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Bangkok

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

(Item 4 of the provisional agenda)

STATE OF THE ENVIRONMENT IN ASIA AND THE PACIFIC: EXECUTIVE SUMMARY

Note by the secretariat

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Introduction

1. Based on a region-wide survey and assessment of the state of the environment, this report identifies the pressing environmental problems in the Asian and Pacific region, touches upon the national and regional responses to these problems and finally deals with the future outlook in terms of environmental challenges in the 1990s and a direction for policy orientation. The report cannot be claimed to present an adequate picture of the emerging mosaic of national and regional environmental conditions and trends, as it deals with a region characterized by wide geographical and ecological diversity and frenetic dynamism and change in economic and social structure. A separate, more comprehensive report on the state of the environment in Asia and the Pacific is being published and will be circulated to the participants at the Ministerial-level Conference on Environment and Development in Asia and the Pacific, to be held at Bangkok from 10 to 16 October 1990.

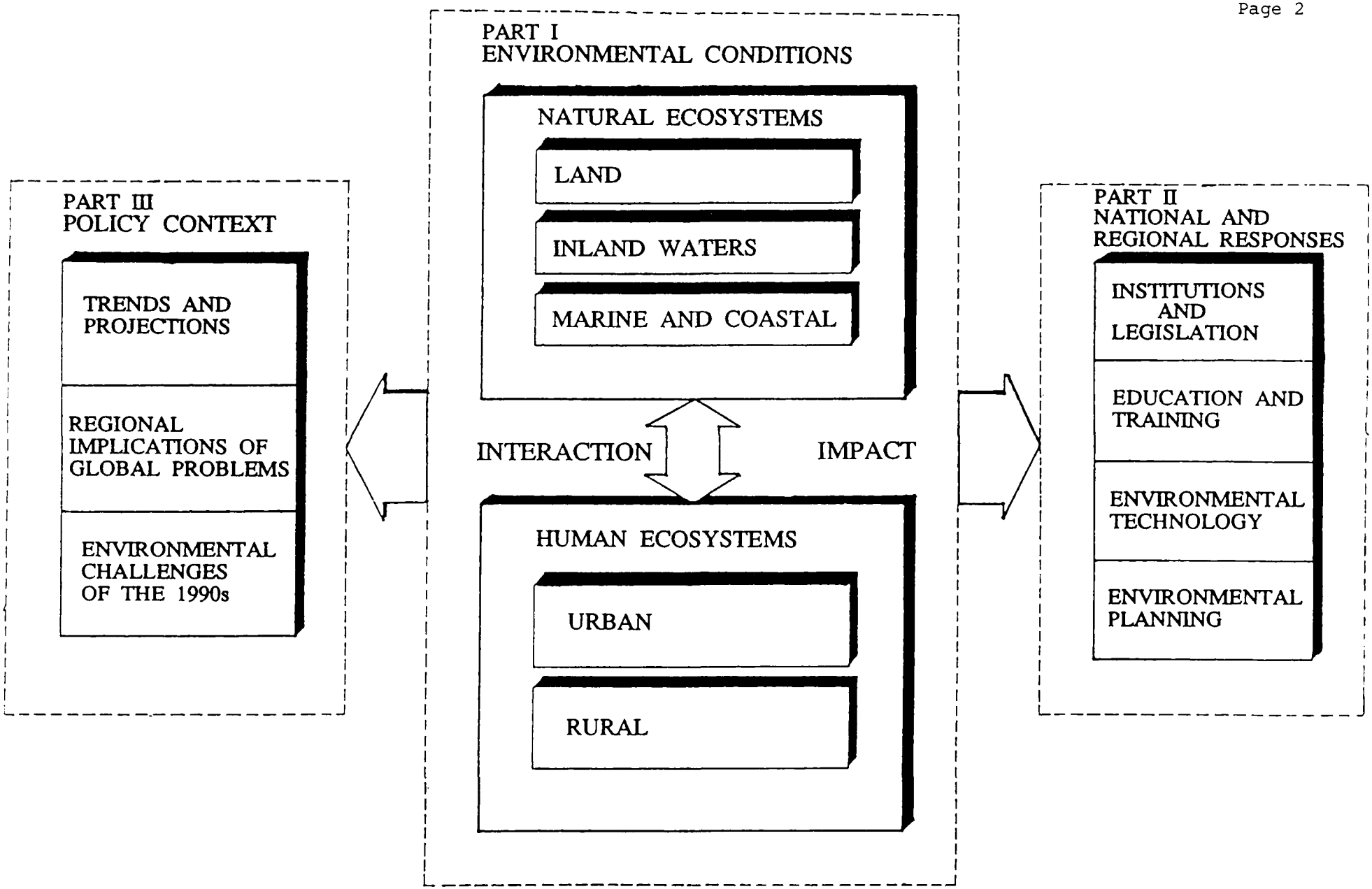
A. Framework of the report

2. The conceptual framework of the report is based on the self-evident paradigm that environmental conditions arise out of the interaction between natural and human ecosystems, as shown in figure I. The exploitation of natural resources, if not ecologically sound, could have repercussions in human ecosystems and on human welfare. Inversely, the pathologic growth of human ecosystems, as in the case of rapid urbanization, could lead to the deterioration of natural ecosystems.

3. After a brief introduction to the region and its resources, the environmental conditions and trends in both natural and human ecosystems are presented. The principal natural ecosystems delineated are the land, inland waters and the marine environment. The human ecosystems are conceived as being made up of the urban and rural environments. Environmental conditions in the natural ecosystems have been assessed by their biophysical status in terms of indicators of quality and quantity, while the case of the human ecosystems has been complemented by indicators of human and social well-being.

4. Changes in the natural and human ecosystems have provoked and continue to impel States and organizations to take corrective and preventive measures. Part III of this report attempts to provide a resumé of the national and regional responses to emerging environment and development

/Figure I.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issues. It is divided into four sections: Environmental institutions and legislation, Environmental education, communication and awareness, Environmental technology and Environmental planning. Up-to-date coverage of these topics is nearly impossible because of rapidly changing situations and it is with this limitation that the present status and trends in these areas have been presented in this report.

5. The interaction between natural and human ecosystems not only provokes regional and national responses but also generates a policy environment that could guide the design of action programmes. This is the subject of part III of the report, which has three main sections. The trends in demography, economic development, natural resources and environmental quality and the interactions among these trends which are the essential inputs for the formulation of policies are discussed in the first section. The global environmental conditions which affect and are affected by the regional situation are considered in the second section, while the final section provides a synthesis of the environmental challenges in the 1990s.

B. The region and its resources

6. Some of the world's greatest store of natural wealth is to be found in the lands, seas and wetlands of the Asian and Pacific region. The region covers almost one half of the earth's surface but contains 23 per cent of the world's land. It encompasses over 30 per cent of the world's agricultural land and over 16 per cent of its forested areas. The world's biggest forest biomass of closed tropical forest, consisting of about 300 million hectares, is in countries of the ESCAP region and covers about a third of the land surface. In its marine environment, the region contains over two thirds of the world's coral reef and about a third of the mangroves. There are over 60 species of mangroves in the region, with the largest single patch in the world at Sunderban in Bangladesh. The countries of the region are home to 2.9 billion of the world's 5.2 billion people (about 55 per cent), produce 44 per cent of the world's cereals, 26 per cent of the world's meat, 43 per cent of the world's total fish and 31 per cent of the world's roundwood.

I. ENVIRONMENTAL CONDITIONS AND TRENDS

7. This part of the report describes the salient environmental conditions and trends in various ecosystems. Hopefully, the analysis contained in this section may assist in the formulation of policy options that are "source-oriented". Sources of environmental problems could come from any level - local to global - and effects could also migrate from one level to another. This is an important factor in policy analysis because the effect that migrates from the purely local to the global level implies that the costs that should have been paid by local polluters will have to be shared internationally. An example of this is the local use of fossil fuel, which could ultimately lead to global warming.

A. Land

8. The prediction of the 1985 state of the environment report on the deteriorating trends in terrestrial or land ecosystems appears to hold true in its totality in the year 1990. Deforestation appears to have increased, deterioration of rangelands persists, land degradation continues and the threat to biodiversity and wildlife in the region has enhanced. On the positive side, growing awareness and appreciation of the problems, successes, no matter how small, in tree planting, land reclamation and the promotion of protected areas/biosphere reserves have raised some degree of optimism for the future.

Deforestation

9. The distribution of forest cover is very uneven in the ESCAP region. It varies from over three quarters of total land in some countries such as Cambodia and Papua New Guinea to less than 5 per cent in Afghanistan and Pakistan. The per capita forest availability ranges from 0.02 hectares in Bangladesh to 10.8 hectares in Papua New Guinea.

10. The rapid loss of forest cover is possibly the most serious environmental threat in the region. According to FAO, the average annual rate of deforestation for all tropical forests in the region in the 1970s was 2.0 million hectares per year. For closed tropical forests it was 1.8 million hectares per year, or about 5,000 hectares per day. If this trend continues, another 18 million hectares of closed forests, or about 6 per cent, will be lost by the year 2000. The average deforestation rate for tropical Asia was about 0.6 per cent. Among the subregions, the rate was highest in continental South-East Asia, where it was 0.9 per cent, while of the countries, Nepal had the highest estimated deforestation rate at 3.9 per cent annually (table 1).

/Table 1.

Table 1. Deforestation in tropical countries, 1981-1985

	Annual rate of deforestation 1981-1985 (Percentage)	Area deforested annually (Thousand hectares)
Group I (High rate of deforestation with significant losses of forest area)		
Lao People's Dmocratric Republic	1.2	100
Malaysia	1.2	255
Nepal	3.9	84
Sri Lanka	2.1	58
Thailand	2.4	252
Group II (Low rates of deforestation with significant losses of forest area)		
Cambodia	0.3	25
India	0.2	147
Indonesia	0.5	600
Myanmar	0.3	105
Papua New Guinea	0.1	22
Philippines	0.7	91
Viet Nam	0.6	65
Group III (High rate of deforestation with relatively small losses of forest area)		
Brunei Darussalam	2.2	7
Group IV (Low rates of deforestation with small losses of area)		
Bangladesh	0.4	8
Bhutan	0.1	2
Pakistan	0.2	7

Source: Adapted from the International Institute for Environment and Development are World Resources Institute (1986), quoted in Repetto R and Gillis, Public Policies and the Misuse of Forest Resources, (New York, 1988).

Unsustainable land use

11. The principal factor contributing to deforestation has been a unidirectional land-use change in favour of cropping. The croplands in the region increased at the rate of 1.25 million hectares per annum between 1850 and 1950 (figure II). From the middle of the present century to 1976, however, the expansion in croplands shot up to 4 million hectares annually. Since then, it has levelled off to about one million hectares per year in the wake of diminishing forest. There is a close relationship between cropland expansion and deforestation, as can be seen from figure III.

Land degradation

12. Unsustainable land use is the principal cause of land degradation in the Asian and Pacific region. Deforestation, overstocking and overgrazing, and undesirable irrigation practices, such as overwatering without the provision of outlets for excess water, have all contributed to land degradation. The majority of developing countries in the region have undergone extensive land degradation and desertification. The area of degraded land is very difficult to estimate, particularly since degradation can be manifested in varying degrees, ranging from light and moderate to severe. Some estimates are given for selected countries in table 2. While they may lack precision owing to the difficulty of obtaining accurate data, they give some idea of the extent of the problem. The country with the greatest overall amount of degraded land is China, while India and Viet Nam have the highest ratios expressed as percentages.

13. The extent to which desertification, an extreme form of land degradation, has occurred in the region is evident from figure IV, which indicates that all main types of land use have their share of degraded land. Rangeland is the worst affected. According to rough estimates, more than 860 million ha of productive land in the region, including degraded forest and woodland, have been affected by desertification. At the regional level, the scale is exceeded only by Africa. The estimated number of people directly affected by desertification in the region is close to 150 million out of a corresponding world total of 300 million. If desertification is judged by its human dimension, this is clearly the most seriously affected region in the world.

/Table 2.

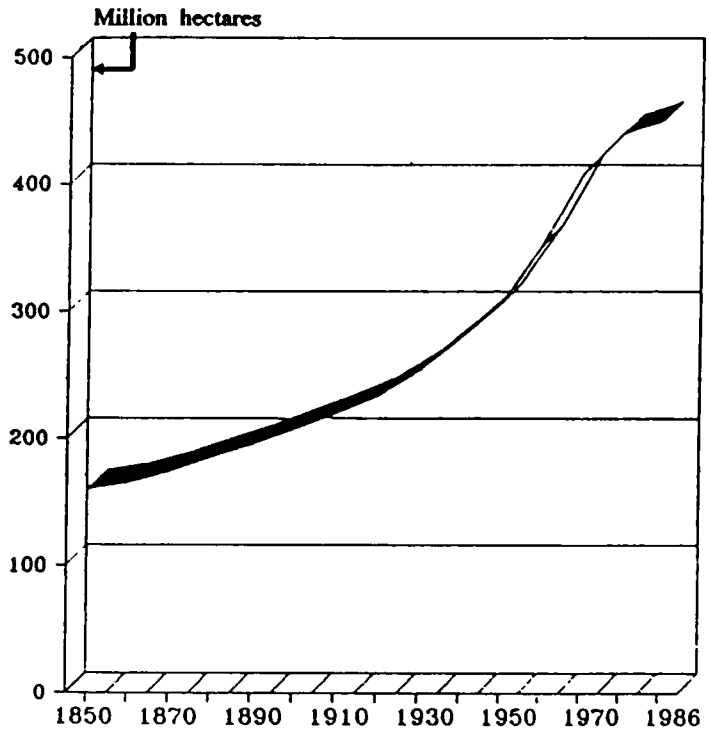
Table 2. Estimated extent of degraded land in selected countries in the Asian and Pacific region

Country	Total land area (Thousand ha)	Estimated degraded land area (Thousand ha)
Bangladesh	13 391	989 (7.4)
China	932 641	280 000 (30.0)
India	297 319	148 100 (49.8)
Indonesia	181 157	43 000 (24.0)
Lao People's Democratic Republic	23 080	8 100 (35.0)
Myanmar	65 754	210 (3.2)
Pakistan	77 088	15 500 (17.3)
Philippines	29 817	5 000 (16.8)
Samoa	283	32 (11.3)
Sri Lanka	6 474	700 (10.8)
Thailand	51 089	17 200 (33.7)
Tonga	72	3 (4.5)
Viet Nam	32 536	15 900 (48.9)

Source: FAO, Environment and Agriculture, Bangkok, 1989.

Note: Percentage of categories of land of the total land area is shown in parentheses.

