0-1
Nitrate	0-1	0-1	1-2	0-2	0-1
Fluoride	0-1	0	0	0-2	0
Eutrophication	0-1	0-3	0	0-2	0-1
Heavy metals	0-1	0-2	0-1	0-2	0-2
Pesticides	0-1	0-1	0-1	0-1	0-1
Sediment load	0-2	0-2	0-1	0-1	0-1
Acidification	0	0-1	0	0-1	0-1

Notes: 0 - No pollution or irrelevant
1 - Some pollution, water can be used if appropriate measures are taken
2 - Major pollution
3 - Severe pollution affecting basic water uses

Source: ESCAP, "Groundwater quality and monitoring in Asia and the Pacific", *Water Resources Series No. 70* (Bangkok, 1991).

Figure 10. Freshwater withdrawals by sector in selected Asian countries



Data source: World Resources Institute, *World Resources 1992-93*, Oxford University Press, New York, 1992.

24. Government agencies have not been effective in resolving conflicting water demands in the face of limited supplies and deteriorating quality (particularly in urban and industrial centres where untreated water is being indiscriminately discharged, causing a serious pollution problem). Present practices are not effective in meeting quantity and quality criteria. First, the responsibilities of Governments in the area of water resources management have typically been fragmented between agencies responsible for irrigation, water supply, power and transportation, with equally fragmented results. Second, pricing has not been used anywhere in Asia as an explicit mechanism for allocating water. (*De facto* pricing does allocate water, however, in those parts of cities forced to buy from private vendors because of a lack of access to public supplies). Third, water rights are poorly defined. Property rights problems are further exacerbated by a lack of coordination among jurisdictions sharing water. This, in many cases, has led to overuse of water resources with concomitant ecological and economic losses.

E. Marine and coastal environment

25. In the marine environment, the most serious problems are in the coastal areas where a large majority of the region's population is concentrated. Of the 75 largest cities in the world, nearly half are in the Asian and Pacific region, and more than half of these are situated on or very near the coast. The movement of people to coastal cities has enhanced land-based pollution. It has been estimated that over 75 per cent of the pollution entering oceans worldwide comes from human activities on land (figure 11). Over 70 per cent of human sewage in the Pacific finds its way to coastal waters without prior treatment.¹⁴ Similarly, over 80 per cent of the pollutants contained in the Yellow Sea and coastal areas south of the Korean peninsula comes from inland activities (domestic and industrial) through the four largest Korean rivers.¹⁵ The situation is equally bad in South-East Asia and worst in South Asia. Coastal erosion has also become a major problem for small island developing States such as Maldives. This could have serious implications for their very existence because of their small size.

26. The river waters also feed coastal zones with silt, and nutrients and chemical contaminants contributed by fertilizers and pesticides used on agricultural land. The suspended load (primarily silt) per square kilometre of drainage basin is three to eight times higher than the world average and contributes to the high turbidity of coastal waters. Fertilizer consumption in the region rose from 33.3 million tons to 57.8 million tons over the period 1982 to 1992. Agricultural run-off transports large amounts of fertilizers and pesticides into the sea. A significant impact of this run-off

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¹⁴ V. Fuavao, *Areas of Environmental Concerns in the South Pacific Region*, (Noumea, SPREP, 1990).

¹⁵ Government of the Republic of Korea, Country paper to the Regional Meeting on the State of Environment in Asia and the Pacific 1995, 26-30 July 1995, Myanmar.

is nutrient enrichment or eutrophication, which manifests itself in algal blooms. The incidence of "red tides", a special plankton bloom in which the dominant species is toxic, seems to be increasing. For example, during the past decade, a wide range of algal blooms have been reported from Australian waters. The State of Tasmania suffered badly from red tides which recently caused the temporary closure of 15 shellfish farms for periods of up to six months.¹⁶

27. In addition to severely depleting the oxygen level and resulting in the mass death of aquatic organisms, the red tides also cause paralytic shellfish poisoning (PSP) attended by serious human health hazards. An outbreak of red tide in the Philippines in 1990 proved costly for the fisheries and shellfish industries. During the four-day tide, the prices of fish and shellfish dropped by some 75 per cent. As a result, the shellfish industry in Manila Bay suffered an estimated loss of US\$ 2.38 million. The frequency of the appearance of a red tide in Tolo Harbour, Hong Kong, climbed from two in 1977 to 19 in 1992 (figure 12). In terms of intensity of effect, the bloom recorded in 1992 was the largest, covering nearly the whole of Hong Kong's eastern waters. China is also experiencing an increasing threat of red tide occurrences in its coastal waters. There were a total of 19 red tide incidences in 1993. One of these, which occurred in the coastal area of Zhejiang province in May 1993, killed prawns raised over nearly 5,000 hectares and resulted in an estimated loss of US\$ 34.5 millions.¹⁷

28. The marine pollution from sea-based activities in the region is largely associated with marine transportation, and offshore mineral exploration and production activities. Approximately 5 million tons of oil enter the Arabian Sea each year, while the Bay of Bengal receives some 400,000 tons from similar sources. The region also has a number of natural oil seeps located off the coast of Viet Nam, in the seas of central Philippines, off the north-west coast of Borneo, to the west of Sulawesi, in the Bass Strait and along the South Victorian Coast of Australia, and off both the west and east coasts of New Zealand.¹⁸ In the wake of booming economies, expanding foreign trade and growth in traffic, the risk of accidental oil spills and deliberate discharges into the region's marine waters is expected to increase.

29. Specialized ecosystems, such as mangroves, corals and sea grasses, and marine species, are also under severe pressure from pollution, infilling (reclamation), dredging, dumping and

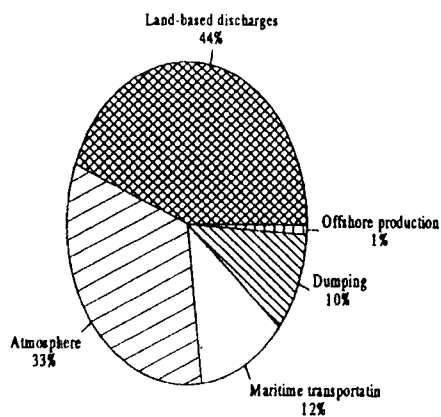
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¹⁶ G.M. Hallegraeff, "Harmful algal blooms in the Australian region", *Marine Pollution Bulletin*, vol. 25, pp. 186-190.

¹⁷ Chinese National Environmental Protection Agency, *China Environment News*, 8 June 1993.

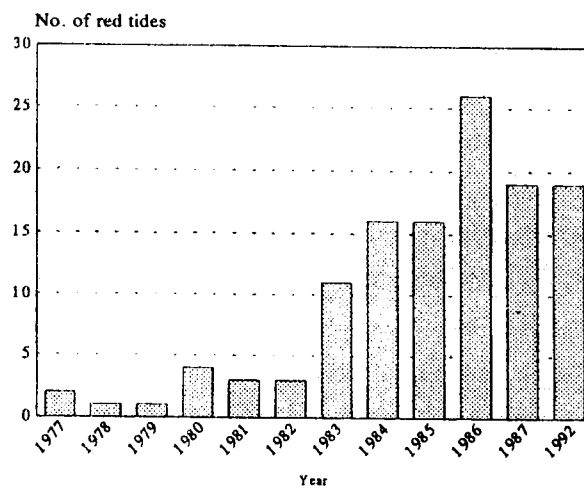
¹⁸ A.D. Couper, (ed.), *The Times Atlas and Encyclopaedia of the Sea* (London, Times Books, 1989).

Figure 11. Sources of marine pollution



Source: Weber (1993)

Figure 12. Number of red tides in Tolo harbour, Hong Kong 1977-1992



Data source: United Nations Environment Programme (1987); Department of Environment (1993).

other coastal alterations. For example, New Zealand has filled or modified 90 per cent of its coastal wetlands.¹⁹ Similarly, the degradation of coral reefs, particularly in small island developing States, has reached an alarming level. The threats to coral reefs emanate from chronic problems of sedimentation, an increase in ultraviolet rays, CO₂ build-up, nutrient loading, pesticide poisoning, breakage and overfishing, as well as acute problems resulting from hurricanes, oil spills, dredging, filling, Acanthaster starfish blooms, temperature peaks and flooding. Corals are also being damaged by trampling, divers' fins and boat anchors, as well as a host of other problems.²⁰ The degradation and loss of mangroves and coral ecosystems which act as nurseries for fish, together with overexploitation has also resulted in a decline in fisheries.

30. Marine fisheries in particular have been overexploited in the developed countries of the region (figure 13). The declining trend of marine fish in these countries is an indication of the over-harvesting of stocks. This has also led to the extinction of several fish species. A clear example of this loss is reported from Australia where 32 out of 100 main fisheries have been overfished or heavily fished. Southern bluefin tuna (figure 14), shark, gemfish and some species of rock lobster have been hardest hit. Several other vulnerable marine fauna, including whales, dugongs and turtles, are also threatened by habitat destruction as well as direct exploitation, poaching, pollution, tourism encroachment and accidental entanglement in fishing nets.

F. Atmosphere and climate

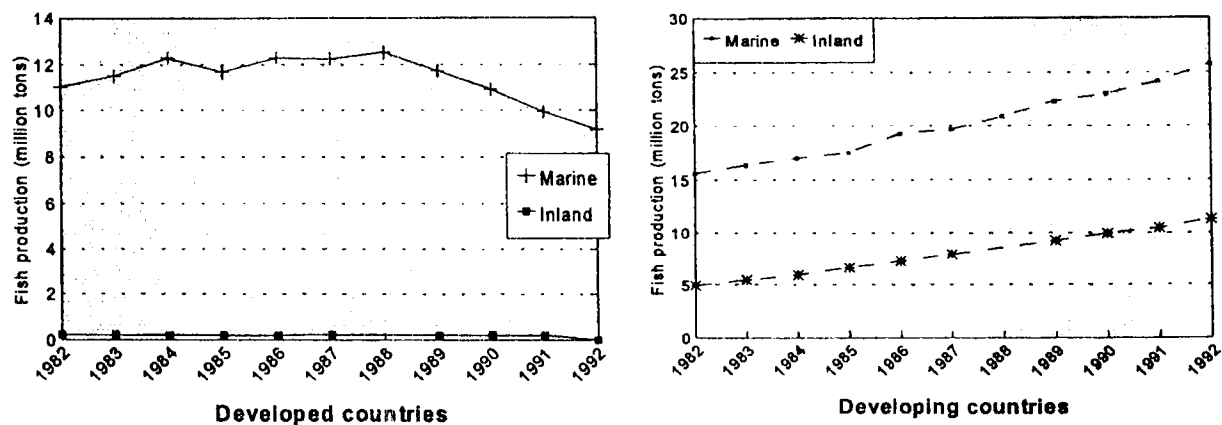
31. Major threats to the atmosphere in the Asian and Pacific region emanate from the increasing intensity of urban air pollution, potential global climate change and acid rain. Urban air pollution has been exacerbated by four particular developments that typically occur as countries become industrialized. These include growing cities, increasing traffic, rapid economic development and higher levels of energy consumption. The situation is especially serious in mega-cities. A recent study by the World Health Organization (WHO)/UNEP covering the urban atmosphere in 11 of these cities (table 2) revealed that ten out of these had a serious problem with suspended particulate matter (SPM), which can have toxic effects if it carries heavy metals or hydrocarbons. SO₂, as well as a blend of SO₂ and SPM, was reported as a serious problem in some of these cities. Apart from mega-cities, there are a large number of medium and small cities in the region that also have very severe air pollution problems resulting from their development as industrial centres close to raw

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¹⁹ Ministry of Environment, *New Zealand's National Report to the United Nations Conference on Environment and Development* (Wellington, 1990).

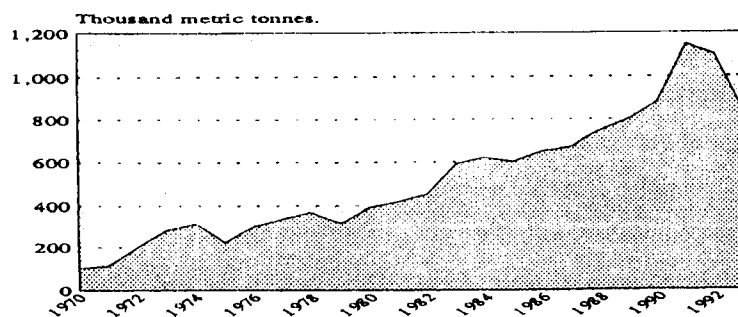
²⁰ S.M. Wells, *Coral Reefs of the World*, vol. III, *Central and Western Pacific* (the International Union for Conservation of Nature and Natural Resources, and the United Nations Environment Programme), (Cambridge, 1988); S.M. Wells "Coral Reefs: undersea gardens lose their sheen", *International Wildlife* (March/April 1990).

Figure 13. Trend of marine and inland fisheries production in Asia-Pacific (1982-1992)



Source: Food and Agriculture Organization of the United Nations/Regional Office for Asia and the Pacific (1994).

Figure 14. Annual tuna catch in the South Pacific 1970-1993



Source: South Pacific Commission (1993); Forum Fisheries Agency (1994).

Table 2. Status of pollutants in the mega-cities, 1992

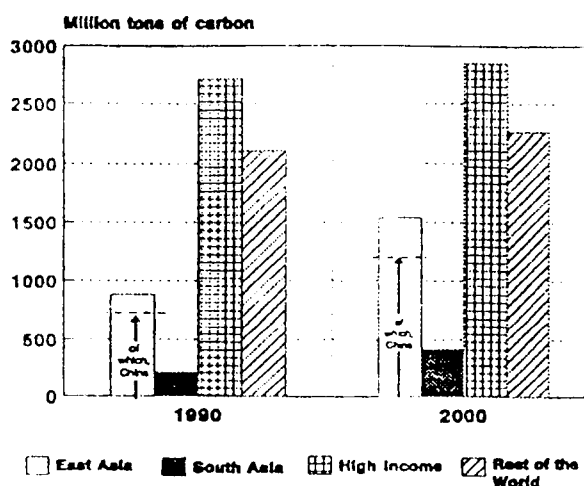
City	SO ₂	SPM	Pb ^a	CO	NO ₂	O ₃
Bangkok	□	●	■	□	□	□
Beijing	●	●	□	○	□	■
Bombay	□	●	□	□	□	○
Buenos Aires	○	■	□	●	○	○
Cairo	○	●	●	■	○	○
Calcutta	□	●	□	○	□	○
Delhi	□	●	□	□	□	○
Jakarta	□	●	■	■	□	■
Karachi	□	●	●	○	○	○
London	□	□	□	■	□	□
Los Angeles	□	■	□	■	■	●
Manila	□	●	■	○	○	○
Mexico City	●	●	■	●	■	●
Moscow	○	■	□	■	■	○
New York	□	□	□	■	□	■
Rio de Janeiro	■	■	□	□	□	○
São Paulo	□	■	□	■	■	●
Seoul	●	●	□	□	□	□
Shanghai	■	●	○	○	○	○
Tokyo	□	□	○	□	□	●

Source: World Health Organization (WHO) and United Nations Environment Programme, *Urban Air Pollution in Megacities of the World* (Blackwell Reference, Oxford, United Kingdom of Great Britain and Northern Ireland, 1992), p. 39.

Notes:

- Serious problem, WHO guidelines exceeded by more than a factor of two.
- Moderate to heavy pollution, WHO guidelines exceeded by up to a factor of two (short-term guidelines exceeded on a regular basis at certain times).
- Low pollution, WHO guidelines normally met (short-term guidelines are exceeded occasionally).
- No data available or insufficient data for assessment.

* It was recently reported by the Government of the Republic of Korea that the SO₂ level in Seoul has dropped and is now within the WHO standard.

Figure 15. Projected carbon dioxide emissions, 1990 and 2000

Source: World Bank 1992.

materials, such as the Singrauli region in India, or energy development sites, such as Illigan City in the Philippines. Many towns of this type in the Central Asian republics (for example, eight of the 21 towns in Kazakhstan) are reported to have exceeded the admissible level of pollution by 13 to 14 times. In a large number of cities, especially those in China, pollution from coal use for domestic cooking and heating is a major source of air pollution. In addition, the burning of biomass for cooking creates severe indoor air pollution problems in lower income urban households and in rural areas throughout the region, resulting in serious respiratory diseases including lung cancer.

32. Increases in the levels of carbon dioxide and other pollutants have been shown to cause global warming which may lead to major long-term atmospheric and climatic impacts. The region only contributes some 20 per cent of the global greenhouse gases; on a per capita basis the current emission is about one to two tons per capita every year, an amount which is some ten to 20 times less than that of the developed countries (figure 15). However, the region would be the worst hit in the event of climate change. The three greatest anticipated consequences of any global warming are sea-level rise, an increase in climate-related natural disasters (floods, droughts and storms), and the disruption of agriculture owing to changes in temperature, rainfall and winds. The consequences of sea-level rise will be the inundation of coastal areas (river deltas being especially vulnerable), salt-water intrusion into freshwater supplies, and an increased threat of storm surges. In addition, the effects will be quite severe on coastal mangrove forests, wetlands and coral reefs, which will "drown" if growth cannot keep pace with a rapid rise in sea level. Wetland losses are estimated at between 35 and over 90 per cent.²¹ A 0.25 meter rise in sea levels could destroy about half of Asia's remaining wetlands.

33. Estimates show that a sea-level rise of 1 metre will inundate 23,000 km² of land in Bangladesh, 126,000 km² in China, and significant areas of land in many other nations.²² Table 3 shows estimates of land loss for six selected countries in the region, together with the associated displacements of human populations. It may be pointed out that the impacts of climate change-induced sea-level rise will be particularly severe for the small island nations of the region, which often have little land that is more than a few metres above sea level, and which depend to a very large extent on the biological and physical resources of the coastal zone. It is also predicted that enhanced greenhouse conditions will intensify the features of the summer and winter monsoons. The south-west monsoon will be hotter and wetter, possibly leading to increased frequency in floods, accelerated erosion and the leaching of nutrients from the soil. Marginal agriculture may be at high risk

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²¹ R.J. Nicholls, "Synthesis of vulnerability analysis studies", *Proceedings of WORLD COAST '93*, (Rijkswaterstaat, the Netherlands, Coastal Zone Management Centre, 1994).

²² C. Topping, Jr., A. Qureshi and A. Samual, *Implications of Climate Change for the Asian-Pacific Region* (Nagoya, Japan, Japan Environment Agency, 1990).

Table 3. Land loss and existing population displaced for various sea-level rise scenarios and no adaptation

Country	Sea-level rise scenario (cm)	Land loss		People displaced	
		Km ²	%	Millions	%
Bangladesh	45 (S1)	15,668	10.9	5.5	5.0
Bangladesh	100 (S2)	29,846	20.7	14.8	13.5
India	100	5,763	0.4	7.1	0.8
Indonesia	60	34,000	1.9	2.0	1.1
Malaysia	100	7,000	2.1	>0.05	>0.3
Pakistan	200	1,700	0.2	n.a.	n.a.
Viet Nam	90	>20,000	>6.1	n.a.	n.a.

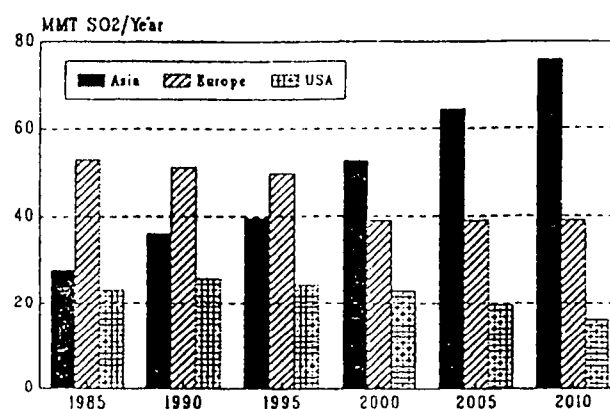
Source: National study team reports.
S1 = scenario 1, S2 = scenario 2
n.a. = not available

Table 4. Acid rain in Asia

Region	High emissions		High depositions		Ecological sensitivities
	Current	Future	Current	Future	
North-East China	X	X		X	Vegetation
Japan, Rep. of Korea			X	X	Soil, vegetation
South China		X	X	X	Soil, vegetation
South-East Asia	X	X	X	X	Soil, vegetation
South-East Asian islands	X	X	X	X	Soil
Northern India	X	X		X	Vegetation
Southwestern India			Borderline	X	Soil, vegetation
Northeastern India		X		X	Soil
Sri Lanka, Maldives			Borderline	X	
Siberia, Mongolia				X	Vegetation

Source: Carter Brandon and Ramesh Ramankutty, *Toward an Environmental Strategy for Asia*, World Bank (Washington DC, 1993).

Figure 16. Current and project SO₂ emissions



Source: World Bank and ADB data.

from even a small shift in the thermal and moisture limits of crop production. Global warming could also alter the growing season, resulting in a variety of consequences which are difficult to anticipate.