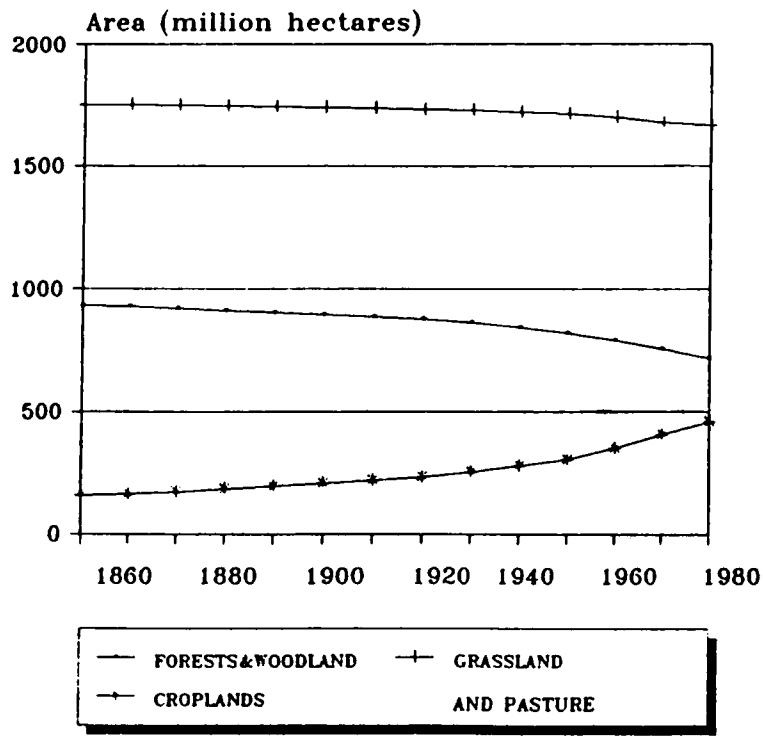
Figure II. Increase in cropland in the Asian and Pacific region, 1850-1986



Source: 1. World Resources Institute, World Resources 1988-89.

2. FAO, Selected Indicators on Food and Agriculture in Asia and the Pacific, 1977-87.

Figure III. Land-use changes in the Asian and Pacific region, 1850-1980



Source: Based on data from the World Resources Institute.

Figure IV (a). Land affected by desertification in the Asian and Pacific region

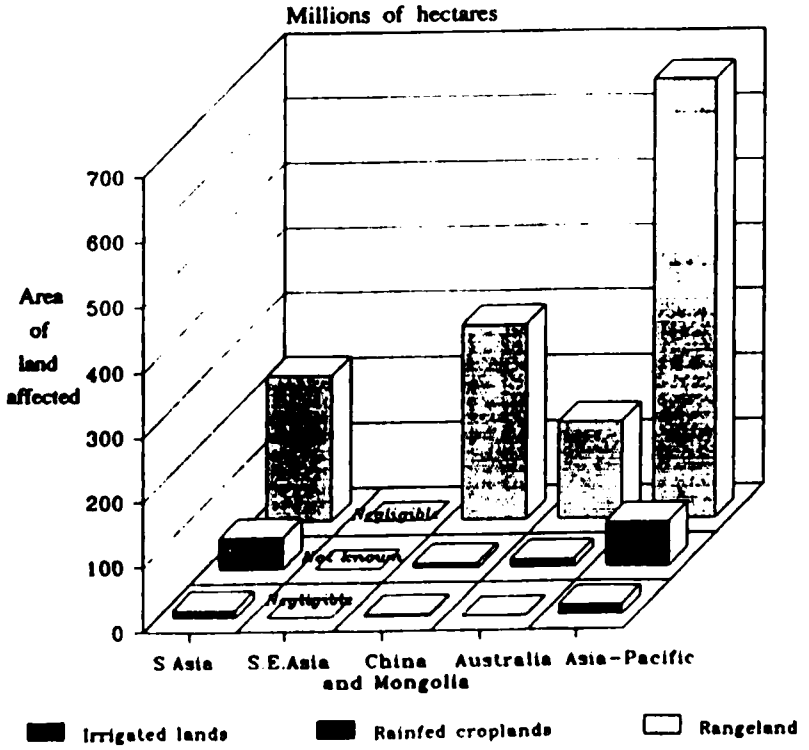
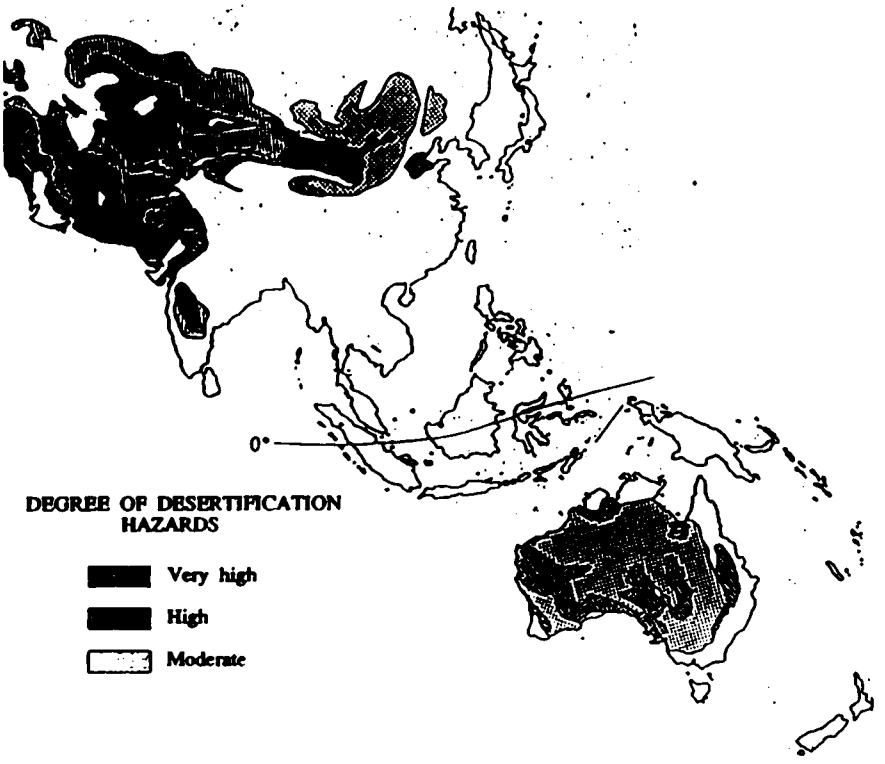


Figure IV (b). Desertification hazards in arid and semi-arid areas of the ESCAP region



Source: UNEP, Voices from the Desert (1985).

Bio-diversity and wildlife plight

14. The region is rich in biological diversity - the variety of genes, species, communities, habitats and ecosystems. This wealth of bio-diversity is due to the vast geographical extent of the region and its varied climatic regimes. Some examples are the relict wet forests of Sri Lanka and the monsoon forests of the Himalayas, Borneo and the Philippines. The Australian lowlands and some of the South Pacific islands have high degrees of endemism and bio-diversity.

15. Since only 1.5 million of the estimated 5 to 30 million species on earth have been catalogued, it is difficult to determine the actual rate of species extinction. However, habitat loss, which is an indicator of the situation of wildlife, shows that 68 per cent of the original wildlife habitat in the Indo-Malayan realm alone has been lost. Table 3 shows the magnitude of habitat destruction in the region. The situation is extremely grave in some countries such as Bangladesh, where as much as 94 per cent of the habitats have been destroyed. A reduction in the area of a habitat usually initiates the process of extinction. This is the case for the primates of South-East Asia, whose population has been declining. The extinction of species is becoming a critical problem in the region. According to the International Union for Conservation of Nature and Natural Resources (IUCN), over 600 animal species and over 5,000 plants in the ESCAP region are rare or threatened.

B. Inland waters

Trends and situation

16. Over-exploitation, growing pollution and destruction of wetlands are the major indicators of deterioration of inland waters in the Asian and Pacific region. Efforts to improve the situation have led to some fiscal (application of the "polluter pays" principle) and legislative measures in recent years in South-East and East Asia. The decision has also been made to take specific measures for river clean-up in some countries. The Ganga Action Plan in India is an example. Such efforts, though they raise a certain degree of optimism, are still by no means adequate considering the enormity of the problem.

/Table 3.

Table 3. Wildlife habitat loss in selected countries or areas of the ESCAP region, 1986[a/]

	Original wildlife habitat (square kilometres)	Amount (square kilometres)	Habitat loss (percentage)
Bangladesh	142 776	8 567	94
Bhutan	34 500	22 770	34
Brunei Darussalam	5 764	4 381	24
Cambodia	180 879	43 411	76
China[b/]	423 066	164 996	61
Hong Kong	1 066	32	97
India	3 017 009	615 095	80
Indonesia	1 446 433	746 861	49
Japan[c/]	320	138	57
Lao People's Democratic Rep.	236 746	68 656	71
Malaysia[d/]	356 254	210 190	41
Myanmar	774 817	225 981	71
Nepal	117 075	53 855	54
Pakistan	165 900	39 816	76
Philippines	308 211	64 724	79
Sri Lanka	64 700	10 719	71
Taiwan Province of China	36 961	10 719	71
Thailand	507 267	130 039	74
Viet Nam	332 116	66 423	80
Total	8 169 860	2 487 653	69

Source: John Mackinnon and Kathy Mackinnon, Review of the Protected Areas System in the Indo-Malayan Realm, International Union for Conservation of Nature and Natural Resources and United Nations Environment Programme (Gland, 1986), pp. 18-19 and 247-274.

Notes: a/ Excluding Christmas and Cocos Islands, Maldives, and the Chagos archipelago.

b/ Tropical portion (i.e. area south of Yunnan high hills, including the southern coastal strip and the island of Hainan).

c/ Tropical portion only (i.e. southern Ryukyu archipelago).

d/ Including Singapore.

Excessive withdrawals

17. Rivers and lakes are the main sources of the fresh water used in the ESCAP region, but a substantial part also is withdrawn from underground reservoirs. A critical level of exploitation of water resources is reached when more than a third of the per capita available water is utilized. In some arid countries like the Islamic Republic of Iran and Pakistan, this threshold has already been exceeded (figure V). In several countries, over-exploitation of ground water has created environmental problems ranging from production losses and land subsidence to salt water intrusion and ground water pollution. Countries affected by these problems include Australia, China, India, Indonesia, Pakistan, the Philippines, Thailand and Viet Nam and numerous island countries such as Fiji, Guam, Japan, Kiribati, Maldives and New Zealand.

18. With the increasing demand for water, a number of dams have been constructed. The number of dams over 15 metres high increased from 1,717 in 1950 to over 23,000 in 1982. Most of these projects had an environmental impact, such as sedimentation, inundation, habitat change and land degradation, particularly because environmental considerations were not included in the formulation and implementation of these projects.

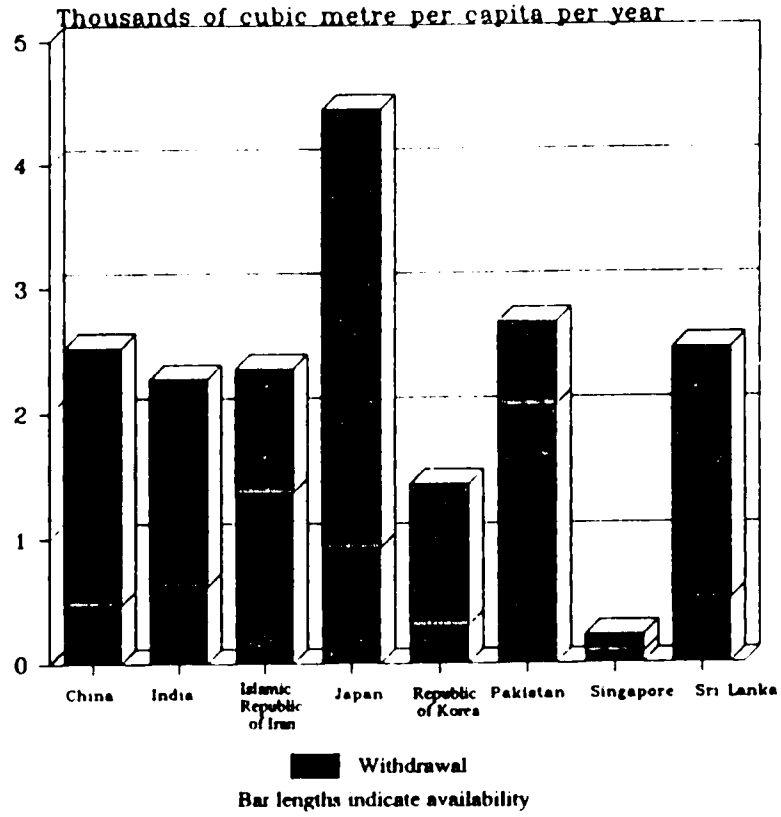
Water pollution

19. Water pollution stems mainly from domestic wastes, industrial effluents, mine tailings, and agricultural run-off. In many of the developing countries of the region, domestic sewage is released untreated or only partially treated into the waterways. Organic wastes and suspended solids are therefore the main water pollutants, but rapid industrialization in the region has resulted in the increasing presence of toxic and hazardous substances. Agro-industries, such as sugar and palm-oil mills, and the chemical industry, including pulp and paper mills, contribute significantly to the pollution of many rivers and lakes. A large number of small and medium-sized industries in the region, which have neither the financial nor technical means to treat their effluents, have also contributed considerably to water pollution.

20. According to analytical data from the Global Environmental Monitoring System (GEMS), bacteriological contamination of water resources as measured by indicator organisms is common not only in the Asian and Pacific region, but in all parts of the world where municipal sewage is

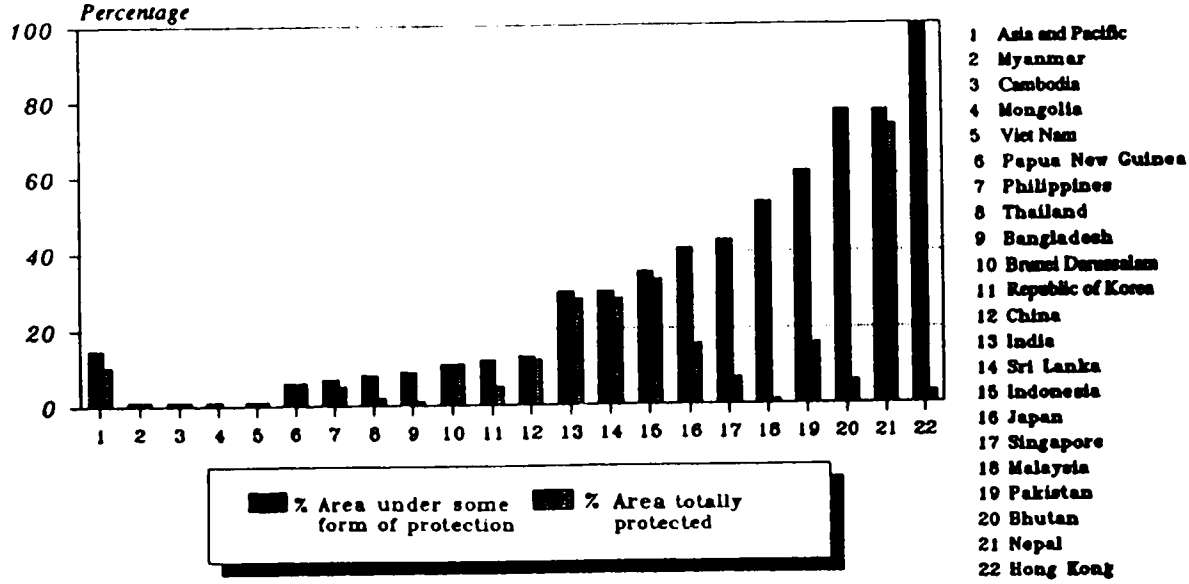
/Figure V.

Figure V. Water availability and withdrawals in selected countries of the ESCAP region



Source: World Resources Institute, World Resources 1988-89.

Figure VI. Status of wetlands protection in the Asian and Pacific region



Source: A.D. Scott and C.M. Poole "A Status Overview of Asian Wetlands" Asian Wetland Bureau, Kuala Lumpur, 1989.

released without proper treatment (table 4). In terms of health risks, however, the high faecal coliform counts in rivers of the developed world may have little impact since the majority of municipal water supplies are treated and disinfected. In large parts of the ESCAP region where this is not the case, high coliform counts undoubtedly contribute to the high morbidity and mortality rates among infants, through diarrhoea and other gastrointestinal infections. Although World Health Organization guidelines for safe drinking water call for 95 per cent of all samples to be free from faecal coliform bacteria, few countries of the ESCAP region can meet this standard. Twenty per cent of the rivers sampled by GEMS have a high or very high coliform content. Problems still exist in even the most developed countries, particularly with regard to untreated or partially treated rural water supplies. In the case of chemical pollution, the situation is worse in underground water than in rivers because of the larger retention time. Therefore if ground water becomes polluted it will remain so for several decades.

Wetlands

21. Wetlands are unique ecosystems in themselves. Essentially they are swamps, marshes, estuaries, mud flats, peatland and other similar areas. These areas are now recognized to be of great value in chemical and biological recycling. They harbour a rich diversity of life forms, filter pollutants and act as reservoirs of nutrients in food chains. Wetlands play a key role in flood mitigation by preventing erosion and maintaining water balance. They are crucial to millions of waterbirds, which migrate from the wetlands of North Asia to South Asia and Australia, and also to the preservation of biological diversity.

22. Despite their multiple utility, wetlands have been a major target of land reclamation. They have also been subjected to pollution and sedimentation. The severity of threats to wetlands of international significance in countries of the ESCAP region is shown in table 5. The pressure on such wetlands appears to be particularly severe in Bangladesh (80 per cent under moderate to severe threat), Malaysia (86 per cent), the Philippines (69 per cent) and Sri Lanka (68 per cent), while in Cambodia, Indonesia, Japan, the Lao People's Democratic Republic, Myanmar, Pakistan, the Republic of Korea and Singapore, at least 50 per cent of all sites are under moderate to severe threat. It is only in Mongolia and Papua New Guinea that the wetlands are still relatively safe, with less than 20 per cent under moderate to severe threat.

/Table 4.

Table 4. Faecal coliforms in rivers monitored by the Global Environmental Monitoring System (GEMS)

Number of faecal coliforms per 100 ml	Number of rivers in each region[a/]			
	North America	Central and South America	Europe	Asia and Pacific
10	8	0	1	1
100	4	1	3	2
1 000	8	10	9	14
10 000	3	9	11	10
100 000	0	2	7	2
	0	2	0	3
Total number of rivers	23	24	31	32

Source: UNEP/WHO, Assessment of Freshwater Quality, prepared in co-operation with the Monitoring and Assessment Research Centre, London, 1988.

a/ No data from Africa reported.

Table 5. Severity of threats to wetlands of international importance in Asia

	Number of sites known	Degree of threat				Per cent sites with moderate to high threat
		None	Low	Mod.	High	
Bangladesh	11	1	1	5	4	82
Bhutan	5	3	-	1	1	40
Brunei Darussalam	3	-	2	1	-	33
Cambodia	3	-	1	2	-	67
China	105	30	34	36	5	39
Hong Kong	3	1	-	2	-	67
India	88	4	44	22	18	45
Indonesia	129	1	54	66	8	57
Japan	38	8	11	17	2	50
Lao People's Democratic Republic	3	-	1	2	-	67
Malaysia	37	-	5	22	10	86
Mongolia	30	23	5	2	-	7
Myanmar	16	-	7	8	1	56
Nepal	14	2	7	4	1	36
Pakistan	42	1	20	15	6	50
Papua New Guinea	26	14	8	4	-	15
Philippines	49	2	13	24	10	69
Rep. of Korea	19	5	3	6	5	58
Singapore	6	-	2	3	1	67
Sri Lanka	31	2	8	13	8	68
Thailand	36	1	18	14	3	47
Viet Nam	23	3	14	4	2	26
Total	717	101	258	273	85	439

Source: Asian Wetland Bureau, A Status Overview of Asian Wetlands, Kuala Lumpur, 1989.

23. Only about 15 per cent of the internationally important wetlands in the ESCAP region have some form of legal protection (figure VI). In some cases there is a lack of protection of representative areas or systems, while in others protection is given only to a forest or similar reserve in the system. There is a need therefore to create adequate protected areas on the one hand and to upgrade the existing weak reserves on the other.

C. Marine and coastal environment

24. The open seas in the ESCAP region are relatively clean, except for floating tar found along shipping lanes. The problems are mainly in coastal zones, which are affected by man almost everywhere in two ways: (a) through alteration of habitat such as mangroves, coral reefs, sea grasses and destruction of such resources as fisheries, (b) through pollution of sea water by land-based domestic wastes, industrial effluents, sediment and agricultural run-off, as well as sea-based oil slicks from shipping lines and mining operations. Several positive steps have been taken in the region to conserve the marine resources through the enacting of legislation and the signing of international and regional treaties and conventions, as well as the establishment of marine parks and reserves and the preparation of coastal environmental management plans. Efforts are also being made to regulate the point sources of pollution. However, these efforts constitute only a fraction of what is needed in view of the magnitude of the problems.

Marine resources

25. The Asian and Pacific region is rich in coastal and marine resources. It has extensive areas of specialized ecosystems such as coral reefs, mangroves and sea grasses, as well as other wetlands at the interface of land and sea, such as estuaries, deltas, tidal flats, mud flats, marshes and lagoons, which form the habitats for sea life and are critical to their food webs, life cycle and productivity. Coral reefs especially are compared with tropical rainforests in terms of productivity and richness in species. For example, the 150 kilometre-long barrier reef surrounding the Republic of Palau in the Pacific has nine species of seagrasses, more than 300 species of corals and about 2,000 species of fish. Similarly, 80 genera and 500 species of coral have been reported from the Great Barrier Reef along the eastern coast of Australia. Coastal wetlands also provide shelter for migratory birds. A variety of products is obtained from these specialized ecosystems, ranging from food and fuel to industrial raw materials. In

addition, they have immense value for tourism. Furthermore, mangroves and coral reefs act as a buffer against tidal currents, floods, storm surges and tsunamis.

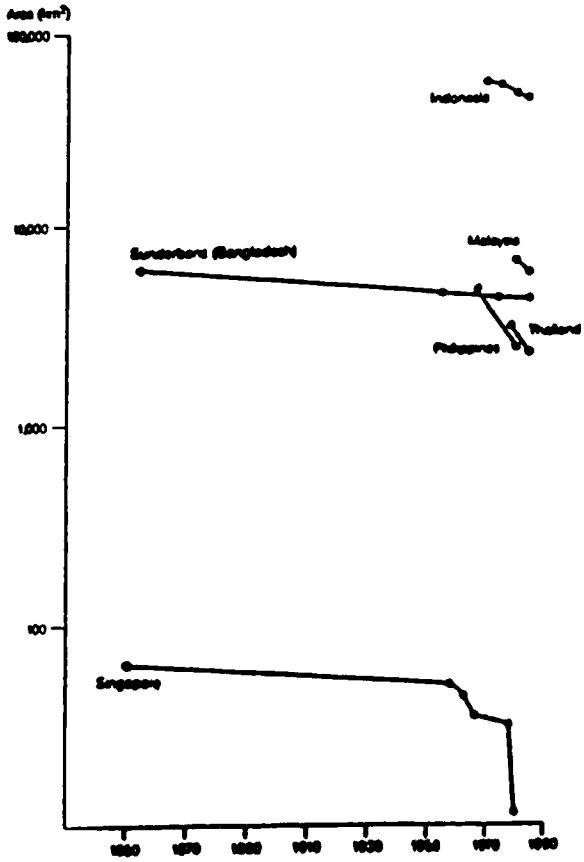
26. These important and productive coastal ecosystems, however, have come under serious threat because of increased human activities and in the name of coastal development and reclamation. Mangrove forests, for example, have been cleared to make ponds for fish and prawn aquaculture. It is estimated that 1.2 million ha of mangrove forests have been converted to aquaculture ponds. Figure VII provides some idea of the extent of destruction of mangroves in the region. Coral reefs are also being destroyed, directly to obtain construction and ornamental materials, and to build air strips, and indirectly by the use of explosives and pounding in fishing operations. The biggest threat to coastal wetlands, particularly those of international importance, is from the reclamation drive to meet the needs of a growing population.

27. Marine resources also provide food to the population in the ESCAP region in the form of fish, sea weed and molluscs, etc. The marine fish catch in the region in 1987 amounted to over 30 million tons, a substantial increase from the 1977 catch of 23 million tons. Despite the overall steady growth in the marine catch, FAO is pessimistic about the chances of sustaining large increases in the region. According to FAO, the time of spectacular and sustained increases in fisheries catches is over since almost all important stocks of demersal species are either fully exploited or overfished, and many of the stocks of the more highly valued species are depleted. Furthermore, reef stocks and those of estuaries and littoral zones are under threat from illegal fishing and environmental pollution. It is likely that, in the years to come, the effects of overfishing will be felt in areas of the region where overfishing and pollution combine to reduce the catch. Many species have already been overfished, for example penaeid and non-penaeid shrimps/prawns in South-East Asia. The production of both these groups declined during the period 1977-1985 (figure VIII) due to full harvesting and partial over-exploitation in the area.

28. Several minerals occur in the marine environment in the Asian and Pacific region. In terms of economic value, oil and gas contribute more than 90 per cent of all the mineral products that are currently extracted from offshore resources. In 1988, 11 countries in the region produced 109 tons of offshore oil and eight countries produced about 52 million cubic

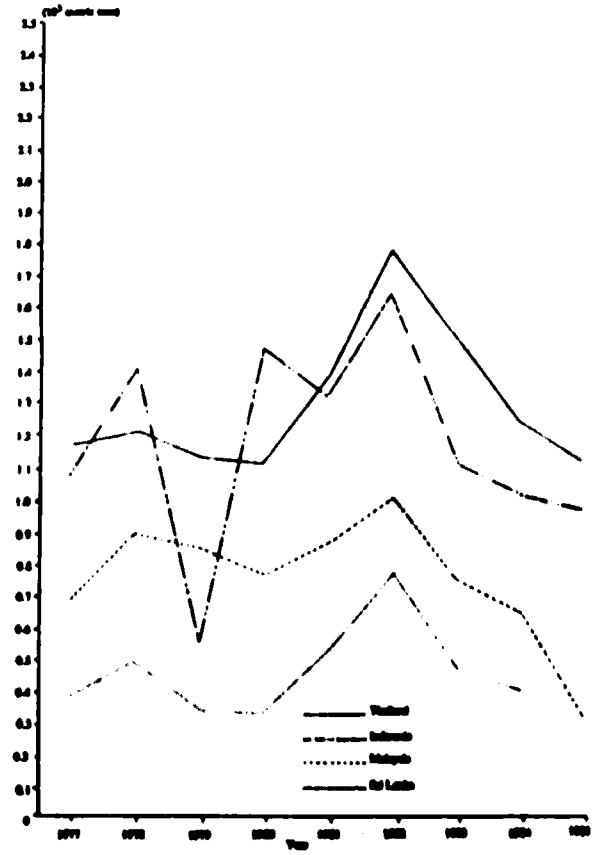
/Figure VII.

Figure VII. Trends in extent of decline in mangroves in selected countries of the ESCAP region



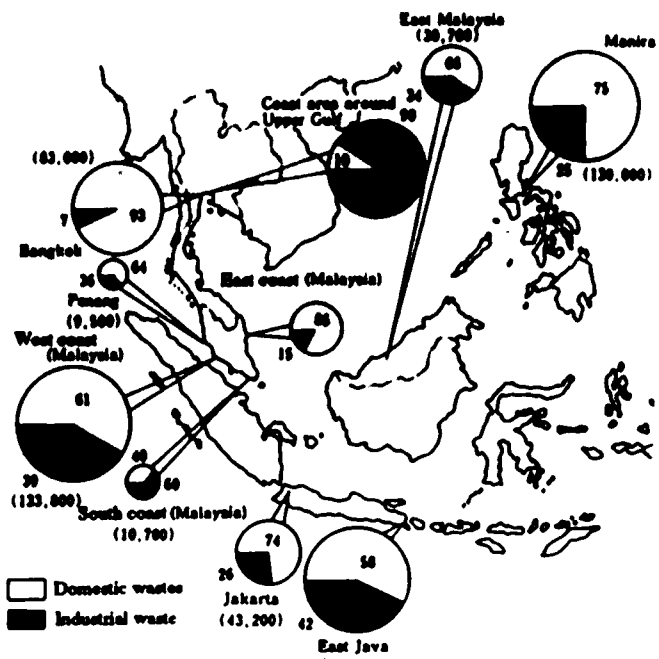
Source: World Resources Institute, World Resources 1994.

Figure VIII. Trends of landings of penaeid and non-penaeid shrimps in selected countries, 1977-1985



Source: FAO, Marine Fishery Production in the Asia-Pacific Region, Bangkok, 1989.

Figure IX. Land-based water pollution (BOD) from major cities and regions in South-East Asia, 1980



Source: UNEP/WHO, Preliminary Assessment of Land-based Sources of Pollution in East Asian Seas (1981).

metres of natural gas. With the increasing exploration and continued production, the region faces threats of marine pollution from accidental and chronic spill due to discharge and leakage from drilling installations. Construction of ponds by reclaiming mangrove for the extraction of salt from sea water is another problem which has affected large areas of coastal habitat in the region.