34. The threat posed by acid rain has also increased in the region. At least two thirds of acid rain emissions in Asia are caused by coal-fired power plants and industrial sources, and the balance by residential heating and cooking. Most power plants in the region have either no pollution control equipment or only rudimentary particulate control. Sulphur and nitrogen oxide emissions have both local and regional impacts. Depending on the stack height and the prevailing wind conditions, sulphur and nitrogen oxides emissions can be carried hundreds of miles. This can cause transboundary pollution (table 4). Given the projected growth of energy consumption over the next ten to 15 years, acid rain is likely to increase. One study predicts that SO₂ emissions will increase from 35 million tons in 1990 to 53 million tons by 2000, and to 76 million tons by 2010, if no substantial efforts are made to control these emissions²³ (figure 16). Based on these projections, Asia may surpass both Europe and the United States of America in SO₂ emissions by 2000 if appropriate actions are not taken to check this trend.

35. The impact of the diminishing ozone layer is already evident in the Pacific in the form of increasing numbers of skin cancer cases (a 22 per cent increase has been recorded in New Zealand over the past decade) and decreasing phytoplankton productivity. Moreover, fisheries may be adversely affected by increasing ultraviolet radiation. Evidence has been found that coral reefs and mangroves, which are important habitats for fish and other marine organisms, become stressed or even die as a result of high radiation and sudden temperature increases.

II. REVIEW OF CAUSES AND CONSEQUENCES OF ENVIRONMENTAL DEGRADATION

36. The status and trend of environmental conditions have a close relationship with economic and social conditions, trends and style of development. It is well recognized that poverty is one of the greatest threats to the environment. Pushed onto marginal lands by population growth and inequitable development patterns, the poor are forced to practice slash and burn agriculture in rain forests, plough fields located on steep mountain slopes, occupy disaster-prone areas and accelerate desertification.

37. Like poverty and underdevelopment, the style and pattern of development also contribute to environmental degradation. The process that has allowed the countries in the region to harvest economic growth has also given rise to ecological problems and deteriorating environmental trends that can halt development in the long run, and can seriously jeopardize human health and survival.

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²³ W.K. Foell and C.W. Green, *Acid Rain in Asia: An Economic, Energy and Emissions Overview*, 1990 (Madison, Wisconsin, Resource Management Associate, 1990).

38. Within the environment-development nexus, this section of the document discusses the causes and consequences of deteriorating environmental conditions in the region. It incorporates cross-sectoral issues related to population, consumption patterns, poverty, human settlements, trade and human health, as well as sectoral issues related to agriculture, industry, energy, transport and tourism.

A. Population, consumption and poverty

39. With a total population of over three billion people in 1995, Asia and the Pacific is the most populous region of the world. Its population doubled from 1.65 billion in 1960 to 3.31 billion in 1995. The current momentum of population growth in the region, if continued, would double the figure again within the next 44 years. At that rate some 1.2 billion people will be added to the population between 1995 and 2020.²⁴ Over 95 per cent of the increase will be in the developing countries, which are least able to cope with the environmental consequences of such population growth. The impact of just meeting the basic needs of the incremental population will exert great pressure on the environment. However, the impact of humanity on the life support systems of the Earth is not determined by human numbers alone; it is more a function of per capita consumption. Present estimates are that, on average, an individual born in an industrialized country consumes 20 to 40 times more resources over his/her life time than a person born in a developing country. The human impacts on the environment can therefore be assessed more realistically in terms of consumption-adjusted population.²⁵ Figure 17 provides both simple or unadjusted and consumption-adjusted percentages of world population for the 20 most populous countries and for two G-7 countries not on the first list. It shows the United States as the largest in terms of consumption-adjusted population, followed by two countries from Asia-Pacific, China and Japan. Only one other country from the region, India, is among the first 11 countries which contain two per cent or more of consumption-adjusted population, together with Germany, France, the Russian Federation, Italy, the United Kingdom, Brazil and Mexico. By comparison, a number of countries in the Asian and Pacific region, that is, Indonesia, Thailand, the Islamic Republic of Iran, Pakistan, the Philippines, Bangladesh and Viet Nam, have considerably smaller consumption adjusted populations, with shares ranging from 0.5 to 1.99 per cent of world total.

40. It is also important to note that consumption patterns in developing countries are mainly focused on basic needs as opposed to luxury consumption found in some industrialized countries. The per capita consumption of even such basic necessities as food are very much lower in

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²⁴ ESCAP, *Population Data Sheet* (Bangkok, 1995).

²⁵ Percentage of consumption-adjusted population = (Real gross domestic product [GDP] in US dollar purchasing power parity of a country/global real GDP) x 100.

Figure 17. Absolute and consumption-adjusted population for the 20 most populous countries of the world and two G-7 countries

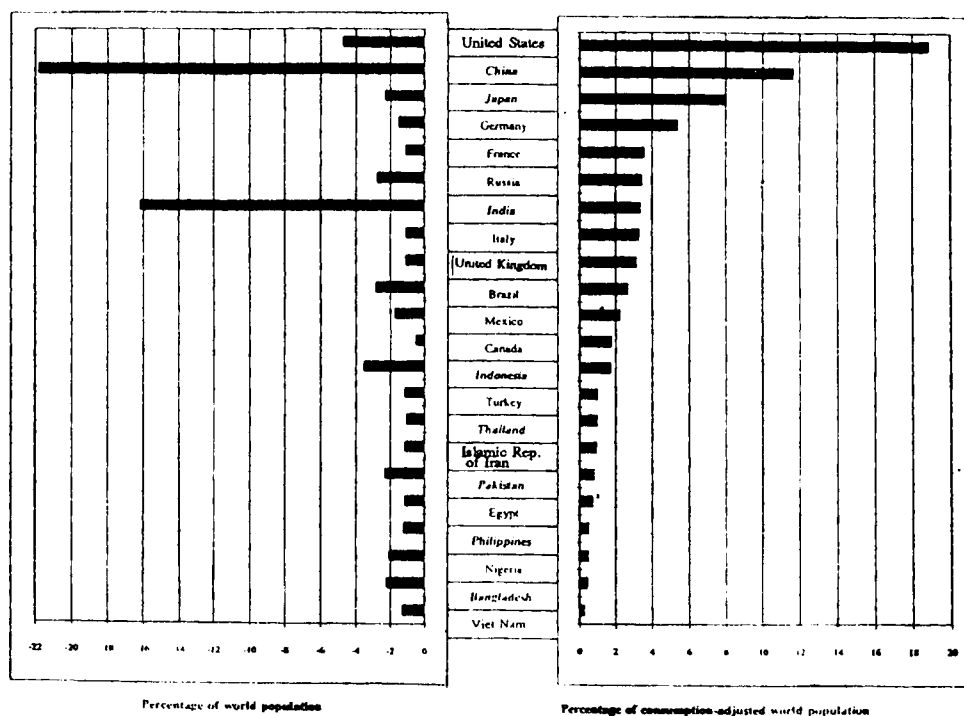
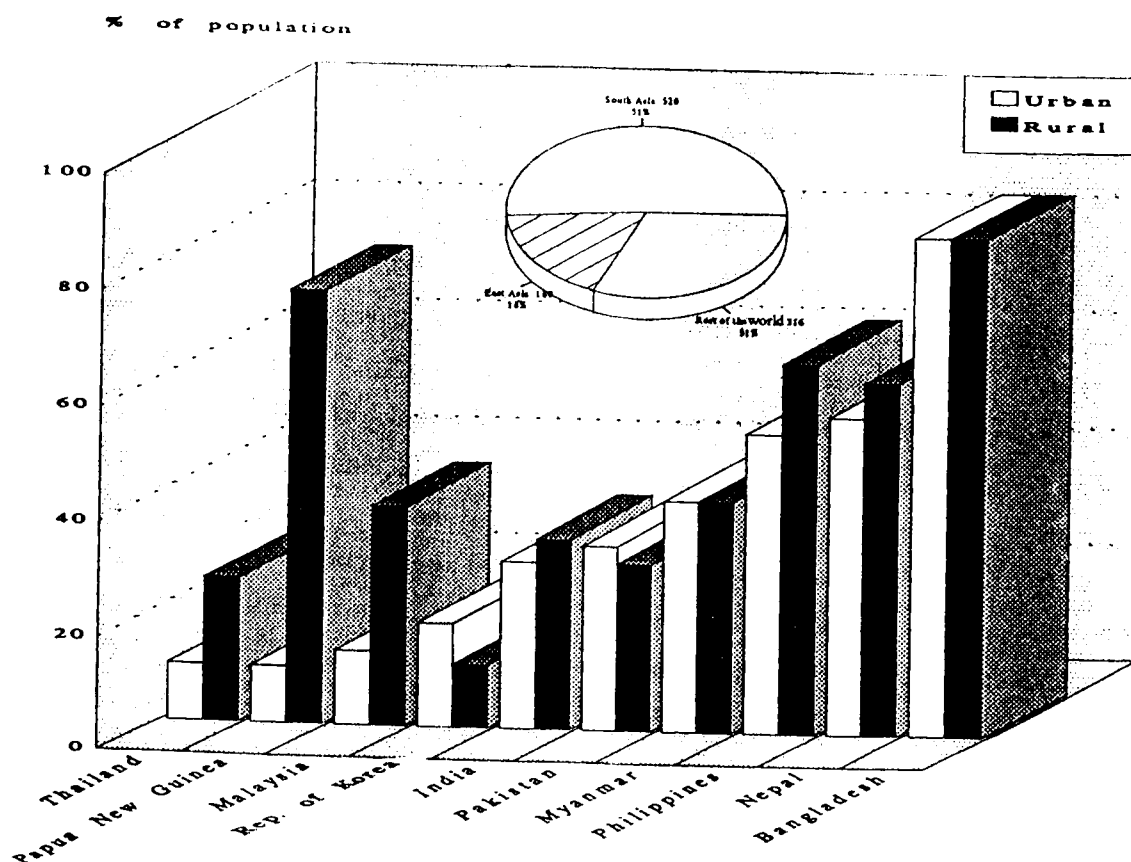


Figure 18. Proportion of population below absolute poverty level by subregions and selected countries of Asia and the Pacific



Source: The State of the World's Children Report 1995, United Nations Children's Fund.
The World Bank (1990) World Development Report

developing countries. For example, the average cereal consumption level in these countries is 246 kg/cap/yr, or just under about one third of the average consumption rate of 716 kg/cap/yr in industrialized countries, where cereals are fed to livestock being for milk and meat. Per capita consumption of milk and meat (which require greater energy for their production) averages 320.0 kg and 60.6 kg respectively in industrialized countries compared with 39.0 kg and 10.7 kg respectively in developing countries.

41. One reason for the low consumption of resources in the Asian and Pacific region is pervasive poverty. Currently, the number of people in the region whose basic needs are not being met is larger than at any time in history. The region contains nearly three fourths of the 1.1 billion people living in absolute poverty in the world, whose incomes and consumption rates are below nationally defined poverty lines.²⁶ The largest concentration of severely impoverished people, estimated at 520 million (figure 18), is in South Asia. Other than South Asia, large absolute numbers of poor are located in the two most populous countries of East and South-East Asia, China and Indonesia. The relatively rapid economic growth which occurred in several countries of the region during the past few decades has resulted in a significant reduction in the proportion of households below the poverty line; however, in some countries where the proportion of poor has declined, their absolute numbers have increased or remained fairly large because of the rapid growth in total population, such as in India.

42. Over the past few decades, many countries in the region have adopted policies to cut population growth rates and alleviate poverty. They have set targets, aimed at stabilizing their populations or moderating the growth rates. However, policies of intervention to achieve the stipulated goals have varied in their results among different countries. China, Indonesia, Sri Lanka and Thailand, for example, have been quite successful in reducing their population growth rates. However, in many other countries of the region, the rates have continued to remain high. The efforts at poverty alleviation have varied. In East Asia notable progress has been made, but in South Asia it has remained rather limited in scale. Nevertheless, a number of innovative community-based initiatives have been successfully developed and implemented for the purpose. The Agha Khan Rural Support Programme (AKRSP) in Pakistan and the Grameen Bank in Bangladesh provide two very good examples. These innovative approaches, however, need to be applied on a massive scale if any significant progress is to be achieved in future.

B. Human settlements

43. With regard to human settlements, urban areas of the region are growing much faster than villages. During the 1980s, urban populations in the developing countries of the region grew at rates of between 3 and 6.5 per cent per annum. Yet, in the mid-1990s, only 35 per cent of the population /...

²⁶ The World Bank, *World Development Report* (Washington DC, 1990).

of the region was estimated to be living in urban areas, compared with 43 per cent worldwide. The region is expected to become predominantly urban in the next 25 years. The 1990 urban population of 991 million is projected to swell to 2.44 billion by 2020, enhancing the proportion of the region's urban population from 35 per cent in 1994 to 55 per cent in 2020. This massive 1.5 billion net increase, which will dwarf China's 1995 total population figure of 1.23 billion, has many serious implications. These relate to the sheer size and rate of the change, as well as to the geographical location. The increase implies the equivalent of the full establishment of a new city of 150,000 people every day for the next 30 years. If present densities are maintained, by 2020 urban areas will be two and a half times more extensive than they are now. A concomitant trend with increasing urbanization is the rapid growth of large cities (figure 19). In 1994, 12 of the world's 17 largest urban agglomerations, with 8 million or more residents nine of which contained above ten million, were located in Asia and the Pacific; this number is projected to increase to 20 by the year 2015.²⁷

44. Environmental problems and concerns related to human settlements in the region fall into three main groups. The first of these is the increased consumption of natural resources, while the second relates to the shelter and dwelling environment, and the third is concerned with the ambient environmental conditions. The growth of human settlements and their trunk infrastructure exerts great pressure on land, forests, water resources and other natural resources. For example, in India, between 1980 and 2000 urban growth is expected to transform about 600,000 hectares of rural land to urban use, which is an area equivalent to 20 new cities of the size of Bombay.²⁸ Likewise, sprawling Bangkok has devoured 3,200 hectares of farmland, an area more than half the size of Manhattan Island. A similar estimate shows that Indonesian cities have expanded by 376,000 hectares over the 1980 to 1995 period. Their continued expansion, along with interurban roads, industries and other uses, is expected to result in the loss of 40,000 hectares of agricultural land every year. The ever increasing demand for water in the growing cities has led to the widespread withdrawal of underground water, which has resulted in the sinking of land in urban centres such as Bangkok, Jakarta and Shanghai.

45. The residential environment in most developing countries of the region suffers from two major problems: overcrowding or lack of housing, and inadequate infrastructure. A high proportion of villagers do not have access to proper shelter, a clean and reliable supply of water, adequate sanitation, primary health care or adequate fuel compared to those people living in cities

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²⁷ United Nations, *Urban Agglomeration 1994* (ST/ESA/SER.A/147).

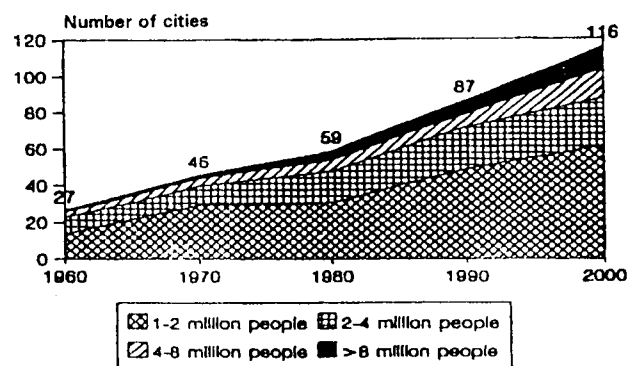
²⁸ D. Dowall, "The land market assessment, a new tool for urban management", paper prepared for the United Nations Development Programme/World Bank/United Nations Centre for Human Settlements Urban Management Programme, Washington DC, 1991.

and towns. For example, only 23 per cent of the farmers in Uzbekistan, 20 per cent in Kyrgyzstan, 14 per cent in Tajikistan and 12 per cent in Turkmenistan have piped water supply. Although, in general, cities have a better basic infrastructure, the urban poor cannot afford the speculative cost of residential land and housing. They often encroach upon whatever space is available, including hazard-prone areas, developing squatter areas comprising huts and shanties. The problem of overcrowding and squatter development is serious even in some island developing States, such as in the capitals of some atoll nations where population density sometimes rivals that of Hong Kong. For example, on Ebeye Island in the Marshall Islands, population density reaches 23,200 per square kilometre. Like their Asian counterparts, Suva (Fiji) and Port Moresby (Papua New Guinea) have shanty towns with all the associated problems of poverty, disease and substandard living. The inhabitants lack regular and full access to basic services and they suffer most from the adverse effects of water and air pollution. Available data suggests that one sixth to one half of the urban populations in the developing countries of Asia and the Pacific are crowded into squatter settlements or slums that have no access to basic urban facilities (figure 20). However, regardless of country or area, the fundamental issue underlying squatting and over-crowding of the urban poor is access to land.

46. Water supply and sanitation facilities were enhanced considerably in both rural and urban settlements during the International Drinking Water Supply and Sanitation Decade, 1981-1990. However, the proportion of the urban population served by sanitation remained unchanged owing to population increase. In fact, the absolute number of people in urban settlements without water supply increased by 18 per cent, and without sanitation facilities by 39 per cent in urban settlements. The number of unserved persons in both rural and urban areas (with the exception of water supply in urban areas) is projected to continue rising to the year 2000 (figure 21). In many cities of the region, up to 60 per cent of the water collected and distributed at public expense is unaccounted for by sales. This is a symptom of a major problem in the water supply sector where far too much emphasis is placed on the construction of new facilities rather than on maintenance, conservation, and efficient use and operation of existing supply systems. An example of the advantages of demand management and conservation over investment is shown in figure 22. The progress in the expansion of sanitation facilities appears to be slow because of the huge investment requirement since Governments opt for conventional water-borne sewage disposal, instead of low-cost community based alternatives.

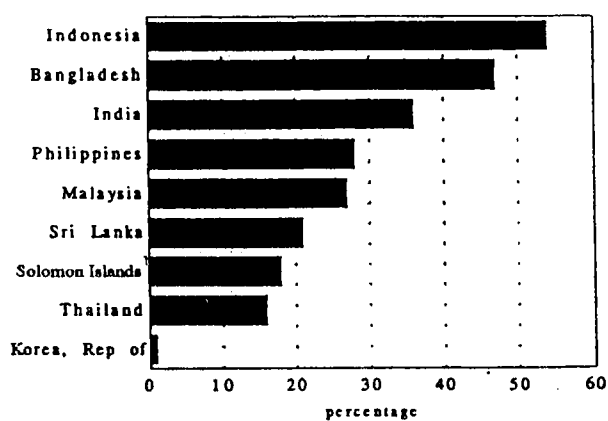
47. The ambient environment in cities suffers from water and air pollution as well as littering. The most important source of water pollution in urban rivers and water bodies is domestic sewage and industrial wastewater (see chapter I, section D, Inland water). Air pollution, which is a serious problem caused by the transport, energy and industrial sectors, and has been discussed in detail in chapter I, section F, Atmosphere and Climate. While the per capita amount of solid waste

Figure 19. Number of cities in Asia by size, 1960-2000



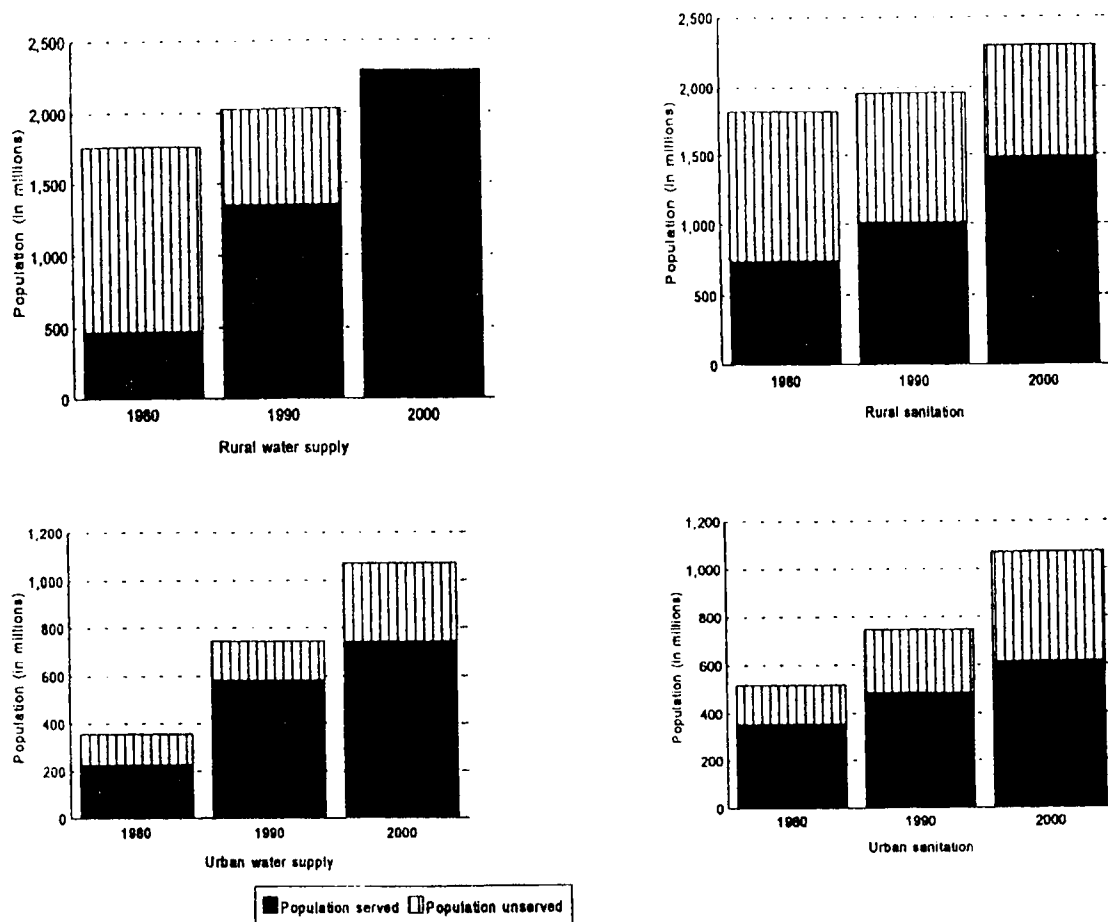
Source: United Nations, 1991.