Marine pollution

29. Most of the wastes and contaminants produced by human activities in the ESCAP region eventually reach the sea. Every year, billions of metric tons of silt, sewage, industrial effluent, chemical residues and run-off from agricultural fields and urban streets pour into the marine environment. Rivers in South Asia alone carry 1.6 billion tons of sediment annually into the South Asian seas. Pollution from land-based sources, particularly sewage, is also a serious problem near harbours and megacities (figure IX). In the South Pacific, it has been conservatively estimated that over 70 per cent of human sewage finds its way into coastal waters without prior treatment. Places such as Port Moresby, Suva, and Majuro are particularly affected. The waters lapping the foreshore of Honiara, in Solomon Islands, support very high levels of faecal bacteria, arising from numerous raw sewage outfalls.

30. In some cases, aquatic life in the seas has been contaminated and has become a potential risk to human beings. In the coastal waters of Jakarta, for example, pathogens are reported in fish and shellfish; in the Straits of Malacca, high levels of coliform bacteria occur in shell-fish beds; and in the Gulf of Thailand, oysters and mussels are contaminated by sewage. An epidemic of hepatitis associated with the consumption of shellfish occurred in Hong Kong in 1988; nearly 1,400 cases were reported.

31. Over the past decade, over-enrichment of marine water and unusual algal blooms have been observed. Along the central and western Pacific coast of Japan, for example (where 72 million people live) above-normal nutrient contents are common and algal cell counts are 10 times those of 20 years ago. The incidence of "red tides", special plankton blooms, in which the dominant species is toxic, also seems to be increasing. The frequency of red tide blooms in Tolo Harbour, Hong Kong, for example, shot up from 2 in 1977 to 26 in 1986. These blooms pose a serious threat both to marine life and to human health through the food chain. They often kill marine

organisms, damage mariculture production and can kill or cause serious illness in human beings who consume shellfish in which toxins from red tides have accumulated.

32. Damage to marine birds and mammals and to beaches by plastic litter and tar balls from oil spills is a serious concern. Oil slicks along shipping lanes are also a chronic problem (figure X). Toxic metals are comparatively less pervasive, nevertheless their hazardous nature demands careful monitoring and control.

D. Urban environment

1. Urbanization trends

33. The urban population of the ESCAP region increased from 271 million in 1955 to 747 million in 1985 and is likely to reach 1.2 billion by 2000. In 1985 more than half of the world's 30 largest cities were in the ESCAP region. By 2000, there will be 28 megacities in the region and this number will increase to 52 in 2025 (figure XI). As the number of megacities increases, the relative number of people living in these cities will also increase. The increasing concentration of a very large number of people in a few places in the region is unprecedented and is putting further stress on already weak institutional and administrative systems. The challenges of sustainable urban environmental management are enormous.

2. Environmental problems and concerns

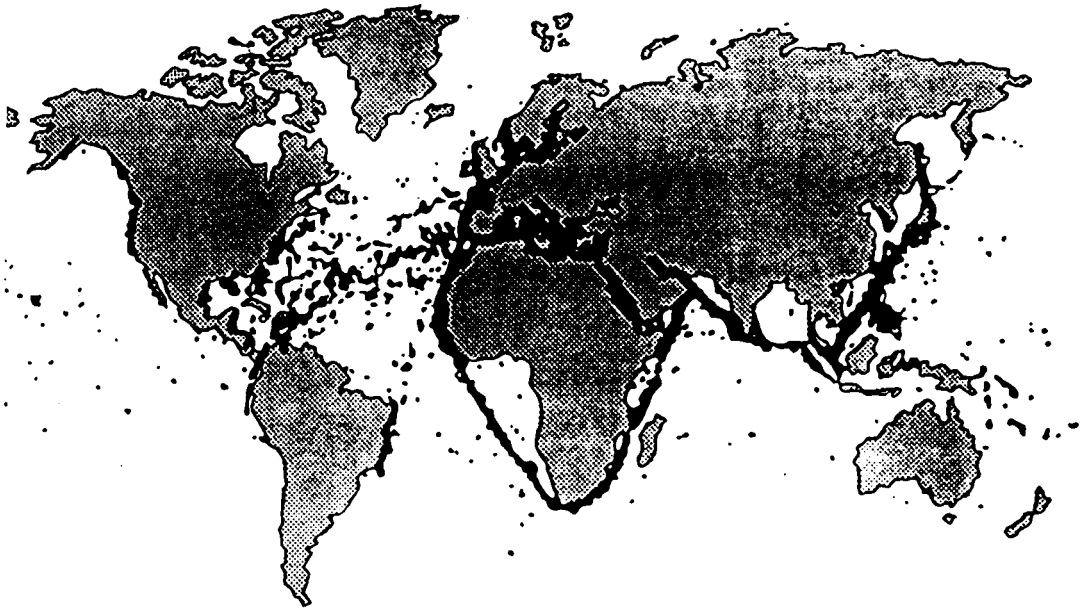
34. There are three main aspects of environmental problems associated with urbanization in the ESCAP region. The first concerns the land surrounding the cities, where urban expansion has resulted in the encroachment of rich agricultural land, as well as deforestation. The second relates to urban shelter and associated problems such as water supply, sanitation and waste disposal. The third aspect is that of the ambient situation, which is manifest in heavily polluted urban rivers, air pollution from dust, smoke and other particulates, as well as increased risks in mounting chemical and hazardous wastes.

3. Urbanization and the surrounding environment

Urban encroachment of agricultural land

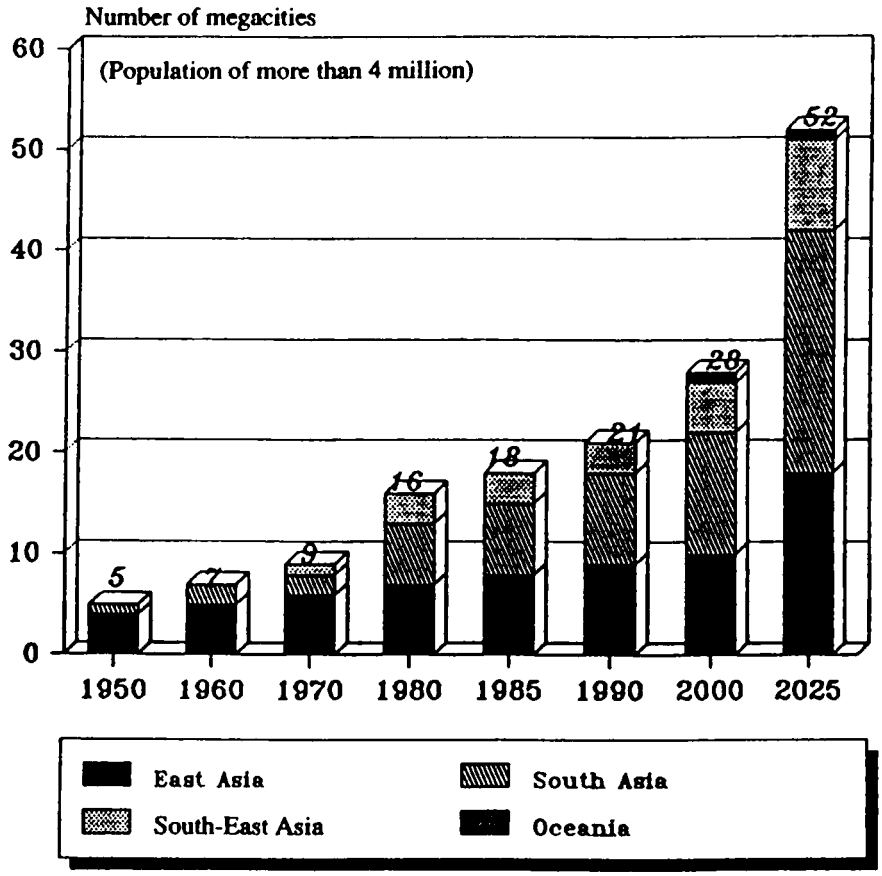
35. The conversion of natural and agricultural ecosystems to provide urban infrastructure, such as houses, roads and factories, is quite common in the region. The area most susceptible to urban encroachment is agricultural land, mainly because good flat farmland is also good building

Figure X. Oil slicks in seas during the 1980s



Source: Explicacion Al Reporte Bruntland, p. 31.

Figure XI. Increase in number of megacities in the ESCAP region, 1950-2025



Source: United Nations Centre on Human Settlements, Global Report on Human Settlements, 1986.

land. Long-term land-use records show that in 100 years (between 1880 and 1980) the built-up area in six countries of the ESCAP region increased from more than 2.5 times, in the case of Pakistan, to more than 11 times, in the case of Brunei Darussalam (figure XII). The trend was particularly high between 1950 and 1980, when buildings and infrastructure doubled in all of these countries and in the case of Brunei Darussalam even quadrupled. The projected increase in the built-up urban areas of selected cities in the region varies from 180 ha annually for Hong Kong to 2,900 ha annually for Bangkok (table 6). The main victim of this massive expansion is prime agricultural land.

Deforestation in urban fringes

36. There is evidence that considerable damage has also been done to forests in the areas surrounding cities. The country in the region with perhaps the best data on this process is India, where satellite images have been used to monitor deforestation. Between 1972-1975 and 1980-1982, the forested area within 100 km of the nine largest cities in India collectively diminished by one third (table 7). In well under a decade, the loss of forested area ranged from a comparatively modest 15 per cent decline around Coimbatore to a staggering 60 per cent around Delhi.

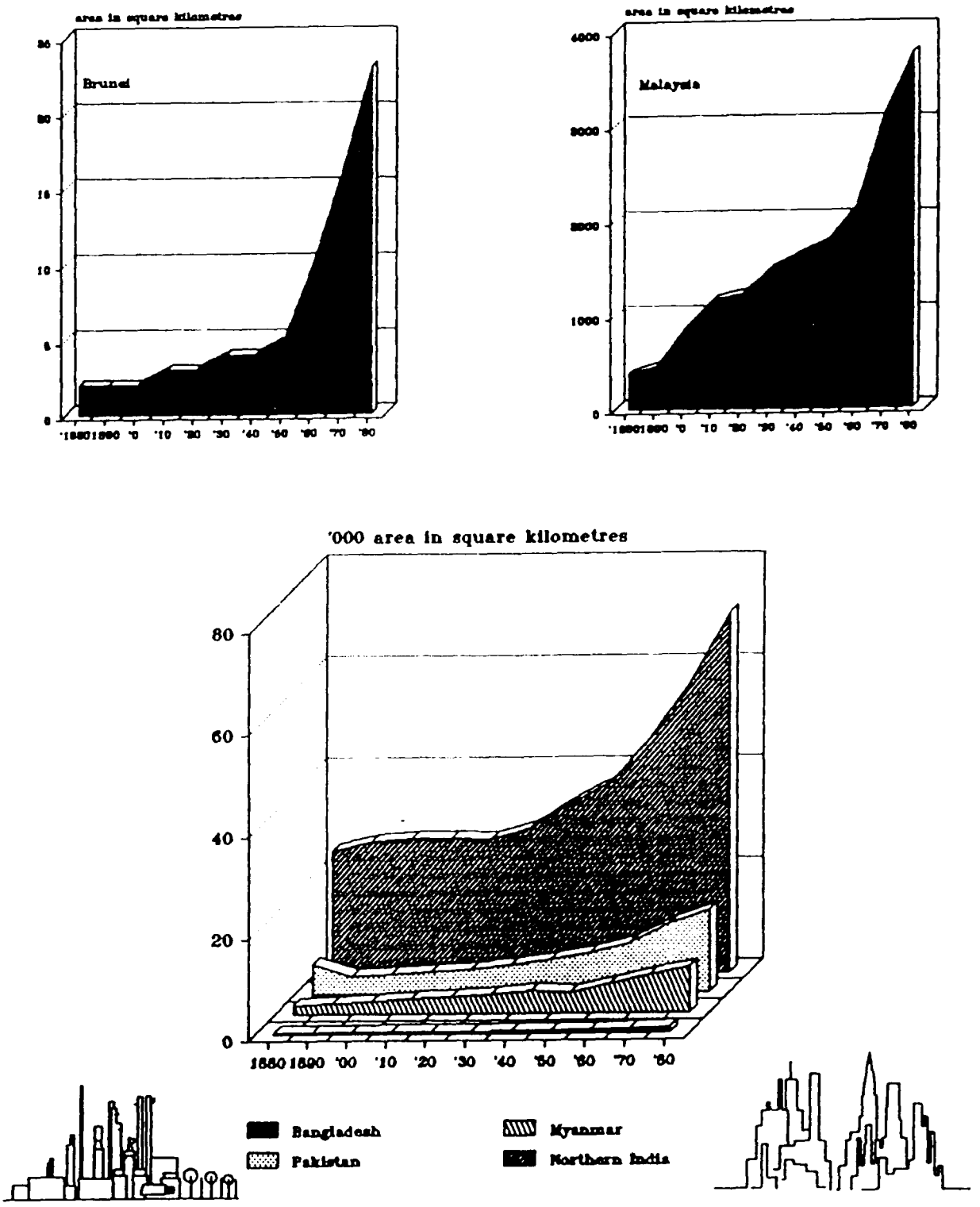
4. Shelter and the dwelling environment

Slums and marginal settlements

37. There are two major aspects of the shelter crisis in the cities of the ESCAP region: first, the backlog in the provision of housing, which has been increasing with time; and second, the infrastructural shortages, including water supply and sanitation, which have become chronic owing to the burgeoning urban population in recent years. The sector of society most affected by these problems is the urban poor. Over the years, the urban poor have provided and continue to provide their own shelter by land encroachment (squatting), constructing clusters of huts and shanties wherever and however they can. As a result, many countries of the ESCAP region are suffering from the spread of slums and marginal settlements. The percentage of the population inhabiting these marginal settlements ranges from 15 per cent in Singapore to over 50 per cent in Bombay and Delhi. In many cases, squatters encroach upon lands which are hazard prone, such as active flood plains. As a result, there are heavy losses of life and property in the event of flood disasters.

/Figure XII.

Figure XII. Increase in built-up area in selected countries of the ESCAP region, 1880-1980



Source: World Resources Institute, World Resources 1988-89.

Table 6. Projected increases in the built-up area of selected cities in the ESCAP region by the year 2000

	Initial period				Year 2000			Average annual compound growth rate (per cent)
					Increase in built-up areas			
	Year	Population (000s)	Built-up area (hectares)	Gross density	Population (000s)	Built-up area (hectares)	Annual (hectares)	
Hong Kong	1973	3 691	11 749	314	5 210	16 590	180	1.29
Ahmadabad, India	1980	2 451	10 073	343	5 196	21 380	665	3.83
Jakarta	1979	6 500	31 304	308	16 591	79 780	2 307	4.55
Colombo	1980	586	3 803	154	1 125	7 310	175	3.32
Tehran	1986	2 720	18 000	151	11 329	75 030	1 677	4.29
Bangkok	1981	5 331	44 428	120	11 936	99 470	2 897	4.33

Source: Adapted from UNCHS, Global Report on Human Settlements, 1986, p. 130.

Note: In calculating the estimated built-up area for the year 2000, densities are assumed to remain the same during the intervening period. Densities for regions were independently estimated, based on existing densities in towns of different sizes.

Table 7. Changes in closed forest cover around major cities in India, 1972-1975 to 1980-1982

City	1972-75	1980-82	Change (Percentage)
	(Square kilometres)		
Bangalore	3 853	2 762	-28
Bombay	3 649	3 672	-35
Calcutta	55	41	-25
Coimbatore	5 525	4 700	-15
Delhi	254	101	-60
Hyderabad	40	26	-35
Jaipur	1 534	786	-49
Madras	918	568	-38
Nagpur	3 116	2 601	-34

Source: B. Bowonder and others, Deforestation and Fuelwood Use in Urban Centres, Centre for Energy, Environment and Technology and National Remote Sensing Agency, Hyderabad, India, 1985.

Table 8. Selected tropical diseases: people infected[a/] by major region (Provisional figures for 1990 in thousands)

	Africa	Asia and the Pacific	America	Europe[b/]
Malaria	250 000	13 500	3 500	
Schistosomiasis	160 000	25 000	8 000	
Lymphatic filariasis	28 000	60 000	900	
Leishmaniasis	1 000	6 000	5 000	10
Leprosy	2-3 000	7-8 000	500-1 000	50

Source: World Health Organization, "WHO News Release", Regional Office for the Western Pacific, Manila, 1990.

Note: a/ Some people are infected with more than one disease.

b/ Imported cases not included.

38. Until the middle of the International Drinking Water Supply and Sanitation Decade (1981-1990), achievements in a number of countries in the ESCAP region were modest. Water supply coverage within urban areas in fact declined slightly during the first half of the Decade from 66 to 64 per cent, despite the provision of the service to an additional 43 million city dwellers. With regard to sanitation, the coverage increased from 39 to 42 per cent and an additional 40 million urban residents were supplied. Availability of water supply connections in urban areas varied from 24 per cent in Bangladesh to 100 per cent in Singapore (figure XIII), while the status of sanitation ranged from 5 per cent coverage in Afghanistan to 100 per cent in Singapore and Tuvalu. The latest WHO figures for selected countries on achievements during the Decade show that these fall short of expectations (figure XIV). There is a need therefore to enhance the efforts and strengthen the momentum of the Decade into the 1990s.

5. Ambient environmental situation

Air pollution

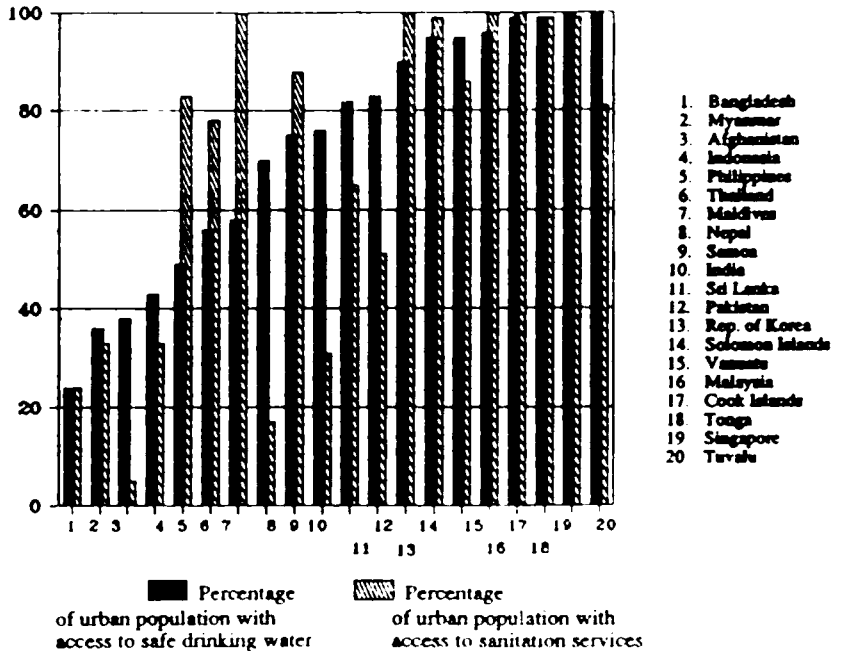
39. Most large cities in the region suffer from air pollution, mainly in the form of suspended particulates and sulphur dioxide. In general, the air in cities of high-income countries, like Tokyo, Osaka, Melbourne and Sydney, have relatively lower levels of particulates and sulphur dioxide than the air in cities of developing countries, like Shenyang, New Delhi, Tehran and Manila (figure XV). In the cities of developing countries, the suspended particulate levels normally exceed the WHO guideline of 60-90 mg/cu m, and in many cases reach 200-300 mg/cu m. In the case of sulphur dioxide also, the WHO guideline of 40-60 microgrammes/cu m is frequently exceeded in cities, with concentrations reaching 200 mg/cu m (figure XVI).

40. The deterioration in air quality in urban areas is mainly the result of the increase in industrial and manufacturing activities with the concomitant upsurge in the demand for energy, and in the number of motor vehicles. Although acid rain is unlikely to be a major and immediate concern for most countries in the region, it is already threatening some heavily industrialized areas in China. Similarly, pollution by nitrogen oxides is one of the problems of highly developed countries, like Japan, resulting from the high concentration of motor vehicles.

41. There is a relationship between the increase in air pollution and the rise in respiratory disease. Air pollution pushes up the incidence and severity of emphysema and chronic bronchitis, and dirty air severely

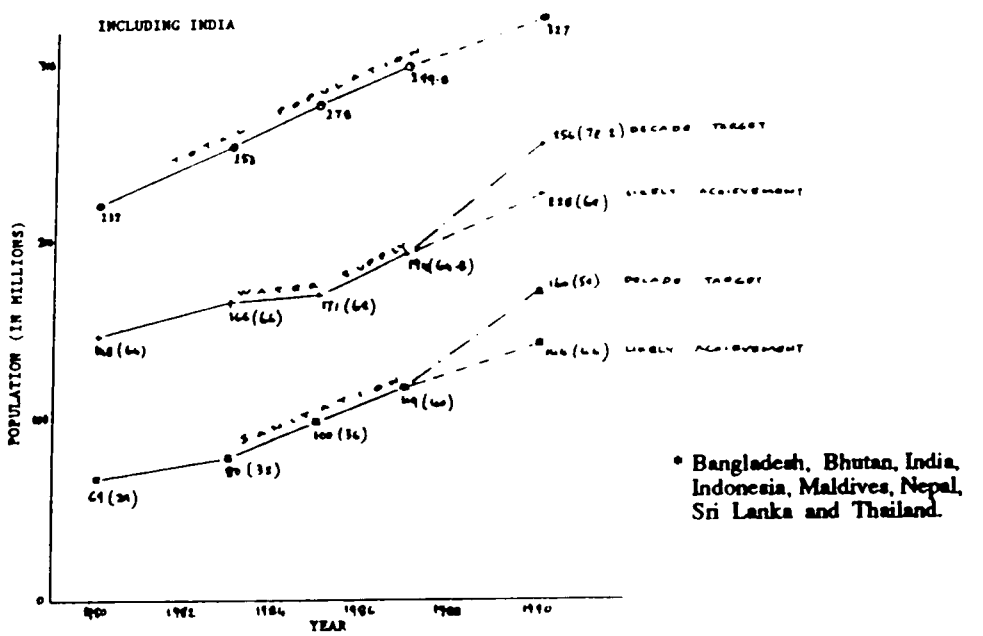
/Figure XIII.

Figure XIII. Water supply and sanitation situation in selected countries of the ESCAP region, 1985



Source: World Resources Institute, World Resources 1988-89.

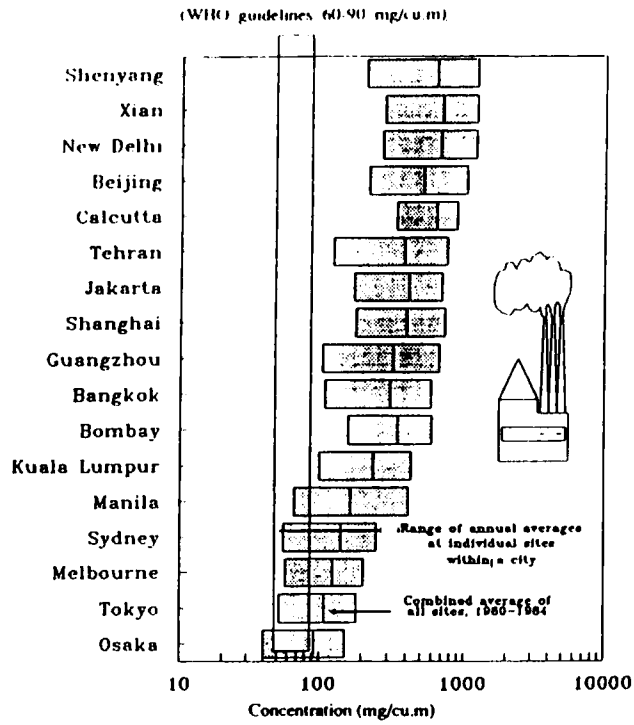
Figure XIV. Urban subsector: water supply and sanitation coverage and targets for selected* countries of the ESCAP region



WATER SUPPLY COVERAGE	- 1990 DECADE TARGET NOT LIKELY TO BE ACHIEVED
SANITATION COVERAGE	- 1990 DECADE TARGET NOT LIKELY TO BE ACHIEVED
GAP BETWEEN WATER SUPPLY AND SANITATION COVERAGE	- BY 1990 GAP WIDENS - POPULATION NOT COVERED BY SANITATION RISES
POPULATION COVERED BY WATER SUPPLY AND SANITATION	- WATER SUPPLY COVERAGE 1.5 TIMES THAT OF SANITATION

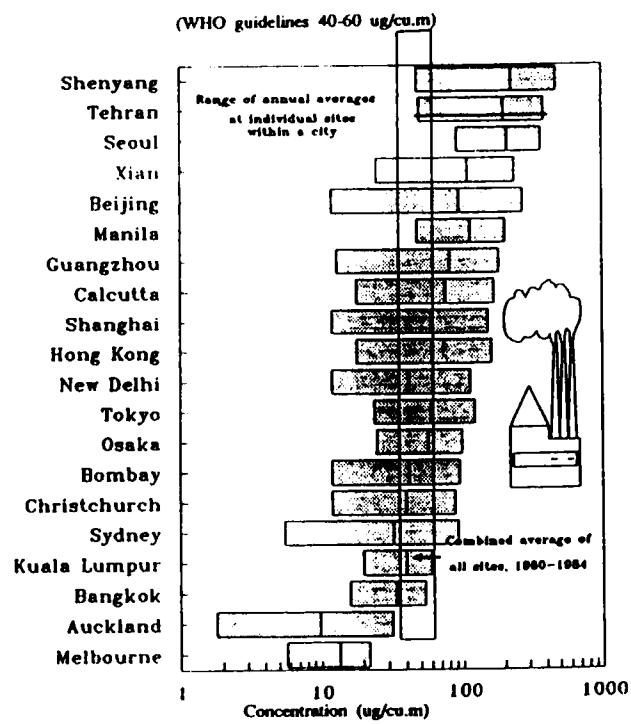
Source: World Health Organization.

Figure XV. Suspended particulate matter levels in selected cities in the ESCAP region, 1980-1984



Source: WHO/UNEP, Global Pollution and Health (Yale University Press, 1987), figure 2, p. 5.

Figure XVI. Sulphur dioxide levels in selected cities in the ESCAP region, 1980-1984



Source: WHO/UNEP, Global Pollution and Health (Yale University Press, 1987), figure 2, p. 5.

aggravates the symptoms of many kinds of asthma. Air pollution also increases the frequency with which people, especially children, contract short-term respiratory ailments. Mortality due to cardiovascular diseases, particularly of the aged (over 65), also increases with air pollution because laboured breathing strains the heart. Studies in China have revealed that air pollution along with smoking also greatly increases the risk of lung cancer.

42. Lead is a major pollutant with severe health effects in cities such as Bangalore, India, where only leaded gasoline is used. The lead concentrations in human blood are generally higher in such cities than in those (Beijing, Tokyo) where unleaded gasoline is used. To reduce lead pollution, China, Hong Kong and Japan have already restricted the use or reduced the level of lead in gasoline.

Solid wastes

43. The storage, collection, transport, treatment and final disposal of solid wastes is another major problem in the cities of developing countries in the region. Typically, cities in the low income countries generate around 0.4 to 0.7 kg of solid waste per capita per day, and high income countries about 0.8 to 1.5 kg per capita per day. Local authority budgets to handle the expanding needs are chronically inadequate. Further, there is a dearth of technical know-how in operating solid waste systems, such as sanitary landfills, composting plants and incinerators. Public education and participation in reducing the cost of disposal and promoting recycling is also seriously lacking.

Hazardous wastes

44. The rapid industrialization in many countries of the region has introduced the additional and relatively more complex problem of the management of toxic and hazardous wastes. There are no comprehensive data for the region on toxic and hazardous wastes but in cities where studies have been undertaken, such as Bangkok, Jakarta and Manila, it is apparent that urban centres are increasingly being exposed to various types of toxic and hazardous wastes.

E. Rural environment

45. Two out of every three inhabitants in the ESCAP region live in rural areas and the rural population growth rate ranges from 1 to 2.5 per cent in the various countries. With the current growth rates, it is expected that

the rural population of the region will increase to 2.5 billion by the year 2000 and, according to predictions, the population of many countries of the region will double before stabilizing.

Pressure on natural resources

46. A number of rural environmental problems have emanated from the unrelenting struggle to meet the basic needs of a burgeoning population from natural resources which are already under heavy pressure. For example, in the Asian and Pacific region 72 per cent of the global agricultural population live on only 30 per cent of the world's arable land. The ratio between the two is shrinking further with time as a result of the faster growth of population compared with the slow growth of agricultural land. Between 1977 and 1987, this ratio declined from 0.29 ha/capita (agricultural population) to 0.27 ha/capita (agricultural population).