Figure 20. Proportion of urban population in slum squatter settlements (%)



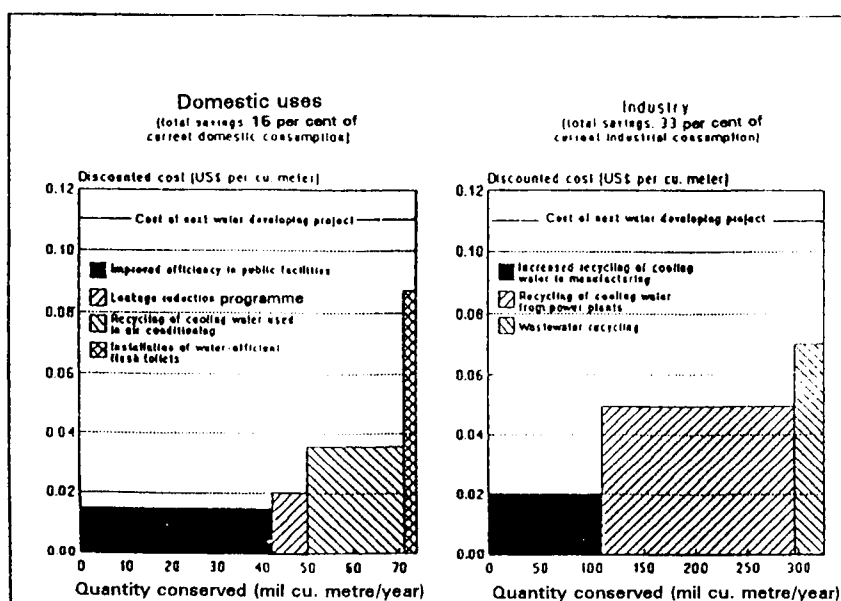
Source: ESCAP, *The State of Urbanization in Asia and the Pacific 1993*, New York, United Nations.

Figure 21. Status of water supply and sanitation



Source: IDWSSDF (1991), "Achievements of the International Drinking Water Supply and Sanitation Decade, 1981-1990", *Water Resources Journal*, March 1991.

Figure 22. Conserving water as an alternative to expanding supply in Beijing



Source: *World Development Report 1992*.

generated in the cities of the region is small, the total amount is very high. The capacity of these cities to collect and dispose of solid waste is under severe strain, which has resulted in the littering of streets, thus posing a major health hazard.

C. Agriculture

48. A major issue of the agricultural sector in Asia and the Pacific is food security. The region is a net food importer. During 1991, it imported food worth US\$38.3 billion and exported food valued at US\$31 billion, with a net deficit of US\$7.3 billion. From 1986 to 1992, import costs grew at 9.2 per cent per annum. The bill in 1992 was US\$16 billion larger than that for 1986. Figure 23 provides the average daily food availability in calories as a percentage of requirements for 22 countries of the region. Average food availability falls below requirements in eight of the countries: Bangladesh, Mongolia, Cambodia, Nepal, Sri Lanka, Viet Nam, the Lao People's Democratic Republic and Thailand.²⁹ Average availability is close to the daily requirements in India and the Philippines, where proper food distribution needs to be ensured in order to avoid shortages.

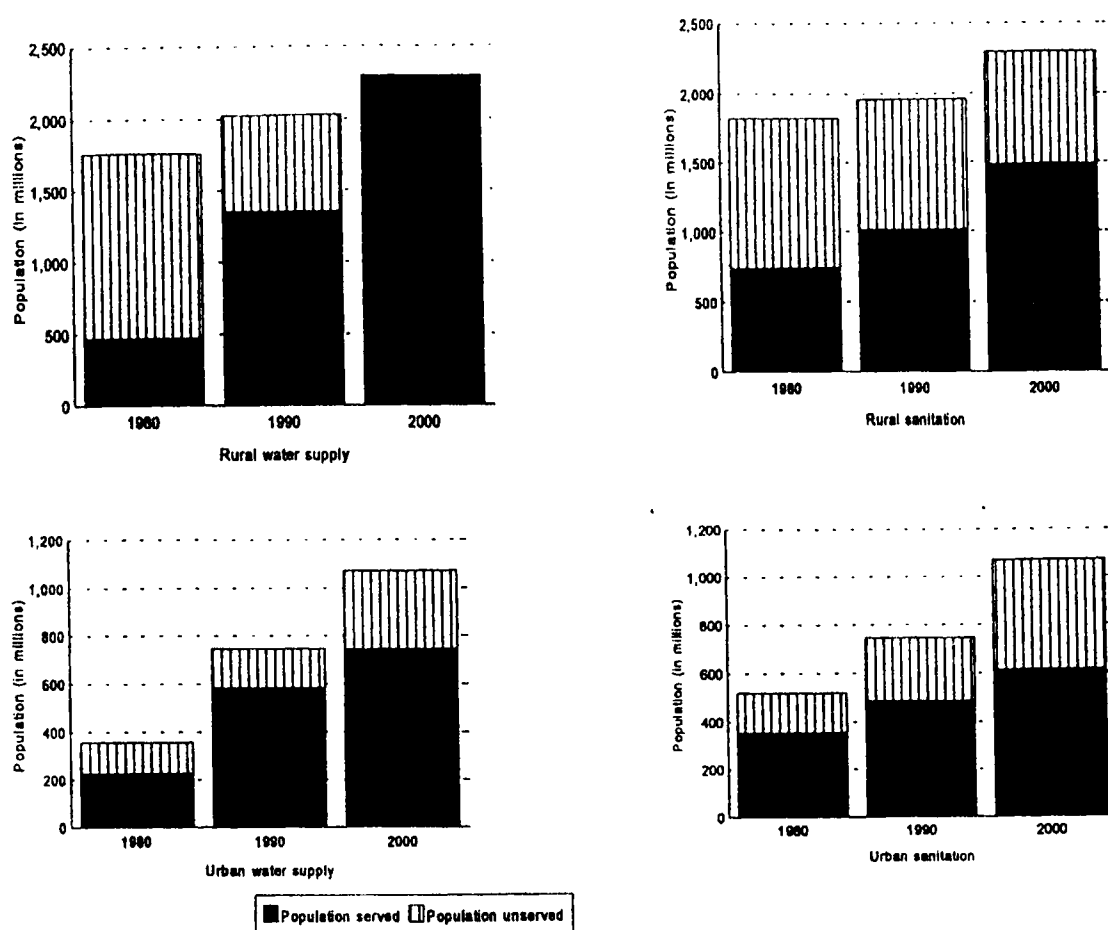
49. The food gap may be broadly related to land pressure. In terms of land availability, Bangladesh, Nepal, Sri Lanka and Viet Nam are among the non-industrial countries with high arable land pressures. Figure 24 shows per capita arable land across the countries of Asia and the Pacific. Average per capita arable land in the region as a whole is 0.148 hectares, compared to 0.263 hectares for the world. Although some one million hectares are added annually to the existing area of cultivated land, the area of arable land per person continues to decline because of the faster increase in population. In some countries, such as Bangladesh and India, this has also led to a situation where land fragmentation has reduced field size to a more critical level. The uneconomical sizes of such fields have forced many peasants to sell their land; these landless people have then moved into forests and marginal lands or migrated to cities, thus increasing the pressure on those environments.

50. The contribution of irrigation to food security in the region, particularly in countries like China, India and Pakistan, is widely recognized. For example, in India, 55 per cent of agricultural output is from irrigated land. Being capital intensive, it has already absorbed more than half of the agricultural investment in China, Indonesia and Pakistan. In India, about 30 per cent of all public investment has gone into irrigation. Irrigation projects, once established, have tended to become heavily subsidized. It has been estimated that average subsidies to irrigation in six

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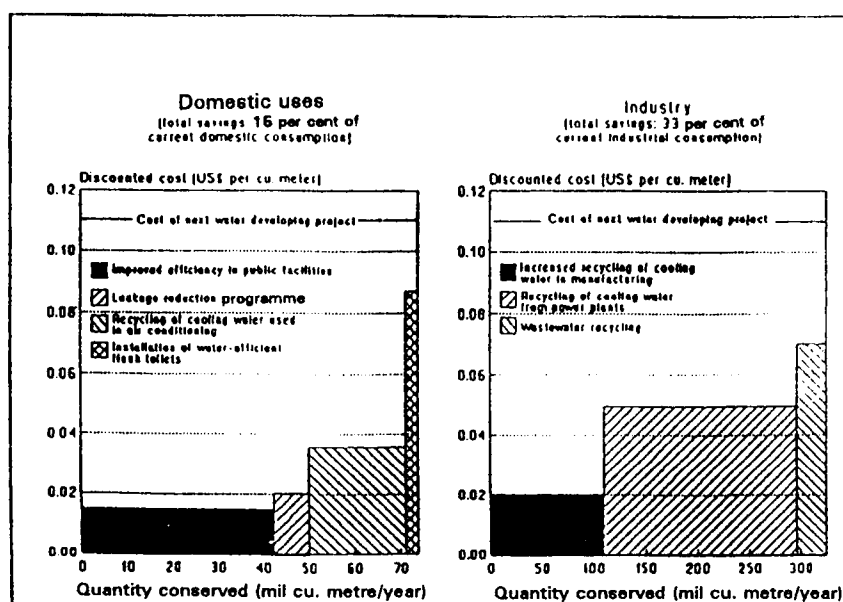
²⁹ Food and Agriculture Organization of the United Nations/Regional Office for Asia and the Pacific, *Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1983-1993* (Bangkok).

Figure 21. Status of water supply and sanitation



Source: IDWSSDF (1991), "Achievements of the International Drinking Water Supply and Sanitation Decade, 1981-1990", *Water Resources Journal*, March 1991.

Figure 22. Conserving water as an alternative to expanding supply in Beijing



Source: *World Development Report 1992*.

generated in the cities of the region is small, the total amount is very high. The capacity of these cities to collect and dispose of solid waste is under severe strain, which has resulted in the littering of streets, thus posing a major health hazard.

C. Agriculture

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²⁹ Food and Agriculture Organization of the United Nations/Regional Office for Asia and the Pacific, *Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1983-1993* (Bangkok).

Figure 23. Daily per capita calories availability (as percentage of requirement) by sources in selected countries of Asia and the Pacific (1990-92)

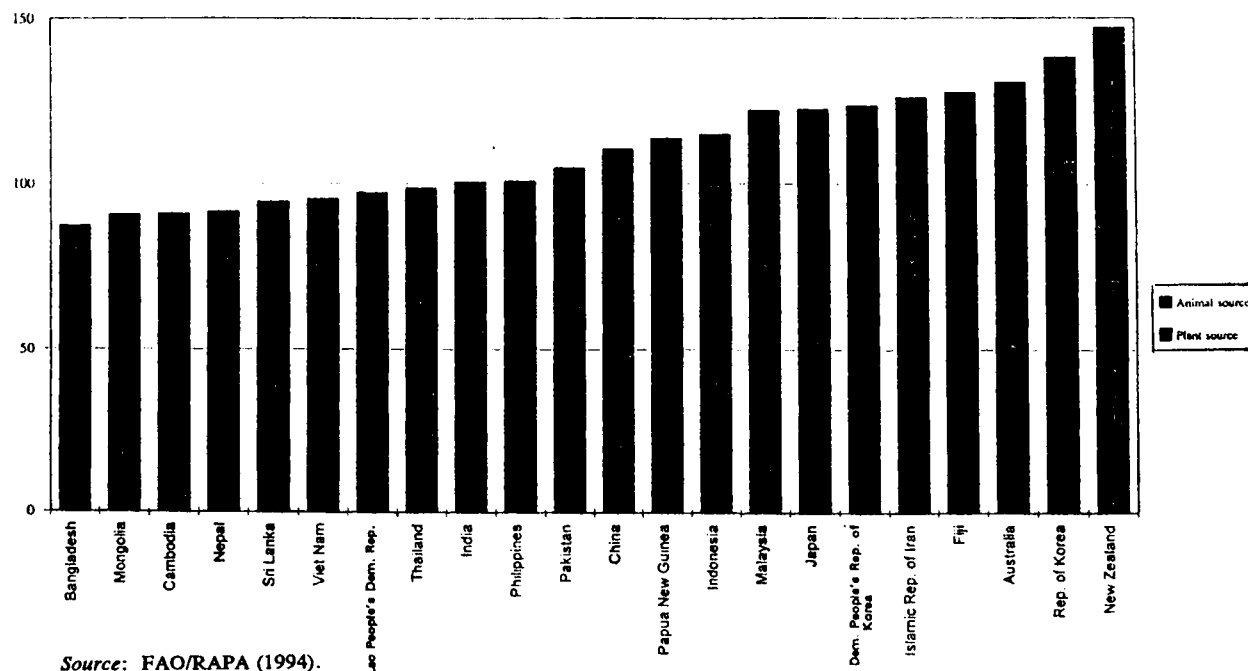
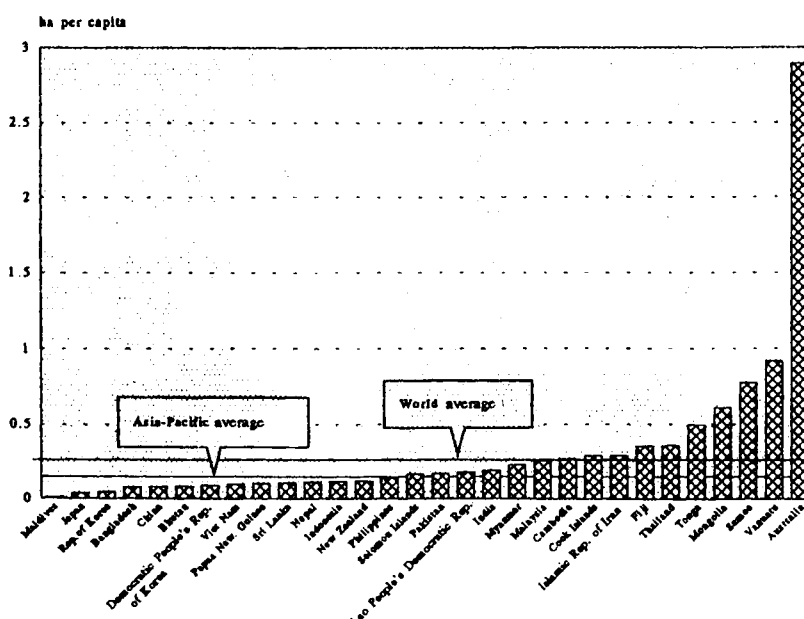


Figure 24. Arable land availability (ha per capita) in selected countries of Asia and the Pacific



Source: Food and Agriculture Organization of the United Nations, *Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1983-93*, Bangkok.

Asian countries was up to 90 per cent of the total operating and maintenance costs.³⁰ With this level of market distortion, it should not come as a surprise that as much as 60 per cent of the water diverted or pumped for irrigation is wasted, becoming the major cause of waterlogging and salinity in many countries of the region.

51. The critical shortage of land for further agricultural expansion has created the need for increasing yields through intensification. In the past, yields have been closely related to the application of fertilizers and pesticides. Fertilizer had become responsible for up to 10 per cent of the production increases in South and South-East Asia by 1965, (except in Sri Lanka, where the application rate was already higher). The production due to fertilizer use had risen to between 24 and 64 per cent by the 1980s, with application levels of 80-90 kg/ha. Yet even during this period, diminishing returns could be discerned. For example, mineral fertilizer consumption increased by 6.4 per cent per annum in the developing countries of the region between 1982 and 1992, but cereal yields increased only by 2.1 per cent/annum.³¹ The average application of mineral fertilizers in the developing countries by 1991 had reached 135 kg/ha. If allowed to rise to Japan's level of 400 kg/ha or New Zealand's level of 1275 kg/ha, fertilizer use may have serious environmental implications. Along with quantity, a major problem of fertilizer application in the region is the imbalanced use of nitrogen. The remarkable increase of nitrogen consumption in the last two decades, 1970-1990, has raised concerns over the destabilization of soil nutrient balances with consequent decreases in yields.

52. Every year, from 1986 onward, the Asian and Pacific region has imported pesticides worth US\$ 1 billion (some of these, such as dichlorodiphenyltrichloroethane (DDT), Chlordane etc., have been banned or restricted for health and environmental reasons in the countries of manufacture). During this period, the indigenous production of pesticide also expanded. For instance, India increased its pesticide production 13-fold from 1970 to 1980 and now meets 90 per cent of domestic demand. Similarly 10 other countries in the region have developed indigenous production capabilities and export markets. In addition to other impacts on human health, one potentially devastating effect of pesticides involves their ability to interfere with the endocrine and immune systems, which regulate the production and function of hormones, in animals and humans.

D. Industry

53. Figure 25 indicates the trends in industrial production, globally, in Asia and the Pacific and in the developing countries of the region for 1982-1992. The figure also shows that the

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³⁰ R. Repetto, quoted in *The State of Food and Agriculture* (Rome, Food and Agriculture Organization of the United Nations, 1993), p. 232.

³¹ Op. cit.

industrial production index moved up steeply in the region, although it registered only a moderate growth in case of the world. The growth in developing countries of the region was even more pronounced. An important aspect to note is that growth in the industrial sector is outpacing growth in GDP. It demonstrates clearly that industrialization is one of the main engines of economic growth in the region. The rapid pace of industrialization in the region has created a new opportunity to distribute more effectively the benefits of development process to cities, townships and rural areas, thereby reducing poverty. However, it has also brought direct or indirect impacts on not only the industrial centres and their environs, but also on the environment at the national, regional, and global levels. The environmental impacts of industry, in broad terms, are increased consumption of renewable and non-renewable resources, and the production of wastes and pollutants. Many industries in the region are highly resource intensive, consuming increasing amounts of energy, mineral and forest resources. If such a consumption pattern continues, the region's resources will be depleted very soon. Thus, there is a need for promoting environmentally sound technologies and methods for reducing intensity of resource use in industry.

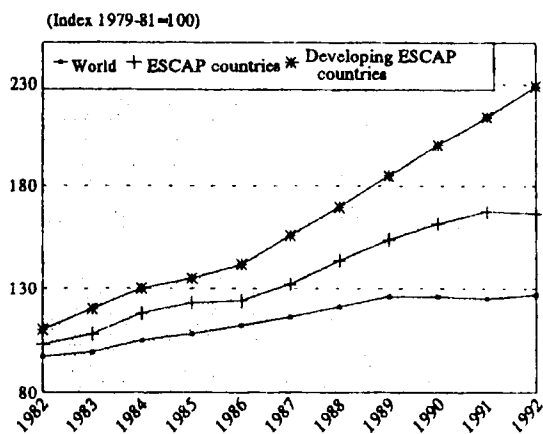
54. High industrial waste generation per unit of industrial production is another major problem. Some countries in the region utilize production processes which are among the most waste intensive. China, for example, generates over 2 kg of waste for an industrial production equivalent of one US dollar at a 1980 constant price, followed by Japan, Australia, the Republic of Korea, Hong Kong and Singapore in descending order (figure 26). It can be seen that the performance of the newly industrializing economies (NIEs) is far better than some developed countries in terms of the waste intensity generated by industrial production. One reason could be due to favourable industrial structure and the advantage of being latecomers to the industrialization process, which has allowed these countries to install improved manufacturing processes using latest technology.

55. Overall, the industrial sector has affected the pollution loads in two basic ways. Firstly, it has increased the volume of pollutants both in the short term and medium term (In the long term, total pollutants may decline if dramatic shifts into cleaner industries take place, or if the share of the industrial sector itself falls. Neither shift is imminent in the region). Secondly, it has changed the pollution intensity of industrial output — that is, the amount of pollution generated per unit of industrial output. In the absence of comprehensive data on either total pollution loads or pollution intensities in the region, the World Bank has used surrogate pollution coefficients. The resulting patterns for industrial pollution revealed by the World Bank study of selected countries, covering Indonesia, the Philippines and Thailand, are indicative of the general trends (figure 27).

56. The magnitude, nature and the extent of pollution are based largely on the pattern of concentration and the technical structure of the industrial sector. For example, in

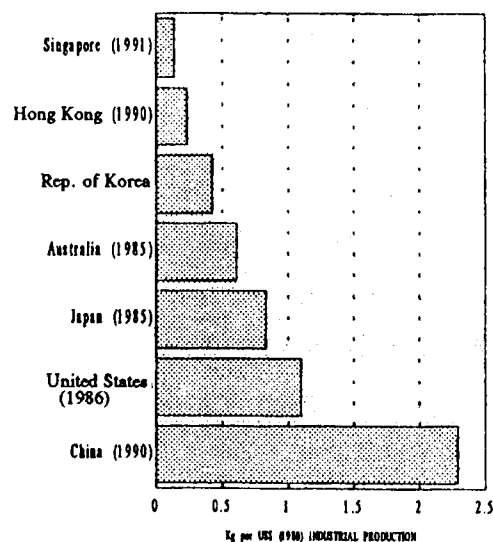
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Figure 25. Industrial production trends (1982-1992)



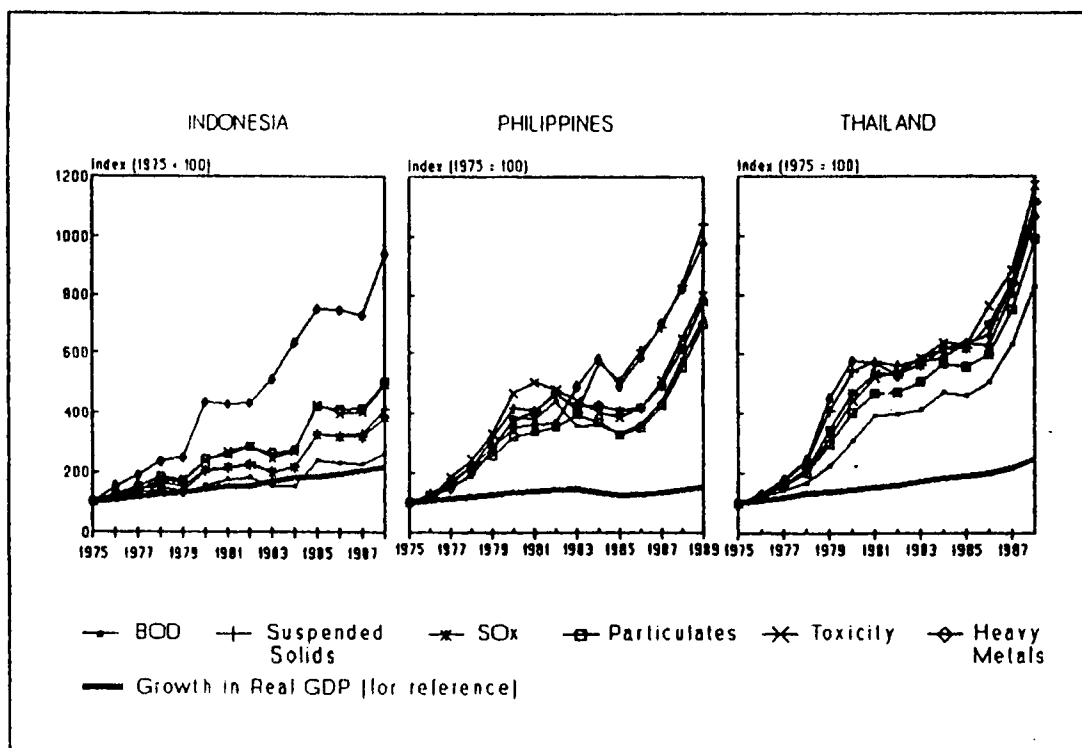
Source: ESCAP Statistical Year Book (1993).

Figure 26. Waste intensity of industrial production



Source: United Nations Environment Programme (1991, 1993).
Environmental Data Report, Oxford.

Figure 27. Estimated total industrial pollution in selected Asian countries



Source: Calculated from the Industrial Pollution, Projection System of the World Bank (Washington DC, 1992).

Central Asia, South-East Asia and East Asia, where the concentration of industry is relatively high, higher loads of pollutants increase the intensity of ambient pollution. Industrial output data for three selected countries in the region (figure 28) show that industrial activities are more heavily concentrated in Indonesia and China, compared with India. As a result, the contribution of the industrial sector to ambient pollution in Indonesian and Chinese cities is very high. Approaches to environmentally sound development of industries in the region have been primarily based on zoning, use of environmental impact assessment, environmental standards and a very limited application of market-based instruments. Limited use of clean technology, weak institutional capacities for monitoring and enforcing of pollution control measures, and the lack of public-private collaboration are the main constraints to sustainable industrial development in the region.

E. Energy

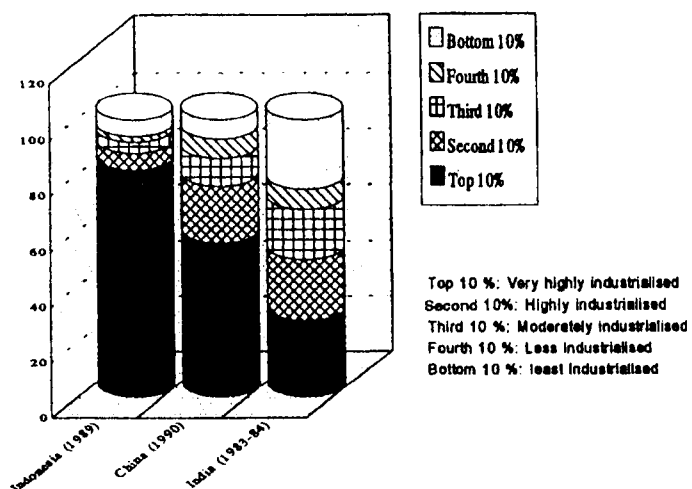
57. Energy requirements pose a problem of the same magnitude and urgency in the region as food needs. Managing high demand growth, and mitigating the environmental impacts of development and energy use, are the two major concerns. The historical trend of consumption of all forms of commercial primary energy indicates that in the Asian and Pacific region the primary energy usage increased at an average annual rate of 4.8 per cent during the 1970-1990 period, a significant growth rate compared to the world average of 2.7 per cent. The energy consumption trends detailed in figure 29 show that consumption in the developed countries of the region increased only moderately, while in the developing countries it increased by more than three and a half times. The higher growth in the developing countries has been attributed to their low energy consumption levels and their higher than world average economic growth rates, rapid population increases, fast urbanization, high energy intensity owing to the stage of economic development, and lower efficient energy use than that which could be achieved with available state-of-the art technology.

58. Besides the high growth rate, a major area of concern in the energy sector is the structure of consumption which is based on a high dependence on bio- and fossil fuels. Non-commercial fuels overwhelmingly dominate household energy consumption in most of the developing countries of the region, such as wood and animal dung. FAO has estimated that over 80 per cent of the wood harvested in developing countries of the region (about 85 billion cubic metres) is used as fuel and charcoal, primarily for domestic use.³² The poor, in particular, lack the income to use substitute commercial fuel. The use of wood for cooking presents a serious problem because the

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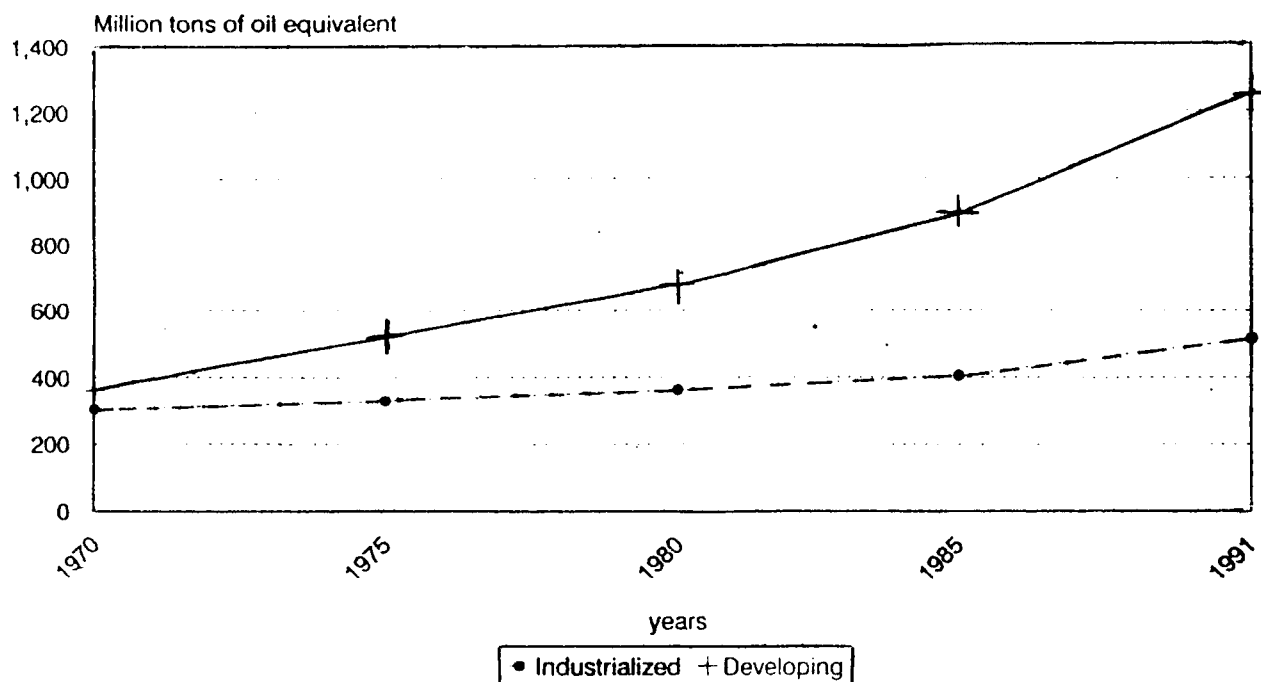
³² Ibid.

Figure 28. Geographical distribution of industrial output
(Land area ranked by degree of industrialization)



Data Source: C. Brandon and R. Ramankutty, *Towards an Environmental Strategy in Asia* (Washington DC, World Bank, 1993).

Figure 29. Commercial energy consumption in industrialized and developing economies of the ESCAP region



Source: Based on United Nations *Energy Statistics Yearbook*, various issues.

consumption rate is higher than the replenishment rate. The deficits are continuously increasing and are estimated to reach 500 million cubic metres by 2000.³³ Programmes to introduce new fuel-efficient stoves and to plant trees for fuelwood have been initiated, but these have met with limited success because of a lack of popular participation and support.

59. The share of fossil fuels in energy use declined slightly from 97.5 per cent in 1970 to 93.7 per cent in 1991 because of the increased use of primary electricity (nuclear, hydropower and geothermal), but it remained a dominant source (figure 30). This trend is likely to continue in the foreseeable future, mainly because most developing countries of the region lack financial and technological resources for research into, and development of, alternate energy sources including new and renewable forms. All types of fossil fuels have adverse local, regional and global environmental impacts, but coal is most severe in this respect. The high use of relatively dirty coal in Asian countries makes the growth of this component of the energy sector problematic, particularly with regard to high emissions of SO₂, particulate matter and greenhouse gases. Extensive use of biofuels as a non-commercial source of energy in the developing countries of the region also contributes to environmental degradation in the form of deforestation and indoor air pollution.

60. A major factor fuelling energy demand is high energy intensity, or high consumption of energy per unit of GDP. In the developing countries of the region, it is often double the level of that recorded in the many middle income and developed countries (figure 31). It has been estimated that an efficiency gain in Asia of just 10 per cent by the year 2000 will not only cut down new energy demand substantially but also reduce the required level of new capital investment by 20 per cent, or some US\$ 90 billion (50,000 megawatts). These savings are enormous, constituting three times the cost of installing cleaner technologies on the remaining facilities that will still need to be constructed.³⁴ Clearly, energy efficiency in the region on both the supply and demand sides is an essential ingredient in any cost-effective and environmentally-sensitive, long-term growth plan for the energy sector.

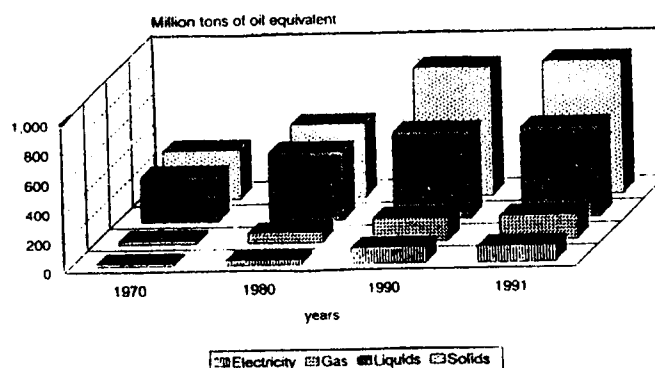
61. Weak policies and institutional problems are the principal constraints to sustainable management of the energy sector in the Asian and Pacific region. Low energy pricing, inefficient utility management and operation, and low priority for conservation and environmental considerations are the key problems needing attention. Public and corporate institutions that are managing energy utilities in the region are plagued with problems of high transmission and distribution losses, brownouts or load shedding, and old and inefficient power stations. Often, more attention is

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³³ C. Brandon and R. Ramankutty, "Toward an environmental strategy for Asia", World Bank discussion paper 224 (Washington DC, 1993).

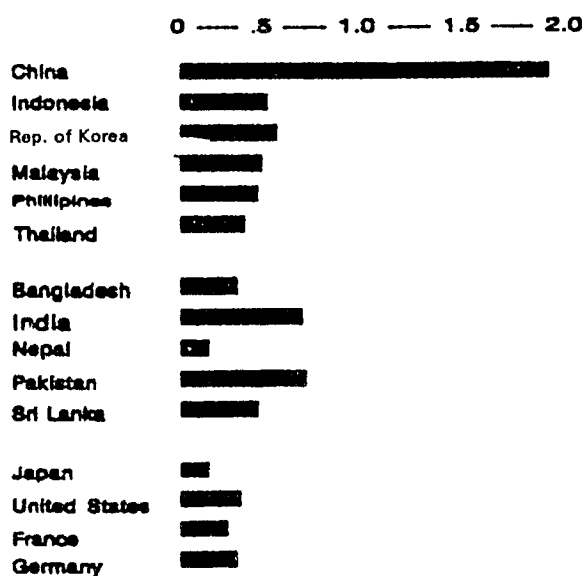
³⁴ Ibid.

Figure 30. Energy consumption structure by type of fuels in the ESCAP region



Source: Based on United Nations *Energy Statistics Yearbook*, various issues.

Figure 31. Energy intensity in Asia (1989), kgoe/US\$ GDP



Note: kgoe = kilograms oil equivalent

Source: Calculated from World Bank data.

given to new plants than to the more difficult tasks of increasing efficiency, reducing losses and establishing more realistic prices. The cost of abating pollution has also not been internalized in many cases.

62. The World Bank has pointed out that some corporate institutions, such as the Korea Electric Company and the Electricity Generating Authority of Thailand (EGAT), have performed very well in terms of operational efficiency.³⁵ Other countries of the region could learn a lot from the operational and management skills of the two organizations through regional and subregional cooperation.

F. Transport

63. Rapid economic growth and industrialization across the region has been accompanied by a significant growth in all types of transport. However growth in road transport has outpaced all other forms of transport which is evident in all respects including road network, vehicles as well as freight and passenger traffic. The estimated number of registered vehicles in the region, which in 1992 (excluding Central Asia) totalled over 130 million (figure 32), has been growing exponentially (figure 33) and doubling every seven years.³⁶

64. Transport activities have a wide variety of adverse effects on the environment, such as air pollution and noise from road traffic, oil pollution from marine shipping, depletion of resources and pollution related to the consumption of energy. Additionally, raw materials, natural resources, and inland and waterfront real estate are consumed in the production of vehicles and the construction of roads, railways, ports and airports. Although different forms of transport contribute differently to environmental degradation, the impact of road transport on the urban environment is most pronounced. Demand for urban transport facilities has expanded at a rate far beyond the handling capacity of existing public transport systems. As a result, the massive increase in the number of vehicles has overwhelmed urban road capacity. Similarly, the trunk roads constructed to connect major cities and sites of production with the intention of quickly opening up economic opportunities, have become a significant source of pollution owing to poor maintenance and the basic inefficiency of the motor vehicle compared to other forms of transport.

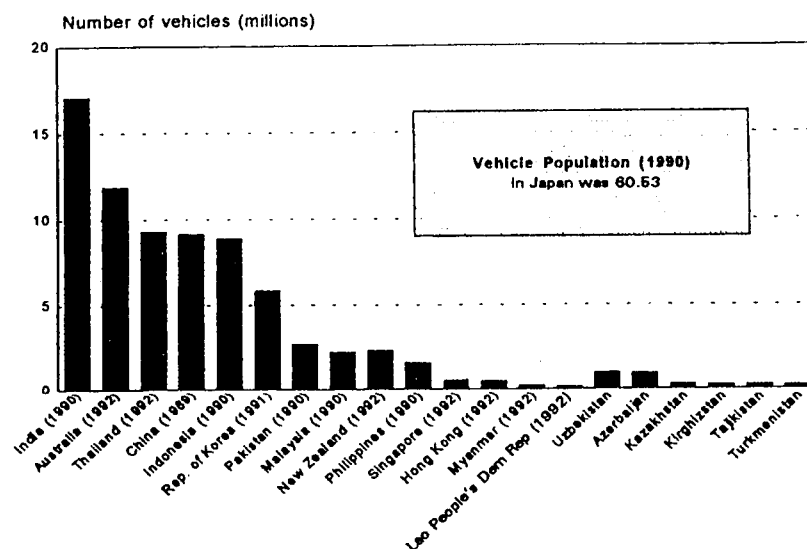
65. The construction of roads, primarily in the small island developing States in the Pacific, has also opened up pristine areas for resource exploitation, causing deforestation. Moreover, with few

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³⁵ Ibid.

³⁶ Ibid.

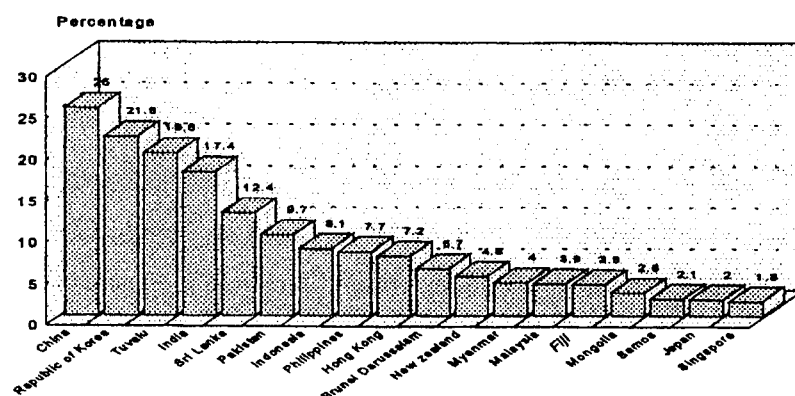
Figure 32. Road vehicle population in selected economies of Asia and the Pacific



Source: "Review of Developments in Transport and Communications in the ESCAP Region", (United Nations publication, No. ST/ESCAP/1333).

Note: Data on motorcycle population for Central Asian republics is not available.

Figure 33. Average annual growth rate of motor vehicles in selected economies of Asia and the Pacific



Source: "Survey of Roads and Road Transport Statistics in the ESCAP Region", (United Nations publication, No. ST/ESCAP/1108).

exceptions, motor vehicles are the major cause of air pollution in Asian cities (table 5). As a result of vehicle emissions, dangerously high levels of carbon monoxide, sulphur and nitrogen oxides, hydrocarbons, lead, particulate matter and toxic substances can be found in most of Asia's large cities. Recent estimates indicate that the population of private vehicles in large cities of developing countries of the region, where road capacity is already stretched close its upper limit, continues to grow at rates in excess of 10 per cent per year. Traffic jams have become the norm. Peak-hour speed in Asian cities averages around 16 kilometres per hour. Extended travel times reduce the efficiency of the vehicle fleet, with a resulting multiplier effect both on fuel consumed per trip and pollution levels.