47. Fast-growing populations with little or no increase in agricultural land have also resulted in growing rural landlessness, either through loss of ownership or, in some parts of the region, particularly South Asia, through loss of tenancy. Bangladesh, India and Pakistan together have over 30 million landless rural households. Assuming an average of six people per household, the 180 million landless in those three countries constitute a larger population than the total population of Brazil.

48. Desperation drives landless and poor men and women to clear steeper hillsides, to cut down the last fruit tree, to overstock and overgraze, and to shorten fallow periods to two or three years. Driven by forces beyond their understanding or control, they have no choice. Their seeming ignorance may conceal a veritable wealth of traditional knowledge about how things should be done. The South Asian peasant who burns fruit trees for fuel is the inheritor of an incredible stock of knowledge about village ecosystem management and about the myriad trees, bushes, shrubs and herbs that once adorned nearly every kitchen garden and homestead compound. Yet today that knowledge is fast disappearing as development experts struggle to propagate monoculture, based on inputs most farmers simply cannot mobilize. The poor get poorer, in conventional terms as well as in knowledge.

Rural living environment

49. The number of people in Asia and the Pacific in the village environment whose basic needs are not met is larger than at any time in history, and it is growing steadily. Proper shelter, clean water, basic

sanitation, primary health care and adequate fuel remain elusive for too many.

50. The shelter problem in rural areas of the ESCAP region pertains primarily to quality rather than quantity. Barring exceptional cases (for example, in rural areas bordering cities), land in villages is generally available for building. However, standard dwellings, which is to say that portion of the shelter stock which adheres to local zoning and building codes, constitute only 17 per cent of dwellings compared with 19 per cent for all developing countries of the world. Many of these dwellings are located in environmentally fragile and hazard-prone areas. As a result, they are vulnerable to severe loss of life and property when a natural hazard strikes.

51. The infrastructural situation in rural areas, particularly water supply and sanitation, is worse than that in urban areas. During the 1980s, water supplies undoubtedly improved. In the context of the International Drinking Water Supply and Sanitation Decade, expanded efforts were mounted to reduce the number of those unserved by good water. Yet even under optimistic assumptions, the number in 1987 was still about 60 per cent. Further population growth will make future efforts to increase coverage even more difficult. In many cases, past neglect will also burden the effort as easier, less expensive areas have been tackled first, leaving the harder tasks for the future.

52. Two thirds of total energy demand in rural areas comes from the household sector. Non-commercial fuels account for 95 per cent of household energy consumption, most used being wood and animal dung. In 1983, nearly 710 million rural people throughout the ESCAP region could meet their needs only by depleting wood reserves. Yet more than 29 million people were consuming amounts "below minimum requirements" for cooking and heating, etc. Shortages were most acute in the mountainous areas of Asia, particularly the Himalayas. Projections for the year 2000 suggest that, without immediate action to improve the situation, 1.4 billion villagers in the ESCAP region either will be unable to meet their minimum energy needs or will be forced to consume wood faster than it is being grown. The shortage of fuel wood has also led to increased use of cow dung and crop residues, causing a diversion of what would otherwise serve as a nutrient to replenish soils depleted by constant cropping.

Environmental health

53. The available data indicate that rural areas have the highest mortality rates, followed by small urban areas, while metropolitan areas have the lowest mortality rates. Infant mortality is at least 100 per 1,000 live births and child mortality at least 150 per 1,000 live births in at least eight countries of the region. Many countries of the ESCAP region are trailing far behind the reduction rates required to achieve the United Nations target of reducing child mortality to 70 deaths per 1,000 live births by the year 2000.

54. Almost 80 per cent of diseases in the developing countries of the region are directly traceable to unsafe water and poor sanitation. Diarrhoeal diseases, in particular, are a major problem in all developing countries of the region. They kill over 1.5 million children every year, or three children every minute, in just seven countries of the region (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka).

55. The incidence of schistosomiasis is increasing in areas where newly constructed irrigation and hydroelectric schemes and modern water resource developments provide ideal breeding places for the snails that host the parasite. According to WHO estimates, about 25 million people in Asia and the Pacific have been infected by schistosomiasis.

56. The measures needed to reduce these diseases, as well as dysentery, typhoid, and other water and sanitation-related tropical diseases (table 8) are obvious. They include the improvement of water quality and quantity; sanitation and excreta disposal practices, and the protection of water sources from contamination.

57. Another group of major diseases prevalent in rural areas of the ESCAP region is airborne. These include pneumonia, bronchitis and other respiratory diseases which are aggravated by air pollution due to household combustion of biofuels that exposes women and children to high concentrations of suspended particulates and benzopyrene. Surveys conducted in some countries show that rural women are exposed to almost 5,000 ppm of suspended particles, whereas the allowed maximum limit for the occupational environment is 290 ppm. Exposure is intensified because: (a) rural houses are poorly ventilated; (b) the newly designed fuel-efficient stoves produce

higher levels of benzopyrene: (c) cooking habits are such that women stand over the stove: and (d) in winter, windows and doors are kept closed while fires burn.

Agro-chemicals

58. The use of chemical fertilizers in the ESCAP region more than doubled between 1977 and 1987, from 22 million to 46 million tons. Chemical fertilizers are added to the soil to maintain or increase its productivity but can have many environmentally detrimental side effects. These include the accumulation of phosphates and heavy metals in soil, the leaching into ground water of nitrates, phosphate and potassium, and eutrophication of lakes by run-off from agricultural fields. It is estimated that 1-6 per cent of the phosphate fertilizer applied in New Zealand is lost to, and pollutes, streams. The problem is endemic in the Asian and the Pacific region, where irrigated land accounts for more than half of global irrigated land.

59. Pesticides are sprayed throughout the ESCAP region. Without pesticides, 30 per cent of all crops would be lost to pests, weeds and disease, and 30 per cent more would be at risk. Pesticides also offer relief from diseases by killing the host organisms which cause malaria, filariasis and schistosomiasis. Pesticides used in the ESCAP region include insecticides (75.8 per cent), herbicides (13.4 per cent) and fungicides (8.4 per cent). The region spent about $US 2.5 billion on pesticides in 1985 and consumption is increasing by 5-7 per cent per annum.

60. The adverse consequences of continued use of pesticides include pest resistance, bio-accumulation of pesticide residues in food chains and persistence in the environment. Rivers, streams, ponds, reservoirs and aquifers are polluted through agricultural run-off and seepage of pesticides. The bulk of human pesticide intake (90 per cent) is through residues in the food chain. The adverse effects of chronic exposure to pesticides have not been conclusively identified, but anecdotal evidence indicates their association with congenital birth defects, cancer, neuropathy, nausea, skin irritation and severe allergic sensitization.

II. NATIONAL AND REGIONAL RESPONSES

61. The goal of environmentally sound and sustainable development cannot be achieved without an adequate response to environmental problems in terms of both preventive and curative measures. The following sections provide an overview of the existing status and trends in four vital response areas: (a) environmental institutions and legislation; (b) environmental education, communication and awareness; (c) environmental technology; and (d) environmental planning.

A. Environmental institutions and legislation

62. Three general positive trends in environmental institutions and laws have been evident during recent years. These are the continuing growth in power and influence of governmental environmental institutions, the increased interest of non-governmental organizations in environmental protection and the proliferation of environmental legislation. Environmental awareness, catalysed in the 1970s, brought a major change in perception at the national, regional, and global levels. New legal frameworks were created and governmental institutions were established to protect the environment and prevent pollution. This national action was accompanied by a parallel development at the regional and international levels in the promotion of subregional environmental programmes, the integration of environmental considerations into the development work of regional and international institutions and the formulation of treaties on conservation and environmental protection.

National institutions

63. The types of organizations existing in countries of the ESCAP region are given in table 9 to indicate the general trends. They vary from high-powered environment agencies as in Japan or a ministry of environment as in New Zealand to a division in a ministry as in Myanmar or a unit in the President's or Prime Minister's office, as in Nauru. In general, these governmental organizations have two basic functions: policy formulation and implementation, including enforcement of laws and standards.

64. Most of the governmental environmental institutions in the region are understaffed and underfunded. The expenditure for environmental management in most countries, as a proportion of GNP, is extremely low. This seriously hampers the functioning and effectiveness of the governmental environmental agencies. The biggest shortcoming in most countries of the

/Table 9.

Table 9. Forms of governmental environmental protection institutions in selected countries and areas of the ESCAP region

Ministerial institutions	
Austraila	Ministry of Arts, Sports, Environment, Tourism and Territories
Bangladesh	Ministry of Environment and Forests
China	Commission of Environmental Protection of the State Council
India	Ministry of Environment and Forests
Indonesia	Ministry of Population and Environment
Iran (Islamic Republic of)	Department of the Environment
Malaysia	Ministry of Science, Technology and Environment
Maldives	Ministry of Planning and Environment
New Zealand	Ministry of the Environment
Papua New Guinea	Ministry of Environment and Conservation
Philippines	Department of Environment and Natural Resources
Republic of Korea	Ministry of Environment
Singapore	Ministry of the Environment
Sri Lanka	Ministry of the Environment and Parliamentary Affairs
Environmental departments/agencies under other ministries	
Afghanistan	Agriculture/Forestry
Brunei Darussalam	Ministry of Development
Cook Islands	Interior Affairs
Fiji	Urban Development/Housing
Kiribati	Various
Lao People's Democratic Rep.	Agriculture/Industry/Co-operatives
Myanmar	Mines/Health/Agricultural Corporations/Agriculture and Forest/Industrie
Nepal	Forest, Soil Conservation and others
Pakistan	Housing and Works (Environment and Urban Affairs Division)
Samoa	Various
Soloman Islands	Land, Energy and Natural Resources
Thailand	Ministry of Science, Technology and Energy
Tonga	Ministry of Land Survey and Natural Resources
Tuvalu	Commerce and Natural Resources/Works and Communications/Social Services Prime Minister
Vanuatu	Lands, Minerals and Fisheries
Separate environmental agencies[1/]	
China	National Environmental Protection Agency
Hong Kong	Environmental Protection Agency
Japan	Environment Agency
Pakistan	National Environmental Protection Agency
Sri Lanka	Central Environmental Protection Authority
Thailand	National Environment Board
Viet Nam	State Committee on Science and Technology
Sub-division in national planning agency	
Bhutan	
Divisions in Prime-Minister's/President's offices	
Nauru	

1/ The environmental agencies listed are the primary national environmental institution established in countries or areas without environmental ministries. Some countries hav separate environmental agencies as well as environmental ministries. In such cases, th agencies are not listed here.

ESCAP region is a lack of integration of environmental and economic policies. The central economic planning unit and the sectoral development agencies rarely work with or consult the central environmental organization. Several mechanisms are being explored by Governments in the region in an attempt to effect horizontal and vertical co-ordination and integration. These are:

(a) The creation of interministerial groups for dealing with environmental and development issues;

(b) The formation of councils for vertical linkages between federal and local units in federal systems;

(c) The establishment of local and municipal units of central environmental ministries in a unitary state system;

(d) The establishment of ad hoc or permanent inter-agency committees to address important issues;

(e) Interagency evaluation of environmental impact assessment reports;

(f) Interagency participation in the planning of integrated area development projects.

Intergovernmental environmental programmes

65. Environmental problems involving the global commons, such as the oceans and the atmosphere, shared watersheds and river systems, and migratory species, led to the formation of intergovernmental institutions, the most prominent of which in the ESCAP region are the following:

(a) ASEAN Senior Officials on the Environment (ASOEN);

(b) South Asia Co-operative Environment Programme (SACEP);

(c) South Pacific Regional Environment Programme (SPREP);

(d) Lower Mekong Basin Development Environment Programme (LMBDEP).

66. In addition, environmental considerations have been incorporated in the work programmes of United Nations agencies and bodies and the multilateral and bilateral donor and aid agencies active in the region.

Non-governmental organizations

67. The non-governmental organizations provide an important and flexible institutional approach to advocacy and the promotion of awareness concerning sustainable development. Currently, there are over 300 prominent

environmental non-governmental organizations in the Asian and Pacific region. When smaller non-governmental organizations are included, the total number reaches thousands. However, not all of these organizations are exclusively environmental in character.

68. These non-governmental organizations include the following at the regional and subregional levels:

(a) Asian Forum of Environmental Journalists;

(b) Asian Wetland Bureau;

(c) Asia-Pacific People's Environment Network;

(d) Association of South Pacific Environmental Institutions.

Most of these organizations are specialized in specific sectors, such as environmental awareness or wetland management. Their role, however, is still not well recognized in many countries of the region.

Environmental legislation

69. Countries of the region have a variety of environmental legislation which reflects the diversity of economic, social and political systems in the region. Constitutional provisions in many countries, such as China, India, Indonesia, Pakistan, Papua New Guinea, the Philippines, the Republic of Korea, Sri Lanka and Thailand, have helped highlight a national priority and thereby influenced future legislative policies and executive action. Irrespective of constitutional provisions, however, most countries in the ESCAP region have a vast body of legislation for the management of the environment and natural resources. There exist three categories of basic legislation in the region:

(a) General framework for environmental administration;

(b) Wide-ranging pollution controls;

(c) Natural resource and land-use management.

70. The first category of legislation usually includes the statement of national environmental policies and the mandates of various institutions in implementing these policies. Usually, this category also has provision for environmental impact assessment. However the manner and rigour of environmental impact assessment implementation varies. Four countries (Australia, Papua New Guinea, the Philippines and Thailand) have specific environmental impact assessment legislation. Nine countries (China,

Indonesia, the Islamic Republic of Iran, Maldives, Malaysia, New Zealand, Pakistan, the Republic of Korea and Sri Lanka) have general legislation incorporating environmental impact assessment provisions. Six countries or areas have no formal legislation but follow informal procedures to implement environmental impact assessment (Bangladesh, Hong Kong, India, Japan, Myanmar and Nepal).

71. In the anti-pollution legislation, the usual regulatory approach is the licensing of waste emissions. Standards are set establishing the level above which pollution is not permitted. Compliance with this legislation is envisioned through "command and enforcement", but lack of resources such as manpower, technology and finance make implementation very difficult, if not impossible. There is a need therefore to orient this legislation more to the participatory approach.

72. The concern over hazardous and toxic substances is relatively new in most countries of the region. While there are diverse approaches to this problem, there are some commonalities. These include the following:

(a) "Cradle to grave" management systems involving all aspects of storage, transportation and disposal;

(b) The assignment of direct accountability to waste generators;

(c) The establishment and proper operation of waste management, storage, treatment and disposal facilities.

73. Almost all countries of the region have some form of resource management legislation. The orientation of most of this legislation, however, is towards the economic exploitation of the resources rather than their sustainable development. Nevertheless, the notions of sustainable yield, integrated ecosystemic management, and stewardship are gaining ground.