66. Oil spills from marine traffic are another major issue of concern in transport sector. The large tanker spills usually take place on or near the coast; the resulting extensive oil slicks destroy sea-birds and marine mammals, and cause immense damage to fisheries and coastal amenities when the oil is washed ashore. Shipping accidents also cause serious problems. In the Straits of Malacca alone, which is the world's second busiest waterway after the English channel with an estimated 2,000 vessels of all types passing through daily, 490 shipping incidents were reported between 1988 and 1992, increasing from 77 in 1988 to 110 in 1992; the trend is still rising (figure 34). Some of these incidents have added significant levels of oil pollution to the marine environment; for example, in January 1993, the 254,000-ton Singapore-registered Maersk Navigator collided with an empty tanker, the Sanko Honor, and caught fire. The Maersk Navigator, leaked 25,000 tons of its more than 200,000-tons cargo of crude oil, creating a 32-kilometre-long oil slick.³⁷

67. The magnitude of pollution-related problems resulting from air transport may not appear great at this time. However, the rapid growth in air transportation has overburdened the inadequate ground transportation facilities which connect airports to residential and commercial centres. Travel times to and from major airports bear little relationship to respective distances, enhancing vehicular emissions. In order to reduce harmful emissions, many countries have introduced unleaded fuel, or are retrofitting engines to use less polluting fuel and promoting high maintenance standards. Strategies to raise the cost of private vehicle use through taxation, traffic management measures (one-way systems, closing streets and provision of exclusive bus lanes) and demand management (such as increased parking fee, car pooling programme etc.) have also been used. Alternatives to private vehicles are also being encouraged. Currently there are very few mass transit systems in Asian cities. Due to the high initial costs involved in providing mass transit systems and limited institutional capacity, many countries of the region are now turning to the private sector as a source of financing, management skills and new technology. However, the involvement of the private sector

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³⁷ A.T.H. Chin, "Containing pollution in the Straits of Malacca: legal and economic consideration", *Asian Journal of Environmental Management*, 1(2), 1993, pp. 77-91.

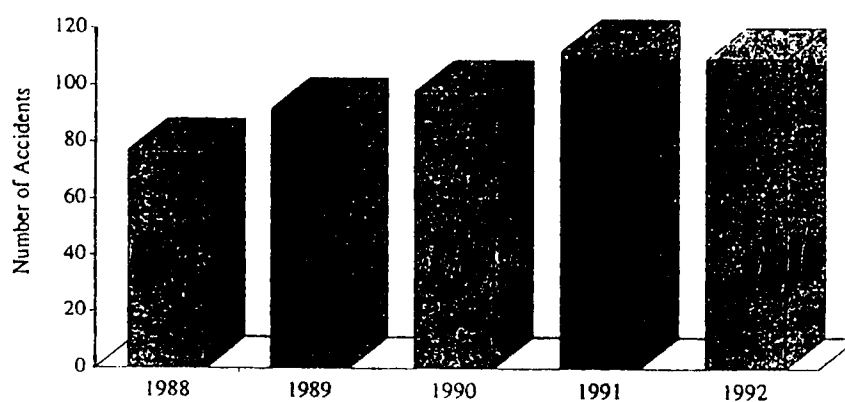
Table 5. Contribution of motor vehicles to air pollution in selected Asian cities

City	Year	Total emissions all sources ('000 tons/year)	Percentage attributable to motor vehicles					Total
			CO	HC	NO _x	SO _x	SPM	
Beijing	1989	n.a.	39	75	46	n.a.	n.a.	n.a.
Bombay	1981	546	86	20	44	n.a.	3	31
Calcutta	1978	537	87	15	25	n.a.	n.a.	n.a.
Delhi	1987	428	90	85	59	13	37	57
Kuala Lumpur	1987	435	97	95	46	1	46	79
Manila	1987	496	93	82	73	12	60	71
Seoul	1983	n.a.	15	40	60	7	35	35

n.a. Data not available.

Source: World Bank, 1992.

Figure 34. Shipping accidents in the Straits of Malacca



Source: *Straits Times*, 3 June 1993.

brings a whole range of legal, operational, management and environmental issues into play that need careful consideration.

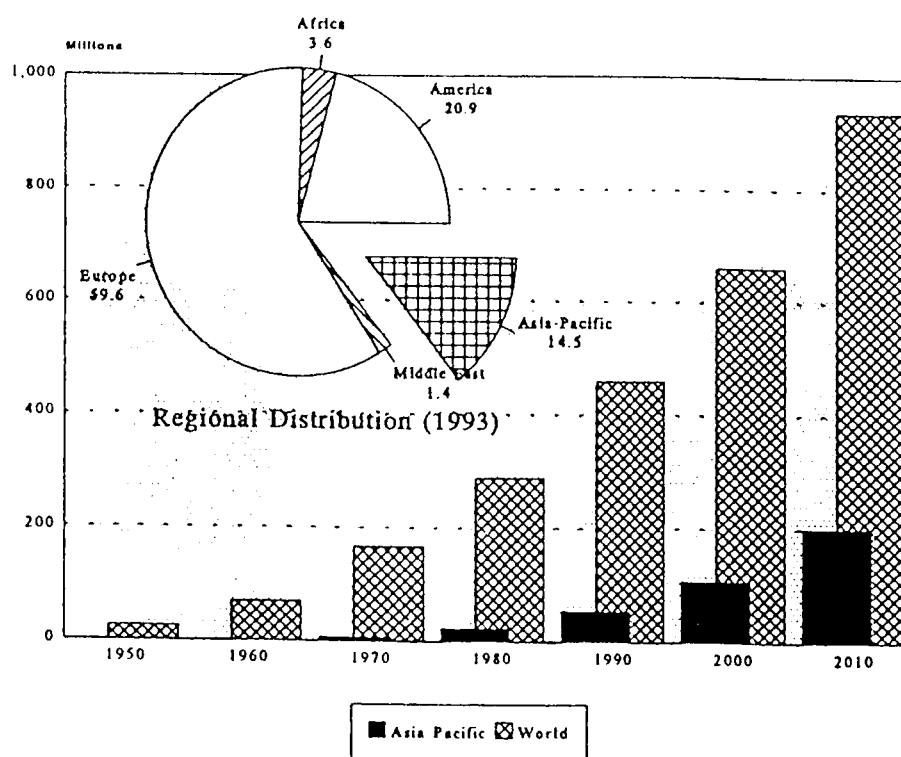
G. Tourism

68. Tourism is the fastest growing sector of the economies in Asia and the Pacific. The region accounted for US\$ 55 billion, some 18 per cent of the US\$ 304 billion spent by international tourists in 1993, an almost six-fold increase from 3.3 per cent of the total recorded in 1960. The volume of tourist traffic increased by over 10 per cent per annum from 1983 to 1993. The prospects for future tourism growth in the region are extremely good. World Tourism Organization (WTO) projections show a rise in the volume of international tourists visiting the region from 72 million in 1993 to 107 million in the year 2000, and 200 million by the year 2010, an almost three-fold increase in 17 years (figure 35). The massive increase in tourist traffic could, however, have serious environmental implications. It has already caused major environmental problems in terms of land erosion, waste disposal, pollution, extraction of resources, deterioration of the ecology and damage to cultural values.

69. With the growing size of resort development projects in the region, the impacts on the physical and ecological environments have greatly increased. An example of this type of a mega-resort is Denarau in Fiji, which is emerging from the transformation of a 277 ha island. Six hotels, a residential area of several hundred town-houses and villas, an 18-hole golf course, a shopping village, a convention and cultural centre, and a marina are being constructed. Over two million cubic metres of earthfill are being used to raise the height of the island as a precaution against flooding. Construction of such mega-resorts have substantial adverse impacts on the physical environment in the form of erosion, coastal modification, landslides and changes in water regimes. Often, the places of scenic beauty that attract more visitors are also overrun by tourist accommodations and their multitude of support systems, with a loss of harmony and scale, as a result of the ubiquitous nature of the skyscraper hotel syndrome. In many cases, local architectural traditions or the relativity of the surrounding land and sea-scape are not taken into account. Construction of buildings and infrastructure too close to the shoreline has, in many cases, caused coastal erosion. Sea walls and groynes constructed to control coastal erosion have often exacerbated the process, as a result of the modified coastal hydro-dynamics. One example of this problem is the enhanced erosion which completely washed away a government quarantine facility built in the 1940s on Makaluva Island, in Fiji.

70. Tourism-related operational activities as well as resort construction have also resulted in loss of, and damage to, natural resources. Forest depletion in heavily trekked hill areas, such as those of Nepal, is well recognized. Trampling and damage in mountainous and other fragile ecosystems,

Figure 35. International tourist arrivals (1950-2010)



Source: World Tourism Organization, *Year Book of Tourism Statistics*, (Madrid, 1994).

such as coral reefs, has been harmful to biodiversity. Over-exploitation of resources for food and decorative items has led, in some cases, to depletion of fish, lobsters and other marine life, for example, turtles. Destructive encroachment into mangroves areas has also occurred during the development of commercial sites for shops catering to tourist.

71. Regular visits of large groups of tourists in some areas have also brought congestion and pollution. Degradation of many Himalayan trails has occurred because of waste products such as plastics, cans and toilet paper which have been left by trekking parties and mountaineers in Nepal, India and Pakistan. The once magnificent Nanda Devi Trail of India, which was traversed by Shipton and Tilman in 1934, has been one of the worst affected. The inadequate facilities for sewage treatment at tourist destinations is contributing to the discharge of untreated liquid wastes into the sea and the deterioration of marine water quality. As a result of enhanced pollution, for example, in Thailand, the operators of scuba diving businesses now take diving parties to locations further away from the coast.

72. The environmental costs resulting from developing new forms of tourism, such as "Golf Tourism", are particularly high. Golf courses require large stretches of land, not only for the course, but also for the associated resort developments (which are the real profit makers) which are an integral part of golf complexes. Golf courses also use large amounts of water for irrigation which interferes with the water flow in the surrounding areas, eventually drying up of ponds, marshes, springs and underground water reservoirs. Further, the massive amounts of agrochemicals with which golf courses are routinely treated may contaminate the water and the surrounding soil and air. The golf course business has also been a major cause of the growing number of landless rural people. Poor villagers often sell their land to developers and become wage labourers within and outside their villages or they encroach on forest areas to find land for cultivation purposes. The growth of commercial tourism has also contributed to the growth of prostitution, drugs, theft and petty crimes and has enhanced the local cost of living.

H. Solid wastes

73. The rapid growth of various sectors of economy, together with growing affluence, in the countries of the Asian and Pacific region has resulted in the increased generation of solid waste. Taking into account the per capita waste generation rates of developed, newly industrialized and developing countries, the total amount of municipal solid wastes generated in the region amounts to 700 million tons per year. Industrial solid wastes vary, not only between countries at different stages of development but also between developing countries. In China, for example, the generation ratio of municipal and industrial waste is one to three. In Pakistan and Bangladesh, however, this ratio is much less. In developed countries like Japan, the ratio is one to eight. However, based on an

average ratio for the region, the industrial waste generation in the region is equivalent to 1,900 million tons/annum (figure 36). The total solid waste generated in the region will therefore be an estimated 2.6 billion tons in 1995. This amount is expected to increase substantially with further economic growth in the region, and at the current growth rates it is estimated that it will double in less than 15 years. This incremental growth will pose very serious problems because existing solid waste collection and disposal systems are grossly inadequate.

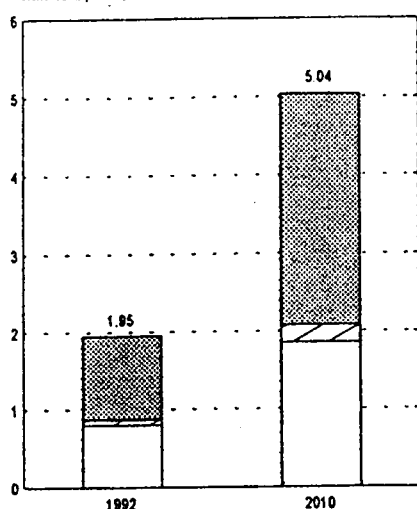
74. Shortage of land is becoming a major problem in the disposal of solid waste. For example, in small island developing States, the shortage of space on land and the shallow depth of the water lens makes the problem acute. Dumping at sea has frequently been adopted as a solution. Thus, in French Polynesia old cars and refrigerators are dumped into the lagoon. In the Marshall Islands, trash is bundled in wire cages and used to build sea walls, allowing leechates to pass directly into the ocean water and loose trash to wash up everywhere. Dumps in mangrove swamps are common, and the chemicals used to spray them leech into sensitive areas that act as nurseries for fish and other marine life. The chemicals poison the juvenile fish as well as arthropods which are essential for the breakdown of organic matter. Another related problem facing the region is the changing composition of waste which occurs with economic growth. Although chronological data is not available for an evaluation of a particular site, a comparison of waste composition in cities of countries at different stages of development provides surrogate data (figure 37) which shows that the amount of non-compostable materials, such as plastic and paper, increases with growing affluence. Moreover the amount of hazardous waste also increases with the level of development, but data on this is particularly sparse due to the lack of monitoring.

75. Disposal of domestic and industrial solid waste is given relatively low priority in many countries of the region despite increasing loads. The resources of municipal waste collection and disposal agencies are often stretched by shortages of collection vehicles, and inadequate transfer stations and disposal facilities. Cost recovery is not emphasized, and the financial constraints limit operation and maintenance costs, and capacity expansion needs. It has been estimated that only 70 per cent of the waste in urban municipal areas is collected, of which, a very small proportion (about 5 per cent), is properly disposed of in sanitary landfills, compost plants or incinerators, and that the rest is improperly discarded in open dumps. Institutional strengthening and sound management practices are necessary to ensure efficient service provision along with cost recovery through user charges. The role of the private sector (both informal and formal), which is already assisting in solid waste management in many countries of the region, also needs to be enhanced. Reusing and recycling solid wastes could reduce the pressure on the collection, disposal and handling systems. Informal scavengers already operate marginal recycling operations in many Asian cities, like Jakarta, where it is estimated that about 200,000 people earn a livelihood in this manner. Similarly, 20,000 people

Figure 36. Solid waste generation in the Asia and Pacific region

Industrial solid wastes

Mil. ton/year (thousands)



Municipal solid wastes

Mil. ton/year (thousands)

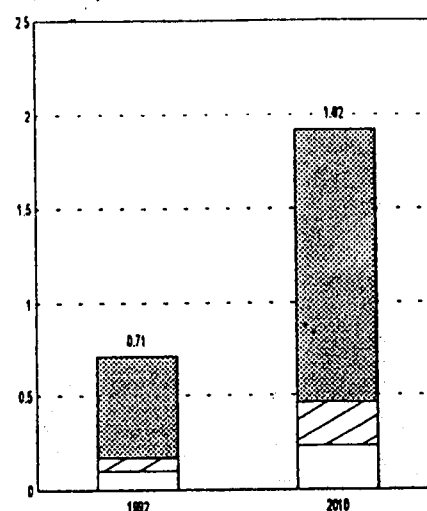
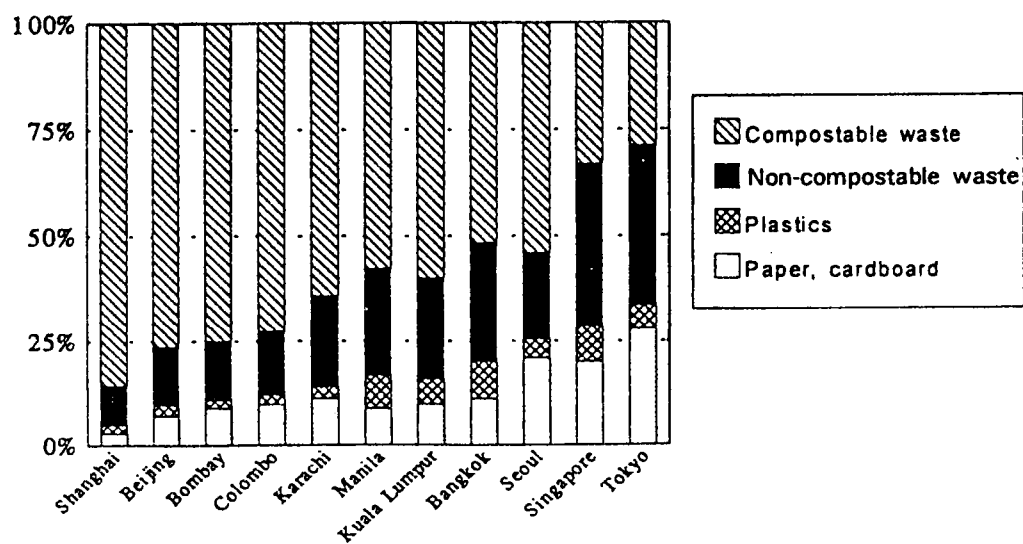


Figure 37. Composition of solid wastes in selected cities of ESCAP member countries



Sources: Lee, K.B. and Toxler, S., Assessment of Waste Management in the ASEAN region, Proc. Conference on Waste Management in the Coastal Areas of the ASEAN Region, 28-30 June 1991, Singapore.

who live around a dump called "Smokey Mountain" in Manila continued to resist relocation, as they derive their livelihood out of scavenging for recyclable material.³⁸

I. Trade

76. Trade can spread the benefits of more efficient and sustainable technologies and products. It can also generate greater wealth in developing countries, a benefit which could conceivably permit stronger investment in environmental protection and help in alleviating poverty.³⁹ So far, however, the potential gains from trade in developing countries of the Asian and Pacific region have been overwhelmed by the negative facets — an inflow of dirty and hazardous waste from the developed nations, and the outflow of raw materials and resource intensive industrial products to developed countries — which contribute to deficit ecological financing. Transfer of hazardous industries without adequate safeguards, and environmental dumping have in the past created increased risks. The industrial accident in Bhopal, India, is a prime example. In addition, movement of wastes have taken place in the Pacific Islands, South-East Asia and more recently, South Asia. However, due to increased awareness created by popular organizations and NGOs, government action has led to some control on international waste imports.

77. The weak bargaining power and the lack of access to sophisticated technologies have compelled the developing countries of the Asian and Pacific region to buy high-priced and technologically efficient imports, while competing intensively to export raw materials or resource intensive and technologically unsophisticated products with low value-added content. Figure 38 shows the composition and the growth of the trade flows of selected developing and developed countries of the region. Natural resource-intensive and polluting commodities have a very high share in the export basket of developing countries. This is perhaps due to the apparent comparative advantage that these countries have for such products. Further, the declining terms of trade⁴⁰ for most developing countries of the region (table 6) have forced these countries to maintain a trade balance through increased exports of such products. The affluent industrialized countries, on the other hand, have undergone a change from raw material processing and heavy manufacturing towards knowledge-intensive products and services. The trade relations between the developing and industrialized countries understate the true economic worth of natural resources while overstating the value-added content through knowledge intensity. This is creating serious environmental damage in the

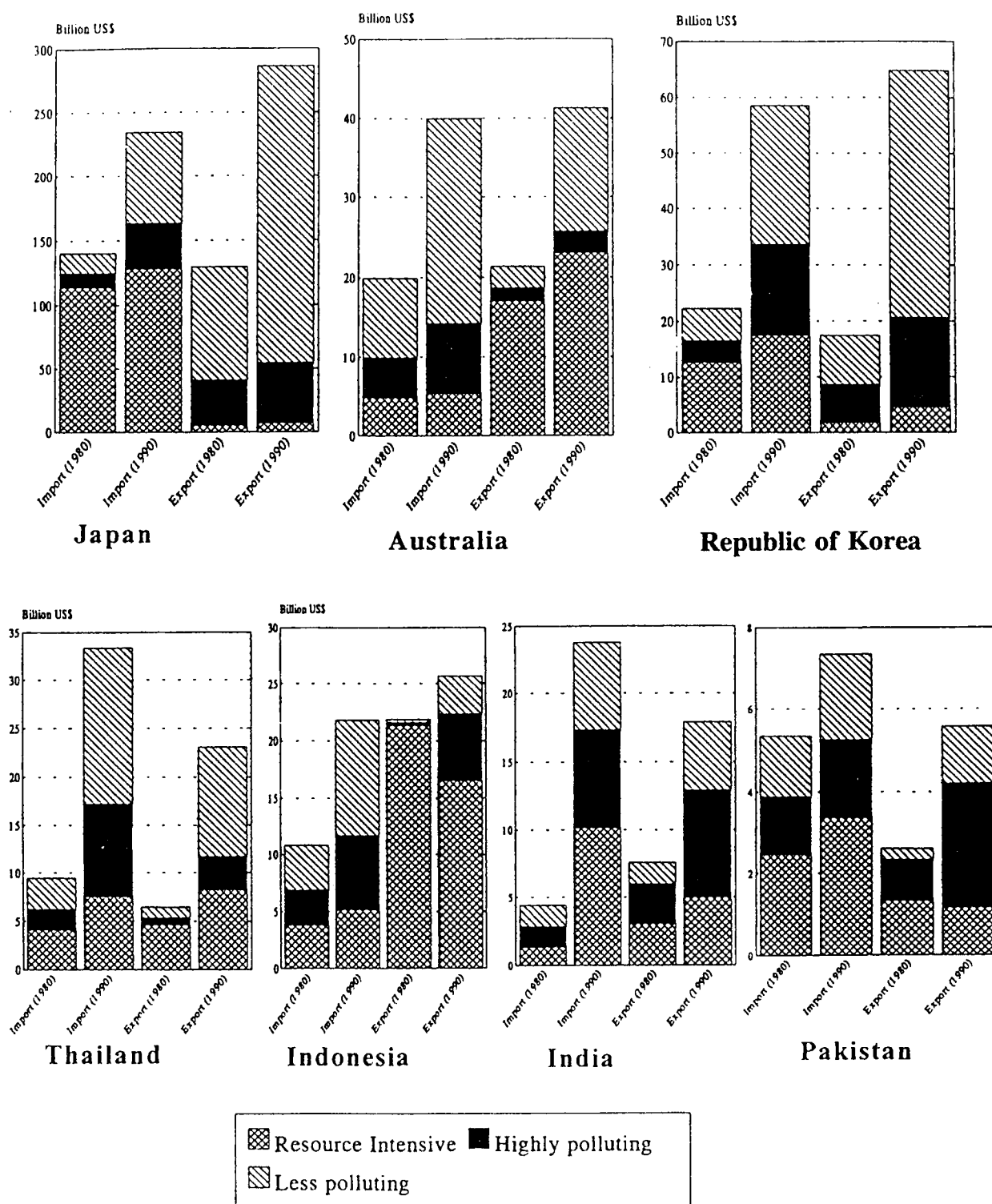
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³⁸ Op. cit., p. 29.

³⁹ Brown and others, *State of the World* (New York, World Watch Institute, N.W. Norton and Company Publishers, 1994).

⁴⁰ If percentage terms of trade (a ratio of export price index to import price index) is less than 100, the aggregate export is compared with import price level and vice versa.

Figure 38. Foreign trade structure in selected countries of the Asian and Pacific region (1980-1990)



Data Source: *International Trade Statistics Year Book*, 1985 and 1993 (United Nations publication), New York.

Table 6. Share of natural resource intensive export, terms of trade and debt indicator for countries of the Asian and Pacific region

Countries	PV/XGS (critical value 200)	PV/GNP (critical value 80)	Share of natural resource intensive * export (%)	Term of trade (1992) 1980=100
Kazakhstan	32	3	50.8	-
Fiji	35	20	62.0	-
Uzbekistan	40	2	18.1	-
Malaysia	41	35	39.0	68
Tonga	42	15	71.7	-
Rep. of Korea	45	13	7.1	106
Vanuatu	46	27	91.3	-
Solomon Islands	52	28	94.3	-
China	76	17	20.8	-
Iran (Islamic Rep. of)	77	15	96.2	50
Thailand	88	35	33.3	83
Sri Lanka	107	41	27.5	81
Papua New Guinea	118	67	82.9	-
Cambodia	119	17	68.2	-
Nepal	152	29	16.1	-
Philippines	174	58	27.0	101
Pakistan	187	37	21.0	82
India	190	21	24.9	100
Bangladesh	192	28	18.4	77
Indonesia	192	58	52.3	60
Lao People's Democratic Rep.	224	40	92.0	-
Myanmar	483	10	88.7	72
Viet Nam	592	173	-	-

Note:

PV= Present value of total debt service

XGS=Exports of goods and services

GNP=Gross national product

* Natural resource intensive include classes and sub-classes No. 0,1,2,3,4 and 68 of the Standard International Trade Classification (SITC) System.

(-)=Data not available

Sources:

- (1) World Bank, *World Debt Tables, 1994-95* (1994).
- (2) United Nations, *Handbook of International Trade and Development Statistics, 1993* (1994).

developing countries. The correction of price distortions in world trade is therefore an important issue in creating sustainable development patterns. Stock depletion and environmental degradation costs must also be internalized.

78. Table 6 documents a substantial role for natural resource-intensive exports in Asia-Pacific trade. The small island economies of the South Pacific, in particular, rely almost totally on natural resource-exports and their downstream products. Agriculture provides a good illustration of natural resource-related trade issues. Although the environmental effects of agricultural trade liberalization on the environmental resources of the region are less clear, increasing product demand is likely to lead to greater chemical use (pesticides and fertilizers) in South and South-East Asia, even if the rate at which they are used remains below European levels. It will also lead to greater water demand, a consideration relevant both to for perennially water-scarce countries, such as Pakistan, and to seasonally water-scarce countries, such as Thailand. The effect on land resources in Asia is also likely to be substantial. Studies have found that forest conversion has been positively related to growth in crop prices in Thailand.⁴¹ But the net environmental effect is also determined by the cropping pattern and by institutional factors such as land tenure. One can argue that higher crop prices should encourage greater investment in soil conservation, provided secure land entitlement is available. The principal lesson, however, is that trade and trade liberalization should also be accompanied by effective domestic policies for ensuring environmental safeguards.

79. Another important factor that has a direct bearing on the growing trend of exporting natural resource-intensive products by developing countries of the region is the increasing debt burden. Table 6 shows some of the debt indicators for selected countries of the region. It can be seen that although only three countries, Viet Nam, Myanmar and the Lao People's Democratic Republic, are severely indebted⁴² in Asia and the Pacific, other countries such as Indonesia, Bangladesh, India, Pakistan, the Philippines and Nepal are very close to the critical level. The apparent comparative advantage of these countries in exporting natural resource-intensive products is likely to compel them to exploit their already dwindling resources further, to relieve the immediate pressure of debt servicing. The emerging trends of a high share of natural resource-intensive commodity export, declining terms of trade, and a growing debt burden are, therefore, mutually reinforcing, and they act as major bottlenecks in achieving sustainable development in the region.

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⁴¹ E. Barbier and J. Burgess, "Agricultural pricing and environmental degradation".

⁴² If the ratio of present value of total debt service (PV) to exports (XGS) exceeds 200, or the ratio of PV to GNP exceeds 80, the country is classified as severely indebted. See, World Bank, *World Debt Tables 1994-95*, for details.

J. Human health

80. The developing countries of the Asian and Pacific region are passing through an epidemiological transition in which human health is being affected by both traditional and modern environmental diseases (figure 39). The dearth of clean water and sanitation, and unhygienic living conditions in many countries of the region are responsible for the prevalence of infectious, parasitic and vector-borne diseases such as diarrhoea, typhoid, hepatitis, intestinal helminths, malaria, dengue haemorrhagic fever (DHF) and schistosomiasis, while pollution from agrochemicals, industrial effluent and hazardous waste has introduced or exacerbated cancer, diseases of the nervous system and cardiovascular diseases. The change in life style and growing environmental stress have also resulted in increased mortality and morbidity from heart, cardiovascular, psychological and stress-related diseases.

81. WHO has estimated that 44 per cent of the deaths in developing countries in 1990 occurred as a result of infectious and parasitic diseases (figure 40). Among these, diarrhoeal diseases associated with contaminated water pose a serious threat in the region. A group of 12 countries — Bangladesh, Bhutan, China, the Democratic People's Republic of Korea, India, Indonesia, Maldives, Mongolia, Myanmar, Nepal, Sri Lanka and Thailand — accounted for some 40 per cent of the total global diarrhoeal episodes. In 11 of these countries, excluding China, diarrhoeal diseases killed 1.7 million children aged below 5 years during 1990 (more than three children per minute). It is estimated that in 1993 a staggering total of approximately 310 million diarrhoeal episodes occurred in children aged under 5 in these 11 countries, with an average of 18 episodes occurring per 10 children. A new strain of cholera, designated as "Vibrio Cholerae O139 (Bengal)", spread rapidly in late 1992 through Bangladesh, China, India, Malaysia, Nepal and Pakistan, causing unusually high mortality, even in adults.⁴³ A very large portion of the population in the region is also exposed to malaria, another water-related, vector-borne disease. The incidence of malaria is high in the region, with between 3.4 and 4 million cases and several thousand deaths annually. Its recurrence, owing to pesticide- and insecticide-resistant vectors, poses special problems in some countries of the region. Among environment-related, parasitic diseases, intestinal infection is widespread in the region. In addition, visceral leishmaniasis (kala-azar) threatens more than 100 million people in South Asia. There were 25 million microfilaria carriers and 19 million cases of filariasis in India alone in 1991.⁴⁴ Schistosomiasis is also endemic in irrigated areas of Indonesia, Philippines and Thailand.

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⁴³ World Health Organization, *The World Health Report 1995*, (Geneva, 1995).

⁴⁴ World Health Organization, *The Work of WHO in the South-East Asia Region* (New Delhi, WHO Regional Office, 1993).

Figure 39. The epidemiological risk transition

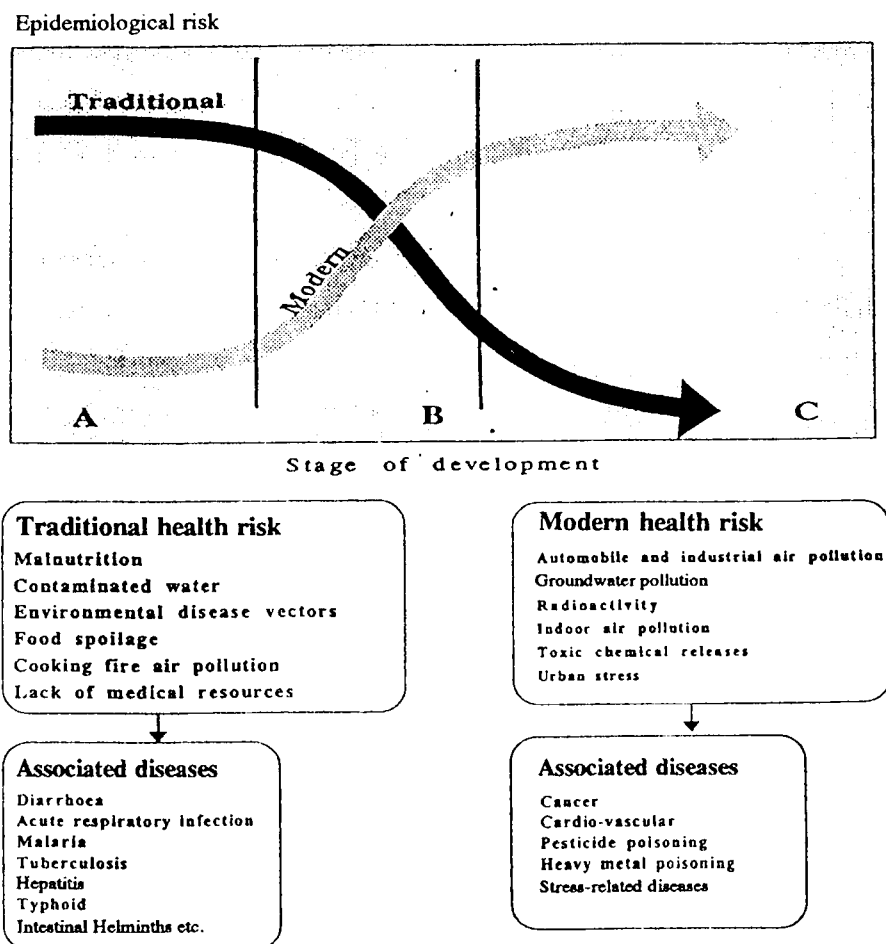
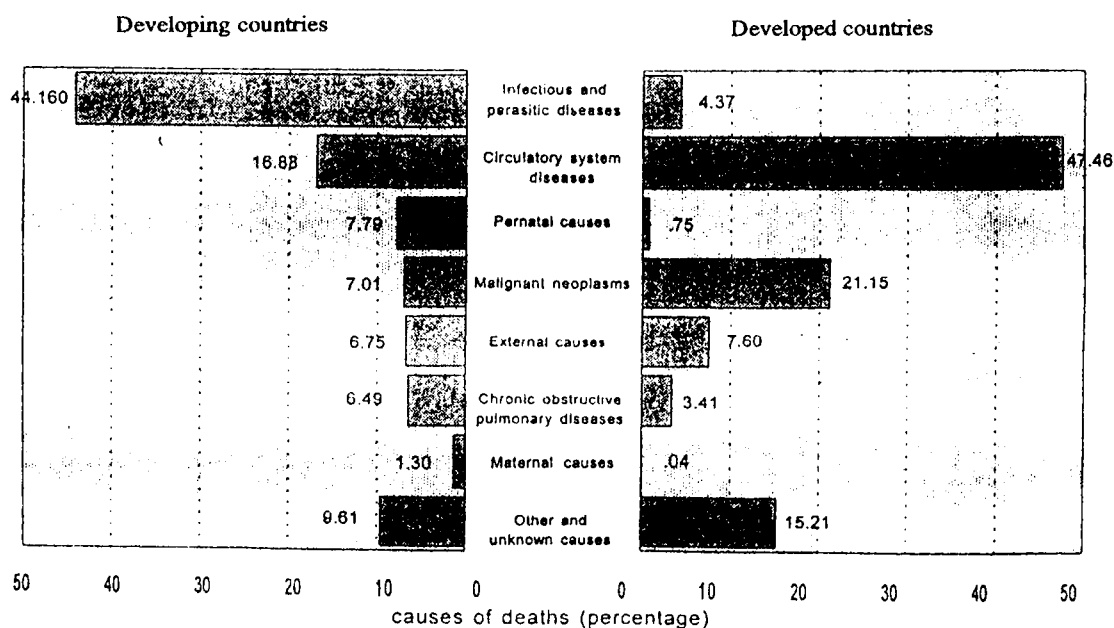


Figure 40. Estimated deaths by cause in developing and developed countries, 1990



Source: "Renewing the health-for-all strategy", report by the Director-General, World Health Organization, 1994.

82. Another major and commonly prevalent disease in the region is acute respiratory infection (ARI), including pneumonia and bronchitis, associated with an unhygienic living environment. ARI is aggravated by air pollution in general, and by indoor air pollution caused by cooking fuel in particular. A WHO report⁴⁵ estimates that Bangladesh, India, Indonesia and Nepal together account for 40 per cent of the total global mortality in young children resulting just from pneumonia. The fatality rates due to pneumonia among hospitalized children are between 4.2 and 18.3 per cent. Among respiratory diseases, tuberculosis also poses a serious problem. More than two million cases were reported from South-Asia alone in 1991. Around 40 per cent of the population in South and South-East Asia has been infected and will remain at lifetime risk of disease and death from tuberculosis. The disease particularly affects those age groups that are economically productive (15 to 59 years). Given the frequency of double infection with HIV and *Mycobacterium tuberculosis*, the rates of which are extremely high in the region, the number of cases of active tuberculosis may rise by a factor of seven during the coming decade.

83. The prevalence of cardio vascular diseases (CVD) and cancer has also increased in the region. The rise of CVD in China and India is detailed in table 7. The annual number of deaths due to CVD in the two countries amounts to 3 million, which is equivalent to more than 25 per cent of all CVD deaths worldwide. Recent calculations clearly demonstrate that the burden of CVD for the Asian and Pacific region; in 1990, the loss in disability-adjusted life years (DALY) amounted to 78.2 million. This figure corresponds to 11.3 per cent of the total burden of diseases in this region and 53 per cent of the global burden of CVDs.⁴⁶ Chemicals have been cited as a major cause of cancer; for example, pesticides that are commonly used in the region are linked to cancers. Neurological disorders, birth defects and reproductive problems are also linked with exposure to harmful chemicals. Increased UV-b radiation from the depleted ozone layer is causing a rise in skin cancers in the Pacific, especially in Australia and New Zealand. Radiation toxicity has also caused cancers and birth defects in the Pacific and may continue to do so.

84. An encouraging trend in the region is enhanced life expectancy, due to improvements in socio-economic conditions and medication, which showed a rise from below 60 years in 1980 to over 65 years in 1995. During the last five years (1990 to 1995) the life expectancy for males increased from 63.6 to 65 years and for females from 65.9 to 67 years. The infant mortality rates for the region also declined from 68 per 1,000 live births in 1990 to 59 in 1995. Greater achievement could also be made in child mortality rates by checking malnutrition which is still extremely high in

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⁴⁵ World Health Organization, report for 1994 by the Director-General to the ninety-fifth session of the executive board.

⁴⁶ C.J.L. Marray and A.D. Lopez, "Global and regional case of death patterns in 1990", *Bulletin of the World Health Organization*, 72(3), (Geneva, 1994).

Table 7. Probability of dying from cancer and cardio-vascular diseases (in %) between ages 15 and 60 years for males (M) and females (F) in China and India 1990.

Disease	China		India	
	M	F	M	F
Stomach cancer	1.06	0.58	0.37	0.21
Colorectal cancer	0.25	0.23	0.12	-
Liver cancer	1.81	0.59	0.14	-
Lung cancer	0.65	0.34	0.38	-
Diabetes mellitus	0.14	0.17	0.49	0.65
Rheumatic heart disease	0.39	0.64	0.35	0.86
Ischaemic heart disease	0.87	0.45	2.61	1.09
Cerebrovascular disease	2.06	1.75	1.08	1.32
Inflammatory cardiac diseases	0.20	0.17	2.31	1.48

Dash (-) equals less than 0.1 per cent.

Source: J.L. Murray and A.D. Lopez, "Global and regional cause of death patterns in 1990", *Bulletin of the World Health Organization*, 72(3).

the region. It has been estimated that 120 million of the global total of 190 million underweight children live in only four countries of the Asian and Pacific region: China, India, Pakistan and Bangladesh. Another 10 per cent or 20 million malnourished children live in four other countries: Indonesia, Viet Nam, the Islamic Republic of Iran and the Philippines.⁴⁷ Furthermore, micro-nutrient deficiencies such as iodine deficiency disorders, and Vitamin A and iron deficiencies are also widely prevalent in the vast majority of the countries of the region.

K. Natural and man-made disasters

85. Although the countries in the Asian and Pacific region are almost universally vulnerable to natural and man-made hazards, the developing countries have been made even more susceptible to disasters or catastrophic events as a result of these hazards (figure 41). The region has been one of the worst hit in terms of natural disasters, accounting for 50 per cent of the world's major disasters (figure 42). Since the International Decade for Natural Disaster Reduction began in 1990, the total number of deaths due to natural disasters in the region has exceeded 200,000. The total damage to property during the decade is estimated at US\$100 billion.

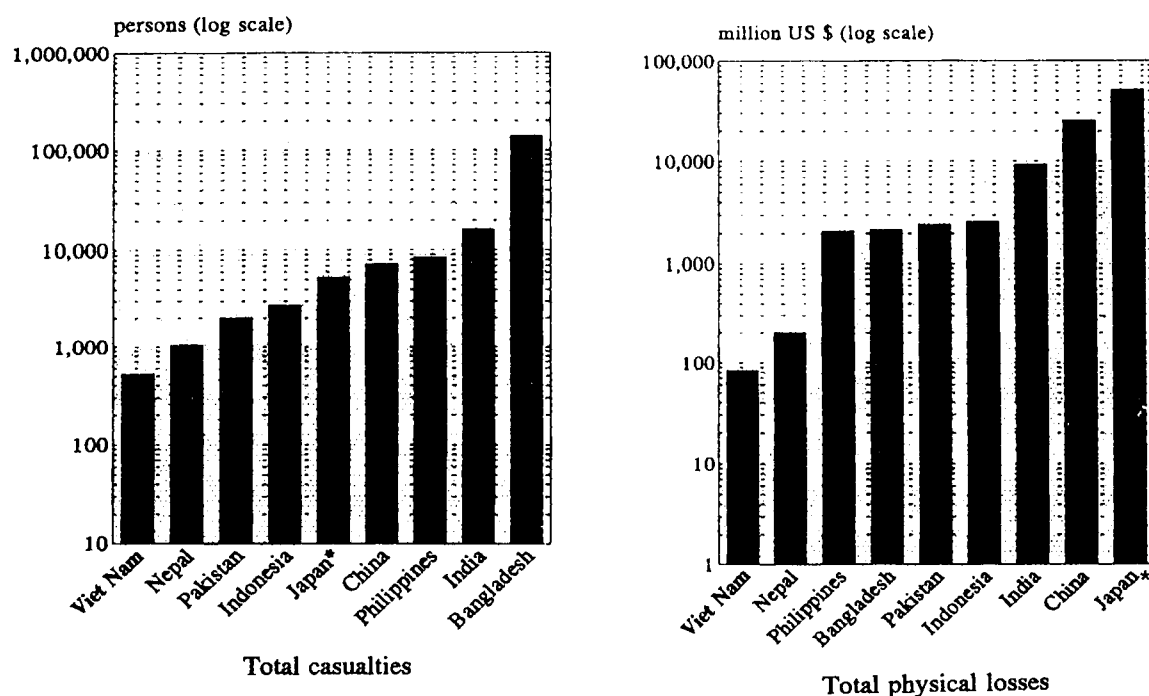
86. Occupation of risk-prone areas and environmentally destructive practices are largely responsible for turning extreme natural events such as tropical cyclones and heavy rainstorms into disasters. Building communities on shorelines and river banks, destroying natural coastal defence systems like mangroves and coral reefs, deforestation, and poor land practices that erode watersheds are all examples of poor environmental housekeeping. The tropical cyclone of 29 April 1991 in Bangladesh killed almost 140,000 people, destroyed a million homes and caused US\$ 2.5 billion worth of damage. During the cyclone, Chakaria was one of the worst-hit sub-districts, largely because 7,500 hectares of mangrove forest had been cleared over the previous two decades for conversion to shrimp ponds and salt beds. Records show that this mangrove area had been preserved earlier this century precisely because it was regarded as a natural barrier against storm surge. Chativangya village, more vulnerable due to a lower embankment, on the other hand, escaped large damage because of the mangroves along the embankment.