International conventions/treaties

74. During the past few years an unprecedented number of treaties on the environment have been formulated. The usual pattern involves the establishment of a comprehensive, umbrella treaty that states the general goals of the parties but does not oblige them to take concrete measures. The obligatory mechanisms are negotiated later as specific protocols which are appended to the comprehensive treaty. The status of commitment of countries of the region to some of the more important treaties is shown in table 10.

/Table 10.

Table 10. International conventions on the environment: status of selected countries of Asia and the Pacific up to 17 July 1990

	Wetlands (Ramsar)	World Heritage (Paris)	Endangered Species (CITES) (Washington)	Migratory Species (Bonn)	Ocean Dumping (London, Mexico City, Moscow, Washington)	Pollution from Ships (MARPOL) (London)	Law of the sea (Montego Bay)	Nuclear Test Ban (Moscow)	Biological and Toxic Weapons (London, Moscow, Washington)	Protection of the Ozone Layer (Vienna)	Protocol on Ozone Depleting Substances (Montreal)	Regional Seas (UNEP)	Control of Transboundary Movements of Hazardous Wastes and their disposal (Basel)
	1971	1972	1973	1979	1972	1978	1982	1963	1972	1985	1987		1989
Afghanistan		CP	CP		CP		S	CP	CP				S
Bangladesh		CP	CP				S	CP	CP				
Bhutan							S	CP	CP				
Brunei Darussalam						CP	S						
Cambodia			S				S		CP				
China		CP	CP		CP	CP	S	CP	CP	CP			S
Fiji							CP	CP	CP	CP	CP	SP	
India	CP	CP	CP	CP		CP	S	CP	CP				S
Indonesia			CP			CP	CP	CP	S		S		S
Islamic Rep. of Iran	CP	CP	CP				S	CP	CP			S	
Lao People's Dem. Rep.							S	CP	CP				
Malaysia			CP				S	CP	S	CP	CP		
Maldives		CP					S			CP	CP		
Mongolia							S	CP	CP				
Myanmar							S	CP	S				
Nepal	CP	CP	CP		S	CP	S	CP	S				
Pakistan	CP	CP	CP	CP			S	CP	CP				
Papua New Guinea			CP		CP		S	CP	CP	CP		SP	
Philippines		CP	CP	S	CP		CP	CP	CP		S		S
Rep. of Korea						CP	S	CP	CP				
Samoa							S	CP					
Singapore			CP				S	CP	CP	CP	CP		
Solomon Islands					CP	CP	S		CP			SP	
Sri Lanka		CP	CP	S			S	CP	CP	CP	CP		
Tonga								CP	CP				
Thailand		CP	CP				S	CP	CP	CP	CP		S
Tuvalu						CP							
Vanuatu						CP							
Viet Nam	S	CP	S				S		CP				
Australia	CP	CP	CP		CP	CP	S	CP	CP	CP	CP	SP	
Japan	CP		CP		CP	CP	S	CP	CP	CP	CP		
New Zealand	CP	CP	CP		CP		S	CP	CP	CP	CP	S	S

CP = Contracting Party (has ratified or taken equivalent action) S = Signatory P = Ratification of Regional Seas Convention

Source: UNEP, 1990.

Note: Up to 10 September, 1989 Australia, Cook Islands, Federated States of Micronesia, Papua New Guinea and Republic of the Marshall Islands had ratified the Convention for the Protection of the Natural Resources, and Environment of the South Pacific Region, while Fiji and Solomon Islands had acceded to it.

B. Environmental education, communication and awareness

Formal education

75. Almost all countries of the region have included environmental education in the school curriculum at the primary level. The emphasis is on first-hand experience of the natural environment. There are some imaginative programmes at this level. In Myanmar, for example, the study of the immediate surroundings is undertaken without formal textbooks. In China, the emphasis is on the gradual cultivation of values and behaviour favouring the protection and improvement of the environment. This is integrated with in-school and out-of-school environmental educational activities. In Japan, one school is experimenting with a "nature observatory garden". In addition, field studies are undertaken in small groups using cassette tape recorders, and on nature trails allowing school children to come in direct contact with the richness and excitement of nature. At the secondary level, the incorporation of environmental topics in the curriculum is mostly confined to individual activities in specific subjects. Environmental education is often integrated into natural science, social studies, geography, ecology, geology, biology, physiology, hygiene, physics and chemistry.

76. Most countries of the region offer environmental education at the tertiary level. Some simply include environmental themes in the existing university curricula of, for example, engineering, biological science, earth science and law studies. Others offer independent post-graduate degree programmes in the environmental sciences, natural resource assessment, environmental law and environmental quality monitoring.

77. Because of the growing demand for the integration of environmental aspects into development, an increasing number of short-term training courses for government functionaries and professionals have been instituted. These programmes cover, environmental management, decision making, environmental impact assessment and prediction techniques.

78. Regional co-operation in formal education and training is facilitated by three existing tertiary-level education networks. These are:

(a) Asia Pacific Network for Environmental Education for Tertiary Institutions;

(b) Network on Environmental Economics;

(c) Network on Coastal Zone Management.

These networks are engaged in the exchange of information and instructional materials and the development of model curricula. There also exist subregional networks such as the Southeast Asian Universities Agro-ecosystem Network (SUAN). In fact, intergovernmental environmental programmes such as ASOEN, SACEP and SPREP have all given high priority to environmental education.

Non-formal education

79. Non-formal environmental education in the ESCAP region is being undertaken in two main streams. The first consists of the use of informal education approaches in schools to reinforce formal learning. The second, which is very rare, consists of systematic, informal educational activities directed at adult groups. The first approach includes visits to field study centres, outings to museums and parks, and the use of audio-visual materials. The second approach involves permanent exhibitions, science camps and the establishment of non-formal education centres, with workers in industry and women as target groups. There is a great need to expand and strengthen the second approach.

Environmental communication and awareness

80. The promotion of environmental awareness has been initiated using printed and electronic media, folk art and in some cases community communicators. Surveys indicate that in some countries of the region, particularly Australia and Japan, substantial progress is being achieved. The print media used in the region vary from simple hand-outs and newsletters to academic journals. There are publications at the regional, subregional and national levels. The United Nations agencies are publishing environmental materials for the region on a regular basis. Some non-governmental organizations are also active in producing printed materials. At the subregional level, environmental newsletters are published by intergovernmental bodies such as SPREP, ASOEN, SACEP, and ICIMOD (International Centre for Integrated Mountain Development).

81. Newspaper coverage of environmental issues in the Asian and Pacific region has not only increased in recent years but also become more diverse in nature. Concern has expanded from local pollution problems to global environmental issues, such as global warming. However, professional environmental journalism still has a long way to go to achieve the desired objectives.

82. The use of the print media in the ESCAP region is severely constrained by the low level of literacy in many countries[1/] and the limited geographic reach of published materials. Because the radio-population ratio is high in the region (figure XVII), radio offers attractive potential for environmental communication and education programmes. The availability of television is not as good but is still high in many countries of the region. The availability of the electronic media will definitely increase in the coming years. However, their use, has not been fully exploited for environmental purposes in the region.

83. Communication through folk media has been proved effective in experimental projects in some countries of the region. Initiatives to combine folk media with the electronic media in order to expand the outreach appear to have good potential. Environmental awareness campaigns could also be made more effective through the use of these media.

84. These campaigns have taken numerous forms in the region. There have been drives for community cleanliness, tree plantation, energy saving and checking pollution. The celebration of Environment Day or Earth Day is an important vehicle for this type of communication. Communicator groups on the environment in the region vary from government officials to non-governmental organizations and volunteer action groups. Government extension workers and local government officials could contribute effectively to environmental communication. One of the important initiatives in environmental communication is the ESCAP-sponsored Asian Forum of Environmental Journalists (AFEJ), intended to promote regional co-operation and networking in environmental communication.

C. Environmental technology

85. Environmental technology includes not only that which applies to pollution control but also that utilized for natural resources management. In general, all technology that promotes environmentally sustainable development should be labelled environmental technology.

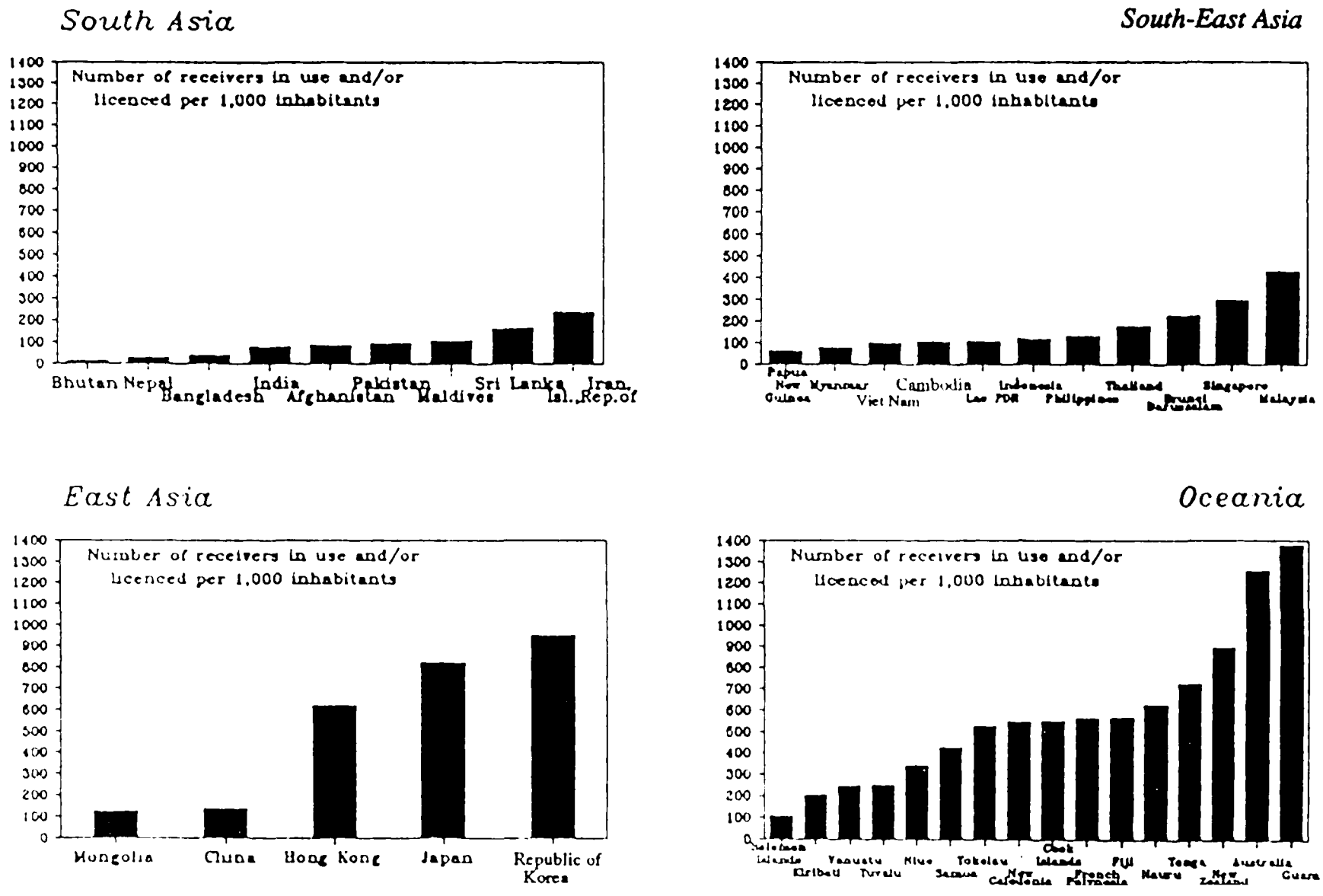
Natural resources management technology

86. The most important developments in natural resources management technology are satellite remote sensing and geographic information systems (GIS). The use of satellite remote sensing technology has been growing in

/Figure XVII.

1/ The overall literacy rate in the ESCAP region in 1985 was 36 per cent.

Figure XVII. Population-radio receivers ratio in the Asian and Pacific region, 1988



Source: UNESCO, Statistical Year Book 1988.

the ESCAP region during the past 10 years. Most of the applications revolve around resource inventories, mapping, ecological surveys, geologic studies, and pollution monitoring. Australia, Bangladesh, China, India, Indonesia, Japan, the Philippines and Thailand have active satellite remote sensing programmes. As these technologies mature, the management of natural resources and the synoptic monitoring of the environment will improve significantly.

87. GIS is a vital complementary technology to satellite remote sensing. It is a technique of comparing, analysing and integrating layers of resource, environmental, socio-economic and other spatial information. Since the data from satellite remote sensing are in digital form, they constitute convenient inputs to GIS. The combination of remote sensing and GIS is a powerful tool for analysing changes in earth surface features such as deforestation, changes in land use, the impact of irrigation, coastal pollution etc. These analyses are extremely useful in environmental planning and management, as well as in policy making. The use of GIS in the region has been growing since 1985. Some countries, like Australia, China, India, Indonesia, the Philippines and Thailand, are using GIS in development projects. Others, like India and the Republic of Korea, are undertaking research and development of software and hardware for remote sensing and GIS.

88. The main constraint facing countries of the region is the problem of co-ordination and co-operation at the national and regional levels. Since remote sensing and GIS would require inputs of data from a number of line departments and since these technologies are potentially useful to diverse agencies, strong co-ordination is necessary to avoid overlaps and to achieve economies. Countries rich in natural resources, such as Indonesia, the Philippines and Thailand can use these technologies most effectively in planning for sustainable development. The regional effort in the field is typified by the ESCAP/UNDP Regional Remote Sensing Programme. This programme has contributed significantly to manpower development and provided a channel for regional co-operation.

Technologies for managing water pollution and domestic wastes

89. Water pollution control technologies for domestic and industrial wastes are well known in most countries of the region. They vary from simple primary physical treatment such as in settling tanks, to combined secondary and tertiary physical, chemical and biological treatment processes. In spite of this, the majority of the countries have few or no centralized

/sewage

sewage collection and treatment facilities. The exceptions are Australia, Japan, New Zealand, the Republic of Korea and Singapore. Most countries of the region cannot afford to construct such systems. Water pollution from domestic sources is becoming a major problem. Many countries can only afford to provide leaching pits and septic tanks. Since these systems provide partial treatment only, they are being improved in various ways. Indonesia and Thailand are experimenting with new designs for leaching pits.

90. In the case of solid wastes, the majority of the countries in the ESCAP region use open dumps for disposal. However, the industrialized countries use sanitary landfills. Some countries use composting and incineration.