87. Apart from their impacts on human life and property, natural disasters also affect the environment considerably. For example, the increasing frequency and lengthening season of tropical cyclones and their growing severity, has caused considerable damage to forests, coral reefs and seriously affected the inhabitants in the small island developing States of the Pacific. Tokelau, which recorded only three storms from 1846 to 1989, has experienced two (Tusi and Ofa) in the

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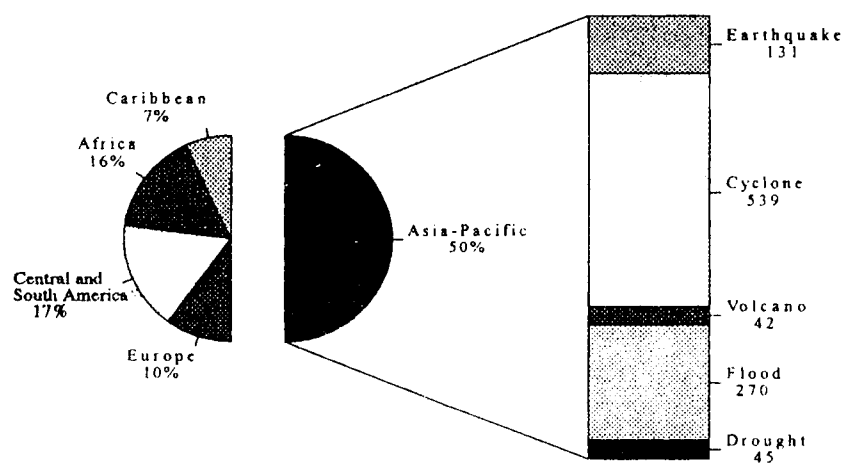
⁴⁷ United Nations Children's Fund, *The Progress of Nations* (New York, 1993).

Figure 41. Losses due to major natural disasters in selected countries of Asia and the Pacific during 1990-94



* Losses for the year 1995 are included for Japan

Figure 42. Worldwide regional distribution of recent disasters (1990-94)



Source: Asian Disaster Preparedness Centre, Asian Institute of Technology, Bangkok.

last five years. Ofa was so severe that waves covered the atolls, washed away topsoil and salted the land so badly that crops would not grow. Together, Ofa and Val destroyed or badly damaged 90 per cent of the buildings in Samoa and destroyed extensive areas of the forests in Savaii. In American Samoa, these two storms created havoc in the tuna-fishing port of Pago Pago and blew tons of garbage into the sea. Nearly all the bats and birds of the forests of Samoa were destroyed and the coral reefs were stripped of life. Similarly, between January and April 1983, French Polynesia had five cyclones; this was more than the number of storms which had occurred in the previous 150 years. All the islands in the Tuamotu and Society groups were damaged when the sea level rose 4 to 5 metres, with waves from 8 to 10 metres high. These high seas totally submerged the villages on the atolls, some of which completely disappeared. The freshwater lens turned saline, big blocks of coral were torn from the reefs and thrown onto the reef flats, vegetation was severely damaged and 50 per cent of the coconut trees were blown down.⁴⁸ Because such natural disasters can jeopardize the very existence of small island developing States, appropriate preparedness, planning and management measures are required.

88. Apart from natural hazards, man-made environmental disasters in the region have often killed many people, had devastating affects on human health and resulted in great economic loss. If small accidents are taken into account, their accumulative number becomes very large. For example, in China, a total of 3,001 pollution-related accidents occurred in 1994 alone. The intensity of damage from some of these accidents in Asian and Pacific region can be gauged from the fact that a leakage of toxic gas (methyl isocyanate) from a pesticide factory in Bhopal in December 1984, killed over 1,500 people, blinded several thousands and affected over 150,000 people. Similarly, a fire in a chemical storage at Klong Toey port in Bangkok, emitted toxic fumes, which killed five people, destroyed five warehouses and hundreds of shanty houses nearby, injured 500 people and left another 6,000 persons homeless, and caused damage estimated at US\$1.6 million. In 1995, in the Republic of Korea, an underground gas explosion at Taegu killed 101 people, while in the collapse of a department store building, 160 people were reported dead, 260 missing and 900 injured.

89. There has been a growing recognition of the significance of disaster prevention and mitigation in the region. Responding to the theme of the International Decade for Natural Disaster Reduction, many countries of the region have appointed national IDNDR committees or central organizations to coordinate the disaster mitigation activities of government bodies and other groups. Significant progress has also been made on forecasting and early warning, particularly in the case of climatic and volcanic hazards. However, risk assessment and management on man-made hazards is still in

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⁴⁸ C. Gabrie, M.L. Licari and D. Mertens, "L'état de l'environnement dans les Territoires Français du Pacifique Sud, preliminary report, L'Institut français de l'Environnement (1995).

the rudimentary stage. Limited success has been achieved in developing countries of the region in disaster mitigation, using non-structural measures, especially those related to environmental enhancement, planning controls, acquisition of land and relocation of people.

III. ACTIONS AND RESPONSES BY PUBLIC AUTHORITIES AND OTHER MAJOR GROUPS

90. Deteriorating environmental conditions have provoked and continue to impel States, organizations and other parties concerned to take corrective and preventive measures, particularly with regard to integrating environment and development activities. This section attempts to provide a review of the responses to emerging environmental and developmental issues by public authorities, the private sector, NGOs and other major groups. The various actions undertaken to protect the environment, such as monitoring, research, education and communication, are also described.

A. Action by public authorities

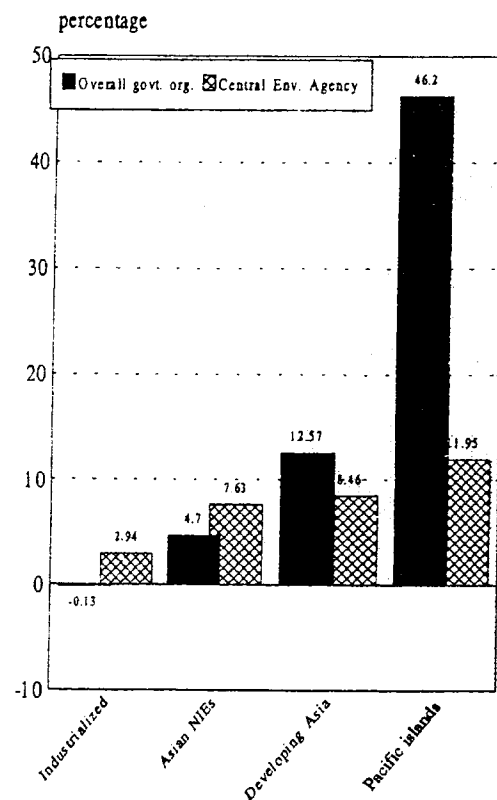
91. A major response from national public authorities towards deteriorating environmental conditions has been the strengthening of institutions, legislation and regulatory measures. As a result, environmental institutions have proliferated throughout the region in the public sector. Almost all the countries of the region now have some form of environmental institution. These range from a ministry (India, Bangladesh, Indonesia, Kazakhstan, New Zealand, Pakistan, Papua New Guinea, the Republic of Korea, Singapore, Sri Lanka, Thailand, Turkmenistan and Viet Nam) to a division/unit in another ministry (Afghanistan). Some countries have independent Environment Agencies (China and Japan); others have agencies or departments as operational environmental bodies which were created to assist the ministries concerned in their work, such as in Bangladesh, Malaysia, Pakistan, the Philippines, Sri Lanka and Thailand.

92. Most of the environmental institutions in the developing countries of the region are relatively small. An encouraging trend in recent years has been the increase in budgetary resources, as well as the size of the staff of these agencies. These increases, in many cases, are more substantial than the average increases for the Governments as a whole. However, despite these increases, the capacities of these institutions are still far from satisfactory in terms of manpower, as well as allocation of financial resources (figure 43) which is still less than 1 per cent.

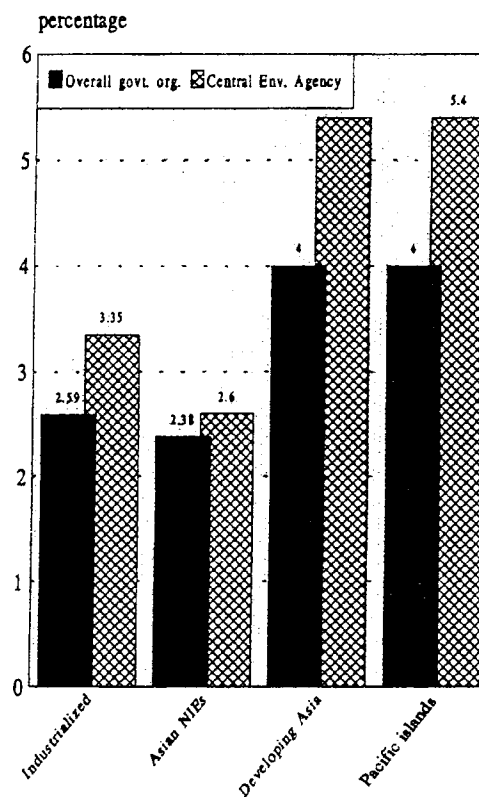
93. Not all environmentally related issues fall within the purview of environmental institutions. For example, there are issues which are related to electromagnetic radiation, natural disasters, disease-carrying species, natural radioactive rays, domestic pets and experimental animals, environmental management divisions in private enterprises, industries manufacturing anti-pollution equipment, and garden design. In many countries, forestry, biodiversity and energy-related issues also are not

Figure 43. Manpower and financial resource for environmental institution

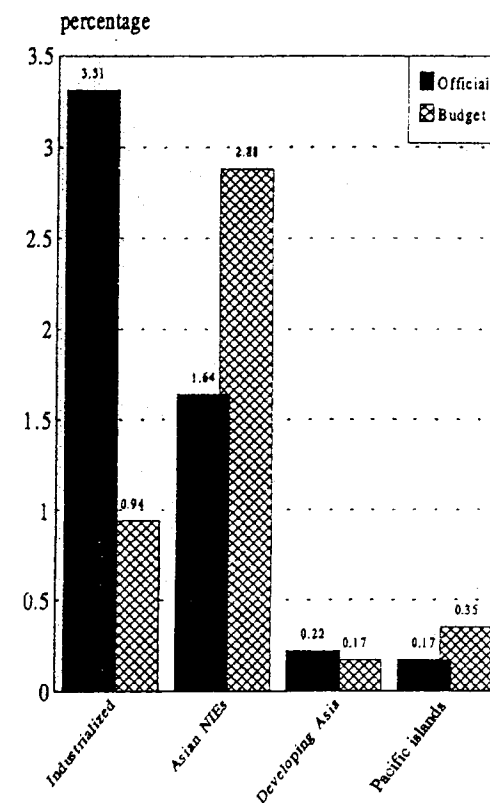
Annual growth rate of number of officials in government agencies (1989-94).



Annual growth rate of budget in government agencies (1989-94)



Proportion of resource allocation in central environment agency (1989-94)
(as percentage of central government organisations)



Source: Kobayashi H. 1994 Environment Agencies in transition (unpublished paper). East-West Centre.

handled by these agencies. In other words, separate ministries or sectoral departments tend to manage these issues, in many cases without any consultation with the main environment ministry or agency. Likewise, the environmental agencies also tend to formulate policies on the issues within their jurisdiction on their own, for example, air pollution due to stationary sources and water pollution as a whole. However, innovative mechanisms such as multisectoral environmental commissions and committees are being put in place to make the coordination process more effective. A recent survey indicates that more than 60 per cent of the issues in the domain of ecological system management, as well as those concerning human activities for improving the environment, which were handled by the environmental agencies were addressed in collaboration with other ministries.

94. Command and control is the main thrust of environmental policy instruments used in the region, and strategic environmental planning, use of legislative means and regulatory standards and planning procedures relating to public works (particularly environmental impact assessments) are the most commonly used tools in environmental planning. Japan, for instance, reformed the environmental legislation and established a Basic Environmental Law in 1993 and the Basic Environmental Plan in 1994. The least utilized instruments were those related to economic incentives. Environment agencies also had no power to audit the environmental performance of sectoral institutions. The agencies were thus left to enhance their capability only to institutionalizing the additional tools, or by improving the existing tools such as environmental impact assessments.

95. Legal recourse, remedies and procedures are available in almost all countries of the region, although effective enforcement of environmental legislation has yet to be achieved. The obstacles are varied, and include: (a) a lack of adequate funds, manpower and technical equipment; (b) a lack of trained personnel to enforce regulation; (c) a lack of necessary political support; (d) relatively weak environmental institutions due to lack of experience, adequate training programmes and restricted funds; and (e) a dearth of legal experts sufficiently familiar with the various ways in which the law can be used as a tool for environmental management. The latter obstacle (e) accounts for the initiative of ESCAP, together with UNEP and the International Union for Conservation of Nature and Natural Resources Commission on Law, for setting up an environmental law training centre for Asia and the Pacific at Singapore. Despite these constraints, public litigation in support of environment protection has increased substantially in many countries of the region, including India, Pakistan and the Philippines.

96. The level of participation by the developing countries of Asia and the Pacific in international agreements is relatively moderate, while in the case of least developed countries (table 8) it is low. In some instances, the reason may be a lack of support, or disagreement with the objectives or specific provisions of treaties. The main reason, however, is that implementation through

Table 8. Status of countries of Asia and the Pacific, regarding selected international conventions on the environment

	Wetlands; Ramsar	World Heritage (Paris)	Endangered Species (CITES)(Washington)	Law of the Sea (Montego Bay)	Protection of the Ozone Layer (Vienna)	Protocol on Ozone Depleting Substances (Montreal)	Control of Movements of Hazardous Wastes and their disposal (Basel)	Biological Diversity (Rio-de-Janeiro)	Climate change 1992 (Rio-de-Janeiro)	Combat Desertification (Paris)	Regional Seas (UNEP)	Other Regional Agreements
	1971	1972	1973	1982	1985	1987	1989	1992	1992	1994		
Afghanistan		R	R	S	R		S	S	S			
American Samoa								S				
Australia	R	R	R	S	R	R	R	S	R	S	SP	SPC
Azerbaijan	R							S	S			
Bangladesh	R	R	R	S	R	R	R	S	R	S		
Bhutan				S				S	S			
Brunei Darussalam			R	S								ASC
Cambodia		R	S	S						S		
China	R	R	R	S	R	R	R	R	R	S		
Cook Islands				R				S	R			
Fiji		R	R	S	R	R	R	S	R		SP	SPC
India	R	R	R	S	R	R	R	R	R	S		
Indonesia		R	R	S	R	R	R	S	R	S		ASC
Islamic Rep. of Iran	R	R	R	S	R	R	R	S	S	S	K	
Japan	R	R	R	S	R	R	R	R	R	S		
Kazakhstan	R							S	S	S		
Kiribati									R			
Democratic Rep. of Korea			R	S				S	S			
Kyrgyzstan	R											
Laos People's Democratic Rep.	R	R		S					R	S		
Malaysia		R	R	S	R	R		S	R			ASC
Maldives		R		S				R	R			
Marshall Islands				R				R	R			
Micronesia				R				S	R	S		
Mongolia		R	R	S	R	R		R	R	S		
Myanmar				S				S	S			
Nauru				S				S	R			
Nepal	R	R	R	S				S	R			
New Zealand	R	R	R	S	R	R	S	S	R		SP	
Pakistan	R	R	R	S	R	R		S	R	S		
Papua New Guinea			R	S	R	R		S	R		SP	SPC
Philippines			R	R	R	R	S	R	R	S		ASC
Republic of Korea			R	S	R			S	R	S		
Samoa				S				S	S			
Singapore			R	S	R	R			S			ASC
Solomon Islands				S	R	R		S	S		SP	
Sri Lanka	R	R	R	R	R	R	R	S	R			
Tajikistan	R	R										
Thailand			R	S	R	R	S	S	S			ASC
Tonga									S			
Turkmenistan				S				S		S		
Tuvalu								S	R			
Uzbekistan	R	R			R	R			R	S		
Vanuatu												
Viet Nam	R	R	R	R	R	R	R	R	S			

Note: R: Ratified; S: Signatory; SP: South Pacific Convention; SPC: South Pacific Conservation Convention; ASC: ASEAN Conservation Agreement; K: Kuwait Convention

domestic legislation is a complicated legal and administrative task, requiring a large amount of professional and administrative expertise and resources.

B. Responses by the business and private sectors

97. Environmental consciousness is taking root rather slowly in the industrial and business sectors within the Asian and Pacific region. At present, even large businesses follow a reactive rather than a proactive approach in addressing environmental problems. The Japanese private sector is leading the region in developing new, environmentally friendly technologies, and in incorporating environmental consideration in their production processes. In general, outside Japan, a low-level of research and development is undertaken by private firms. Although private sector organizations have expanded significantly in recent years as a channel for developing smaller-scale technologies, and for transferring technology to the public domain that meets the needs of people in developing countries, most environmental technology research and development in the region still takes place in universities and in government research and development institutions.

98. The share of industrial investment going directly into pollution controls is, at present, less than 5 per cent. Most of this investment has gone to approaches and technologies for end-of-pipe pollution control, waste disposal and remedial clean-up of pollution. Manufacturers in Japan, for example, spent an average of 4.4 per cent of capital expenditures on pollution control between 1973 and 1990 (not including noise pollution expenditures). During the same period, Japanese electricity utilities spent 2.8 times more on pollution control as a share of capital expenditures. There was a marked increase in antipollution investment in Japan in the early 1970s; it peaked in 1975, accounting for 21 per cent of all investment in the private sector. As a result, Japan has achieved a comparatively better integration between economic development and environmental protection.⁴⁹

99. In terms of environmental management tools, environmental impact assessment is used widely in the region. Environmental audit is the next most used environmental management technique. However, the use of this technique has yet to become common practice, because some companies have proprietary processes which they do not want outsiders to review; others are reluctant to undertake environmental audits as they are afraid that green groups may demand to see the information and use it against them. Many companies feel that environmental audit would contribute to higher costs of production. Nevertheless, some companies have realized that carrying out an environmental audit not only helps them judge where the company stands with regard to legal requirements and the degree of risk a plant poses to the surrounding population and the environment, but also to pinpoint where wastage is occurring.

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⁴⁹ Environment Agency, *Report of the International Workshop on Eco-Asia Long-term Project* (Tokyo, 1995).

100. The two major shortcomings obstructing the greening of industry and business in developing countries of the region are the weak monitoring and enforcement capabilities of environment agencies, and the lack of green consumerism. Even in a developed country like Japan, where consumer cooperatives have started promoting the cause of environment,⁵⁰ green consumerism has yet to make a significant impact. The most significant growth area in green consumerism in Japan has been organic food, the demand for which is linked primarily to concern for personal health. Similarly, in other countries, most consumers are still buying the cheapest products, regardless of whether they are environmentally friendly or otherwise. Notwithstanding green consumerism, some Governments — including Japan, Australia, New Zealand, India, China and Singapore — have already introduced green labelling schemes aimed at encouraging green consumerism and providing incentives for manufacturers to account for the environmental impacts of their products.

101. If the current growth of environmental consciousness and awareness in Asia and the Pacific continues, the region will become the greatest potential market for environmental goods and services in the world. The market is already quite large; for example, China's direct investment in the prevention and control of industrial pollution alone was US\$ 1.67 billion in 1993, and total turnover in environmentally-related businesses was expected to reach almost US\$ 60 billion in 1995. Similarly, the total Indian market for pollution control amounted to US\$ 400 million in 1990 is expected to grow to US\$ 600 million by the year 2000, provided the Government steps up the pace of enforcement. Japan already has the second largest national environmental market in the world. This has spurred regional and foreign professional and business organizations to tap into this market through a growing number of exhibitions on clean technologies.

102. Apart from action by individual firms, business charters and programmes for sustainable development have also become important over the past few years in the developed countries of the region. For example, the Business Council of Australia has an environmental committee and has developed position papers on a business perspective on sustainable development. Similarly, in Japan, the Federation of Economic Organizations (Keidanren), which has 900 representative enterprises as members, in April 1991 compiled the Keidanren Global Environment Charter which prescribes action standards for Japanese enterprises. Such type of charters also need to be developed and promoted in developing countries of the region.

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⁵⁰ S. Hirasutka, "Role of consumer cooperatives in alternative lifestyles", in *International Organization of Consumers Unions, Consumers and the Environment* (Selangor, Malaysia, Setiakawan Printers, 1992).

C. Contribution of major groups

103. Major Groups in Asia and the Pacific, including NGOs, youth, women and indigenous people, singly as well as collectively, have played important roles in raising the environmental concerns, and in the development of awareness on environmental issues. NGOs, for example, have spear-headed actions by pressure groups and advocates of environmental conservation, and have contributed to the development of environmental policy and action programmes aimed at better environmental safeguards. In addition, they have: collected and disseminated relevant information; commented on environmental trends and conditions; advocated reforms; advised and/or cooperated with Governments on environmental protection and enhancement programmes; carried out awareness campaigns; involved ordinary citizens in action programmes; provided education in relation to the environment; assisted in the management of protected areas and vulnerable ecosystems; and encouraged greater corporate and governmental accountability in relation to the environment.

104. NGOs in India, Indonesia, the Philippines, Nepal, Pakistan, Sri Lanka, Thailand and the small island developing States have contributed significantly towards environmental protection. Pacific island NGOs are coordinated through the Pacific Island Association of Non-Governmental Organizations (PIANGO) with its headquarters in Honiara, Solomon Islands. PIANGO provides a common voice at regional and international forums, and it promotes environmental and social action by NGOs throughout the subregion. Among the most influential international NGOs that are active in Asia and the Pacific are the International Union for Conservation of Nature and Natural Resources (IUCN), World Wide Fund for Nature (WWF) and Greenpeace which conduct a wide range of environmental research, in addition to pollution surveys and monitoring of forestry activities. The South Pacific Action Committee on the Human Environment and Ecology is also an NGO-coordinating group based at the University of the South Pacific, at Suva. Its main objective is to promote environmental communication by distributing a wide range of resource materials. It operates ENVIRANET which provides monthly information through the 18 extension centres of the university, by using the distance education satellite network. Apart from international NGOs, there are thousands of national NGOs in the countries of the region. However, most of these face shortages of funds and skilled staff, and are weak in terms of technical capabilities on environment.

105. Young people, including school children, have participated and donated their time, efforts, skill and even money for worthy environmental causes, including environmental surveys, inventories and monitoring, tree-planting campaigns, urban and rural beautification programmes, village tank rehabilitation, landscaping, waste disposal etc. Depending on the nature of the systems, the youths were allowed a certain degree of leadership and initiative in these activities. Youths are also highly active in the NGOs and other independent sector organizations. Although no statistical analysis is

available, many regional, national and community-level NGOs working on issues related to environment and development have depended on the contributions of youth. Whether it is in environmental awareness campaigns or community mobilization work, young people have spearheaded and carried out many of these tasks. While youths and their organizations have demonstrated much enthusiasm and commitment towards environmental issues in the region, they have been constrained in their activities by technical guidance. Moreover, youth environmental programmes have not sufficiently involved some groups outside the mainstream, such as the disabled, street children and youths belonging to nomadic communities. Thus there is a need to design and implement programmes which will effectively involve these categories of youths.

106. Among the major groups, women have also contributed substantially towards sustainable development in the region by acting as environmental activists, campaigners, resource managers and conservationists. They took early initiatives in protecting the forests through systematic actions such as the *Chipko* (hug the trees) movement in India, and by organizing campaigns against nuclear testing and waste dumping in the Pacific. The fact that the survival rate of trees planted by women is higher than those planted by men in the region clearly indicates the importance of their role as resource managers and conservationists. The role of women as consumers, however, has hitherto not been utilized in the region. In this role they could greatly influence the promotion of green products, while discouraging the development of goods that are environmentally unfriendly. The main constraints faced by women in their environmental activities, apart from the common problems of lack of resources and technical assistance, are social and cultural barriers which tend to prevent them from playing a central role in the community. Lending institutions are sometimes reluctant to lend money to women, even though they have often proved to be far better at repaying such loans.

107. The contributions by indigenous peoples to environmental enhancement has been related to local-specific ecological rationale, leading to the promotion of sustainable farming, fishing, water use and agroforestry practices in the region. The indigenous peoples represent a wealth of knowledge, much of which does not exist in books; it has been passed on from generation to generation, based on experiences gained from living in harmony with nature. Their knowledge has already been used by scientists in the identification of plants which have medicinal value, for the synthesis of drugs, and in the maintenance of biodiversity, without any credit or benefits being given to the indigenous people. Unfortunately, the impact of indigenous people on the maintenance of natural environments in the region is diminishing owing to the increasing pressure which is being generated by population growth and commercial interests.

D. Environmental assessment, monitoring and research

108. Environmental assessment in Asia and the Pacific is being conducted at the national and regional levels. Several programmes have been initiated to cope with the increasing demands for monitoring and assessing the state of the environment. The assessment process itself is becoming decentralized in many countries; for example, in Japan, state of environment reports have been prepared annually for more than 20 years. In addition to ground-based monitoring through instrumentation, many countries in the region have utilized satellite remote sensing for evaluating their natural resources. In this connection, the increased data flow from space has coincided with the fast spread of computer technology that has enabled development of the Geographical Information System (GIS) which can produce crucial information for decision makers. The increasing application of GIS is a move away from sector-based analysis of data towards a holistic approach which is aimed at the integration of biophysical and socio-economic information used in identifying cost-effective options for attaining sustainable development.

109. Monitored information is often stored as databases. The present data collection and distribution system in the region has three main shortcomings. First, the data available for planners are strongly oriented to development programmes based on inputs and outputs, rather than on the conditions of natural resources. Second, the data are mostly sector-oriented and often cannot be utilized effectively for cross-sectoral analysis. Third, data produced by one department are often cannot be accessed by others. The data gap on natural resources is being filled by the increased flow of data from satellites. However, collection of the corresponding ground data has not kept pace with the increasing amount of satellite data. In addition, variation in the coverage, quality and consistency of data at the national and regional levels reduces their usefulness in comparative analysis.

110. Environmental research has rightly been oriented to two major objectives: methodology improvement and strategy reappraisal. Collecting, classifying and analyzing environmental data, and enhancing their relevance, reliability and credibility, demands standardization. However, no major efforts are being undertaken in that direction. The evaluation of environmental sustainability and the assessment of the state of environment, whether national or regional, have been based on certain selected parameters for which data is readily available; no efforts have been made to integrate these data into a composite index. The Asian Development Bank recently undertook a project to develop such an index, which will be tested in China, Indonesia, Marshall Islands, Nepal, Pakistan and the Philippines. Japan also recently started a programme to develop indicators in support of the efforts of the United Nations Commission on Sustainable Development.

E. Environmental education and awareness

111. Environmental education programmes have traditionally been aimed at students at the primary, secondary or tertiary levels, and to a lesser extent at teachers associated with these levels. While this is necessary, it is by no means sufficient. There is a critical need to reach out to other groups among teacher trainers and educational personnel (for example, educational administrators and planners), professional groups and societies, business and industry, the mass media (print and electronic, as well as traditional), voluntary organizations and NGOs, workers and the general public (particularly the subgroups comprising rural and urban communities, community leaders, women and youth).

112. The current stage of development in formal environmental education, in general, reflects a "contrived learning" approach. A few issues from real life have been filtered into the established curriculum development process, and have emerged essentially as "in-classroom" learning sequences. While such an approach is useful and should continue, real-life action in response to the growing environmental crises, both in countries of the region and globally, requires moving further towards direct intervention for the enhancement and protection of the environment. Further, very little environmental education and training has been directed towards policy and decision makers, particularly those concerned with resource use and allocation at the senior government level. At the same time, the channels or sources through which people in the region gain their awareness and knowledge of the environment are weak. Principal among these are: activities and programmes of NGOs, and grass-roots level, community-based organizations; and the mass media. The essence of environmental communication through these channels has been to convince the people that there really is a problem at hand, that it requires their urgent attention, that environmental problems do have solutions, and that these solutions do actually work.

113. In spite of numerous achievements on the part of individual journalists or newspapers, however, environmental journalism and broadcasting in the region as a whole still has many limitations and distortions. To begin with, the newspapers and electronic media have varying degrees of outreach success in different countries, depending on literacy rates (which are still very low in many countries of the region) and the ability of people to afford a radio or television, or to purchase newspapers on a regular basis. In addition, a variety of constraints affect the quality and depth of environmental coverage by the electronic media and newspapers of the region. These include internal constraints, such as a lack of adequately trained programme producers and reporters, inadequate resources to commission investigative reports and a low level of interest in environmental issues on the part of managers and editors. Overdependence on governmental sources of information continues to be another drawback.

IV. PROSPECTS AND CHALLENGES OF ENVIRONMENTALLY SOUND AND SUSTAINABLE DEVELOPMENT

114. Since the Ministerial Level Conference on Environment and Development in Asia and the Pacific 1990, and three years after the Earth Summit, very little has been achieved in terms of reversing the seriously deteriorating environmental trends in the region (figure 44). Although the indicator for economic development, when measured by the traditional GDP per capita, shows progress, some serious distributional distortions in human welfare remain; there are gainers and losers, with the greatest loser being the environment. A few of the testimonies to this situation are: the accelerated rate of resource loss, such as deforestation and the worsening pollution levels of air, water and soil. Deforestation has resulted in land degradation, disturbed water regimes, floods and loss of biodiversity. The estimated extent of land degradation in vegetated areas in Asia (20 per cent) exceeds by far the world average (10 per cent). One implication of this fact is that the suspended load per square kilometre of drainage basin in the region is three to eight times the world average. The most bothering aspect of the biodiversity-loss problem is the lack of information on species and habitats, not to mention the ecological relationships among living organisms. In terms of pollution, data from the Global Environmental Monitoring System show that the levels of faecal coliform and dissolved mercury in rivers of the region exceed the recommended levels by 50 to 100 times. WHO data show that ten of the 12 cities with the highest particulate matter levels are located in the region, as are six of the 15 with the highest SO₂ levels.

115. The most important impact will come from the doubling of the population in the region in the next 44 years. There will be 3.3 billion more people in the Asia/Pacific. The world has never seen so large an addition to the human species in such a short time. This growth is unprecedented in human history and there will be surprises that we cannot even predict today. The requirement for food will double and the needs for water and sanitation will quadruple. The consumption of energy and manufactured goods will increase five-fold. There will be unprecedented threats to habitats and forest resources, while pollution may increase tenfold.⁵¹

116. In terms of sustainable development, the issue of poverty alleviation is closely related to the question of demographic growth. The interrelationship between demographic growth and poverty can be gauged from the fact that the significant reductions observed in the percentage of populations below the poverty line in Asia and the Pacific do not translate into similar decreases in total numbers of absolute poor. The core issues of poverty alleviation are access to resources, expansion of productive employment, the enhancement of social integration and the empowerment of the poor.

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⁵¹ Results from the analysis based on World Resource Institute data.

Figure 44. Environmental trends in Asia and the Pacific, 1990-2000										
	South Asia		East Asia		South-East Asia		Pacific		Central Asian rep.	
	1990-95	1995-2000	1990-95	1995-2000	1990-95	1995-2000	1990-95	1995-2000	1990-95	1995-2000
Land										
Arable land	0	0	0	0	0	0	0	0	0	0
Land degradation	↑	↑	↑	↑	↑	↑	0	0	↑	↑
Desertification	↑	↑	↑	↑	↑	↑	0	0	↑	↑
Forests										
Deforestation	↑	↑	↑	0	↑	↑	0	0	↑	↑
Plantation	0	↑	↑	↑	0	↑	0	0	0	0
Biodiversity										
Loss of habitat and species	↑	↑	↑	↑	↑	↑	↑	↑	0	0
Inland Waters										
Consumption	↑	↑	↑	↑	↑	↑	0	0	↑	↑
Quality	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Marine Environment										
Coastal pollution	↑	↑	↑	↑	↑	↑	↑	↑		
Resources loss	↑	↑	↑	↑	↑	↑	↑	↑		
Atmosphere										
Air pollution	↑	↑	↑	0	↑	↑	0	0	0	↑
Greenhouse gases	0	↑	↑	↑	↑	↑	0	0	↑	↑
Solid Waste										
Generation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Management	↓	0	0	0	0	0	0	0	↓	↓
Population										
Growth rate	↑	↑	0	0	0	0	0	0	0	0
Poverty	↑	↑	0	0	0	0	0	0	0	0
Human Settlements										
Urbanization	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Slums and squatters	↑	↑	0	0	↑	↑	0	0	0	0
Agriculture										
Food security	↓	↓	0	0	0	0	0	0	0	↓
Agrochemical use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Industry										
Industrialization	↑	↑	↑	↑	↑	↑	0	↑	0	↑
Industrial pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Resource use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Energy										
Commercial use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Transport										
Vehicles	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
Vehicular pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Tourism										
Volume	0	0	↑	↑	↑	↑	↑	↑	0	0
Environmental degradation	↑	↑	0	0	↑	↑	↑	↑	0	0
Trade										
Resource deg. & pollution	0	0	0	0	↑	↑	↑	↑	0	0
Human Health										
Life expectancy	0	0	↑	↑	↑	↑	0	0	0	0
Traditional diseases	0	0	0	0	0	0	0	0	0	0
Modern diseases	0	0	0	0	0	0	↑	↑	0	0
Infant mortality	0	0	↓	↓	↓	↓	↓	↓	0	0
Natural disasters losses	↑	↑	↑	↑	0	0	↑	↑	0	0
Responses										
Public authorities action	↑	↑	↑	↑	↑	↑	↑	↑	0	0
Business sector's response	0	↑	0	↑	0	↑	0	↑	0	0
Env. monitoring & research	0	↑	↑	↑	0	↑	0	↑	0	0
Env. education & awareness	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
Activities of major groups	↑	↑	↑	↑	↑	↑	↑	↑	0	0
Int'l conventions (participation)	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Subregional cooperation	↑	↑	↑	↑	↑	↑	↑	↑	0	0
Note:	↑	Increase			↓	Decrease			0	No change
	0	Slight increase			0	Slight decrease				

117. Massive growth in urbanization is another critical challenge. On the positive side, it could promote economies of scale, elevate life expectancy and increase social opportunities. All these could contribute to better chances for sustainable development. On the negative side, the rapid growth of cities will compromise further the already overstretched capacities of local governments to provide infrastructure and job opportunities fast enough to enable the new settlers to enjoy some of the advantages of urban life. Even now, life in many urban slums is more horrifying than in the depressed rural areas.

118. The rapid urbanization and industrialization will also increase the demand for infrastructure. According to ADB, Asia will be spending about US\$1.5 trillion on infrastructure in the next decade, which is roughly 15 to 20 per cent of the global savings. The inertia of present-day man-made systems, and the complexity of their inter connection with one another and with the natural spheres, preclude the easy achievement of sustainable development for the region within the next two generations.

119. The material system or the man-made infrastructure for producing goods that include energy, food and water, together with a large range of metallic, non-metallic and organic substances and the products derived from them, is likely to exert great stress on the natural systems due to the inherent anthropogenic destabilizing forces. The consumption of commercial energy, which is vital to the material system, will rise rapidly. It almost tripled during the period from 1970 to 1990, despite the oil price shocks. By 2010, the region will be the largest consumer of commercial energy in the world. In the face of the current low-level of energy consumption in the region, even a development strategy that is perfectly in line with the agenda for sustainable development is likely to result in an increasing use of energy for at least two more generations, in terms of both absolute and per capita consumption. Therefore the starting premise of any policy agenda for sustainable development should be that the energy consumption per capita will increase almost universally in the region. Given the target of larger GDP per capita, the choice is not the scale but the types of energy systems or energy mix, utilized, and recovery through conservation.

120. In terms of food, the material system of the region has adjusted to the challenge of increasing population by intensified agriculture, through the increase in irrigated land area, the use of fertilizers and mechanization, and the expansion of fisheries and aquaculture. Although a portion of the fisheries production was exported by some countries of the region, the resulting revenue earnings may have been utilized in importing other basic food commodities such as grains. Whether these strategies will continue to work satisfactorily will be a major challenge for sustainable development in the region in the next few years.

121. The ingredients critical to meeting the challenge of producing enough food will be fertilizers, irrigation and containment of land degradation. In the next two generations, fertilizer and agrochemicals will not be the limiting factors, in view of the availability of natural gas and deposits of phosphates, potash and other chemicals. The main issue in this regard will be the increasing vulnerability of high-yield crop varieties to pesticide-resistant pests, the degradation of soil due to the misuse of chemical fertilizers, and the growing risk to human health. Water will be the key limiting input in further intensification of agriculture, particularly in the populous and relatively arid areas. The demand will be for much larger irrigation systems. One of the biggest development challenges in many countries of the region will be how to allocate water, in places where it is scarce, among the various sectoral users. Water allocation depends primarily on the general development strategy and traditional patterns of water use. In many countries the pricing of water is not determined by market forces, and various kinds of subsidies abound.

122. The outstanding feature of the material system is undeniably pollution. As the material inputs expand, the pollution load in terms of direct discharges in all the natural spheres will inevitably increase, with a correspondingly high cost to human health. About three quarters of all toxic emissions come from just four primary industries: plastics, paper, chemicals and metals. Open-pit mining for metals has ruined whole mountains and large areas in the Pacific islands. Many Asian countries could be next unless proper mitigating measures are enforced. Mining is now moving debris, sediments and soils in volumes that are larger than those carried by the all rivers of the world. In the industrial sector, tourism was previously regarded as a cleaner form of industry. However, its fast growth has brought new environmental threats, along with additional employment, increased flow of foreign exchange and improved infrastructure in and around resorts. It has been responsible for causing damage to important ecosystems in the region, such as mangroves, coral reefs, lakes and forests. Increased tourism traffic, the growth of mega-size resorts and newly emerging golf tourism in the region are causing major environmental management problems in the form of resource loss and pollution, together with pressure on local ways of life, social values and cultural ethos, which is the equivalent to social pollution.

123. Despite the escalating regionwide pollution and deterioration of natural systems, which can be traced back to the way the material system operates, the prices of raw materials have continued to fall. Clearly, the sharp rise in demand for natural resources and the costs of pollution are not being reflected in the prices of commodities. The capabilities of market forces are not being utilized to solve this problem due to the weak position of commodity-producing countries. This disparity raises the most critical trade-related challenges to sustainable development in the poor countries. It reflects the highly unequal economic bargaining power of the industrialized and developing countries that results in highly skewed terms of trade in favour of the already rich nations. It implies that

resource exporting countries must export more to maintain the same level of earnings, which equates to more extensive logging, the intensification of agriculture or greater volumes of raw material exports. Further, the consumption patterns in the affluent countries not only appear self-indulgent but encourage similar patterns in the developing countries. This is already evident in the rapid rise of personal ownership of automobiles which are now choking the cities of Asia. The national indebtedness of developing countries severely constrains their abilities to implement sustainable development programmes. Debt service sometimes balloons to critical proportions, fanning inflation, increasing poverty and threatening political stability.

124. The focus needs to be placed on fostering regional and international cooperation, and on reaching a new level of understanding among nations. Sustainable development is a global issue because the political economy that governs man-made systems can no longer be treated separately from the natural spheres which, in turn, embrace all countries. The strong and indestructible linkages can be discerned from the emerging global problems of ozone depletion, climate change, associated sea-level rise and the loss of biodiversity. Regional and subregional cooperation is essential as can be seen from commonality of priority problems (table 9). It could lead to rational utilization of all natural resources and the development of sustained land-use systems, the protection of forest and the conservation of biodiversity, as well as the formulation and implementation of complementary strategies for resource management, and the control of pollution and land degradation.

125. At the international level, the ubiquitous issue of socio-economic disparities between rich and poor countries continues to surround and obfuscate debates in financing global initiatives on environment. In almost all the discussions on new conventions and protocols, the most contentious issues are inevitably those relating to financing and technology transfer. Although Agenda 21 recognizes the principle that industrialized countries should bear the greater burden of meeting international environment objectives, the translation of this principle into specific mechanisms and monetary values is often difficult, unable to rise above narrow self-interests of States. Unless confronted with a clear and urgent crisis like the ozone hole, the problem of financing can make negotiations tragically slow.

126. The multitude of problems outlined above raise the important question concerning the real prospects of sustainability: can countries of the region reach their desired level of quality of life within the next two generations? The answer has to be yes, not because of blind optimism but because of previously demonstrated ingenuity, resiliency and determination of the countries of the region. In the next two generations, which is the longest meaningful time-frame that can be used in looking at sustainable development, humankind will have the increasing capability and the means to solve the technical problems. The technological base and financial resources that spawn these problems will also lead to their solutions, provided technology and resources are made available

Table 9. Subregional priorities

Subregion	Priority areas													
	Land	Water	Forest and biodiversity	Marine environment	Energy	Food	Population	Poverty	Consumption	Pollution	Natural disasters	Climate change	Solid and hazardous waste	Water supply and sanitation
N.E. Asia	x	x		x	x		x		x	x	x	x	x	
S.E. Asia	x		x	x				x		x			x	x
Small island States		x	x	x	x						x	x	x	x
South Asia	x	x	x	x	x	x	x	x		x	x		x	x
Central Asia	x	x			x	x				x			x	x
Australia/New Zealand	x		x	x	x				x	x				

* Indicates priority.

through international cooperation in the spirit of global partnership for sustainable management of shared resources.

127. The issues and problems analysed in this document detail the environmental and developmental challenges which will face the region by the turn of the century, in terms of policy and implementation. The strategies and programmes by meeting the challenges outlined in this synthesis have been identified in the Regional Action Programme and in other documents presented for the consideration of the Ministerial Conference on Environment and Development in Asia and the Pacific.

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