Industrial pollution control technologies

91. There are countries in the region that apply relatively simple industrial pollution control technologies with good results. In Shanghai, China, for instance, the effluent from a straw pulp paper mill is treated with a system consisting of primary settling tanks for fibre and sludge removal. The biochemical oxygen demand (BOD) is biologically treated using biodiscs and, finally, a secondary settling tank is used for clarification. Another example is a pulp and paper mill in the Philippines which uses bagasse to produce sack kraft paper. Here, a disctype fibre recovery facility is used. The suspended solids are removed by chemical flocculation and a settling pond. Aerated ponds are used for BOD removal. Finally, the black liquid is biologically oxidized in lagoons. The above are representative technologies that are being used in the region by small and medium-scale industries.

92. The technologies for industrial air pollution control are also well known and used. However, the problem invariably is the lack of financial resources for construction, operation and maintenance of pollution control systems. Some countries of the region have designed disposal systems for toxic and hazardous wastes at new industrial sites, such as on the Eastern Seaboard of Thailand and in East Java in Indonesia.

93. ESCAP has published industrial pollution control guidelines for the following industries: sugar, brewery and distillery, palm oil, tapioca, fish processing, fertilizer and electroplating. For each of these industries, alternative pollution control technologies have been extensively discussed and evaluated and recommendations have been made for the most cost effective technologies. Recently six other sets of guidelines have been published by

ESCAP for the mitigation of pollution from hazardous industrial wastes of the Tantalum, VCM-PVC, PTA-DMT-Polyester, Styrene and ABS, Titanium Dioxide and Hydrogen Peroxide industries. These guidelines are very useful, particularly for the small and medium-scale industries of the region. The United Nations Environment Programme (UNEP) Regional Office for Asia and the Pacific has published design manuals for electroplating and small battery manufacturing plants. The manuals provide step-by-step procedures for the design of simple and low-cost air and water pollution control facilities for these establishments.

Low-waste and non-waste technologies

94. With the exception of Japan and possibly Australia, the use of clean technologies in the region is still in its infancy. Nevertheless initiatives are under way. The ASEAN countries, for example, have committed themselves to implementing demonstration projects using clean technologies. Currently, the use of low-waste and non-waste technologies in the region involves recycling, re-use and utilization of wastes. For examples, wastes of distilleries are used for biogas production: waste coconut water is used to produce beverage or vinegar: bagasse from sugar is used to manufacture pulp.

95. The use of energy efficient equipment and processes, cogeneration, waste heat recovery and utilization, improved combustion technology, better process monitoring and control, and the optimum use of insulation are some of the options available for energy conservation. These techniques are being used in some countries, but are not universal in the region.

96. Technologies for the production of energy from sources such as natural gas, nuclear power and hydroelectricity, as well as geothermal and solar energy, which emit limited or no greenhouse gases are also used by countries of the ESCAP region. Technologies for the control and removal of pollutants from thermal power plants are known and well established in many parts of the region. They include the use of multicyclones, electrostatic precipitators, bag filters, flue gas desulphurization technologies, the two-stage combustion method and flue gas denitrification technologies.

D. Environmental planning

Integration of environment and development

97. The basic objective of environmental planning is to integrate environment and development for sustainable future progress. Efforts at

/integrating

integrating environment and development have been made in the Asian and Pacific region at four levels, categorized from the viewpoint of spatial areas covered as: (a) regional or international: (b) national: (c) district (or subnational): and (d) project.

98. At the regional/international level, various organizations, including United Nations agencies and bodies, development banks and other international organizations, are integrating environmental planning methodologies into their own work programmes and have also been assisting countries of the region to do the same through project implementation, guidelines, workshops and technical assistance. ESCAP, for example, integrates environmental considerations into its overall programme of work in various sectoral areas. In addition, the Commission has promoted environmental awareness, with special attention to policy planners, administrators and the media. It has also assisted countries in implementing environmental impact assessment and has provided technical assistance for promoting environmental planning. UNDP has incorporated environmental aspects into all its development projects and it has assisted ESCAP in developing a regional strategy on environmentally sound and sustainable development. A number of other agencies, including UNEP, the World Bank and the Asian Development Bank have also co-operated with ESCAP in its effort to promote sustainable development in the region.

99. At the national level, medium-term national economic development plans in many countries of the region have included independent chapters on the environment. This explicit incorporation of environmental considerations in development activities at the highest planning level has taken place in China, India, Malaysia, the Republic of Korea and Thailand. A number of national conservation strategies have been prepared within the framework of the World Conservation Strategy, for example in Australia, China, Malaysia, Pakistan, Nepal and Viet Nam. In the Philippines, this effort has been carried further in the formulation of the Philippine Strategy for Sustainable Development, which provides the guidelines for national development programmes: this document was even endorsed by the Cabinet. In some countries, such as Myanmar, Pakistan and Thailand, natural resource or environmental profiles have been prepared. These could provide important inputs in any environmental planning exercise.

100. Efforts to apply the economic-cum-environmental planning approaches have also been made at the subnational and project levels. Some examples are the strategic environmental plans of Palawan in the Philippines, the

Segara Anakan area in Indonesia, the Eastern Seaboard in Thailand, and the Klang Valley in Malaysia.

Application of environmental planning instruments and methods

101. The use of tools and methods for environmental planning has also increased in the region. Growing application of environmental impact assessment is one explicit example. Through it the environmental authorities are able to exert influence on development projects. It also contributes to the promotion of environmental awareness among decision makers, development planners and the public. The current status of the environmental impact assessment systems has already been presented in paragraph 70 above. There are three distinct groupings of countries: those with specific laws on environmental impact assessment; countries with general legislations empowering a government agency to require environmental impact assessment; and countries where the environmental impact assessment requirement has been introduced through administrative measures.

102. Natural resources accounting, which is the quantification of the depreciation of environmental assets and the incorporation of the loss in the system of national accounts is an emerging tool that could be effective in the integration of environment and economics in national decision-making. Some pioneering initiatives have been undertaken in China, Indonesia, the Philippines and Thailand, but a systematic effort is needed to develop and refine methods for indigenous application.

103. Environmental data bases are essential to sound environmental planning. International and national efforts in the development of systems for environmental statistics are under way. UNEP and the Statistical Commission of the United Nations have launched a programme called "A framework for the development of environment statistics" which is geared to the provision of methodological guidance for the establishment of environmental statistics at the national level. Two useful environmental data systems have been established by UNEP: the International Referral System for Sources of Environmental Information (INFOTERRA) and the International Register of Potentially Toxic Chemicals (IRPTC). These systems cover about 20 countries in the region.

104. Environmental monitoring is essential to environmental planning and management. Activities in this regard have improved considerably in the countries of the ESCAP region during the past five years. At the international level, the WHO-UNEP Global Environmental Monitoring System

(GEMS) is one of the most important developments. In the Asian and Pacific region, 15 countries are participating in the GEMS air quality monitoring programme and 17 countries in the GEMS water monitoring programme.

III. POLICY CONTEXT

105. For the purpose of determining policy options for the future, part II and part III provide the sectoral details of the context from which policies could emerge. However, policy analysis would be incomplete without the consideration of two important points. Firstly, the sectoral conditions, trends and issues are not totally isolated from one another. In fact, there is a high degree of interdependence among the sectors. They influence and blend with one another. Second, the Asian and Pacific region is a geographical concept: in reality the region is ecologically connected to the rest of the world. It responds to global environmental influences and contributes, as well, to global environmental problems.

106. Accordingly, the first two sections of this part discuss: (a) the results of the complex interaction of sectoral trends and their projections: and (b) the regional implications of global environmental problems. These are discussed in sections A and B below. A synthesis of these in section C provides not only the future outlook in terms of environmental changes in the 1990s but also shows the direction for policy orientation.

A. Environmental trends and projections

107. The data on trends are those available up to the present. The projections are obtained by simulating the evolution of selected indicators of demography, economics, environment and natural resources. Standard systems models and the known relationships between the variables are used in generating the projections. The year 2020 is chosen as the time horizon in order to provide an intergenerational perspective while at the same time not exceeding the confidence limits of the computer simulations. Since the projections do not take into account future policy interventions, they may only indicate the order of magnitude of the effort needed to overcome the problems.

Demographic indicators

108. The countries with the fastest growing populations in the region are Mongolia, Pakistan, the Islamic Republic of Iran, Maldives and some Pacific island countries. The current population of the region is 2.88 billion.

Projections indicate that it will double in the next 39 years. While growth rates are expected to vary across countries, an overall increase in the consumption base would put additional pressure on natural resources. The exact nature of this pressure will depend on the capacity and resilience of ecosystems, consumption patterns and income levels. Unfortunately, the highest population densities and most rapid population growth rates will occur in already degraded environments.

109. Almost half the population of the Asian countries and three quarters of the population of the Pacific and industrialized countries will be living in urban areas by 2020. Indeed, with growth rates ranging from 3.0 to over 6 per cent, the countries' urban populations will double in the next 11 to 23 years. The number of megacities (over 4 million) may increase to 40 by 2020. While offering economies of scale, this will generate severe environmental pressures in terms of land-use allocation and pollution. The trend of declining rates in the growth of the rural population will continue, but even so the magnitude of growth will be enormous in view of the large existing base.

110. Life expectancy throughout the region is improving. With the notable exception of China and Sri Lanka, developing countries, in general, have low life expectancies. There is an overall trend and projection of infant mortality decline. The declining mortality with persistent high fertility in most countries is the main cause of population growth.

Economic indicators

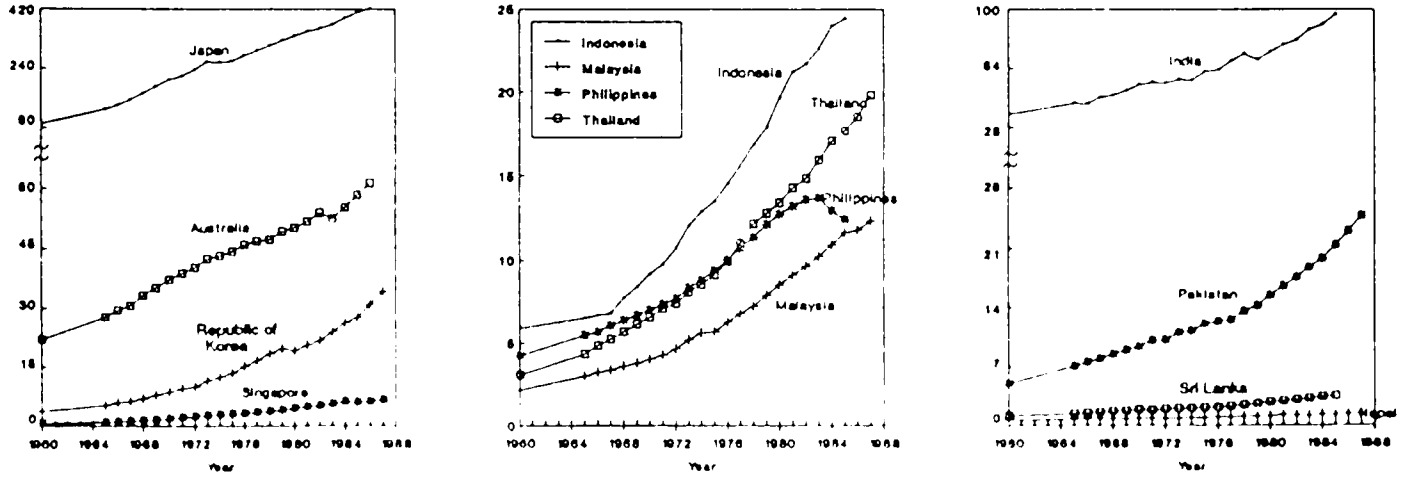
111. The value of GNP has increased throughout the region. Economic growth in the region averaged 6.8 per cent per year during the 1980s, however, the rates of growth have been variable. The most rapid growth rates have been in South-East Asia, where rapid industrialization is taking place. When combined with population growth, the economic gains are diluted in many countries such as India (figures XVIII and XIX). In future, the reduced resilience of degraded ecosystems is expected to have a growing influence on local and national economic growth.

112. There is very little data on poverty. However, it is estimated that, on the average, 40 per cent of the population in low-income countries are in the category of the absolute poor. In the medium-income countries the figure is approximately 18 per cent. Poverty is also reflected in the fact that around 40 per cent of all rural households in South Asia are landless.

/Figure XVIII.

Figure XVIII. Trends in GNP for selected countries of the ESCAP region

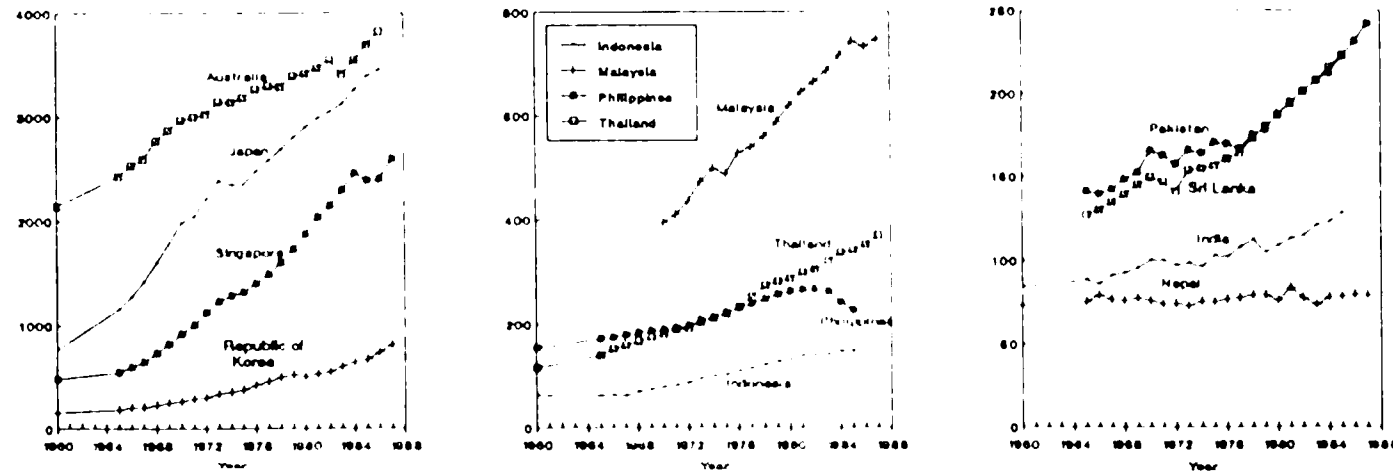
(Billions of United States dollars, 1970 prices)



Source: United Nations, Statistical Yearbook for Asia and the Pacific 1988, New York; World Bank, World Tables 1980, Washington, D.C.

Figure XIX. Trends in GNP per capita for selected countries of the ESCAP region

(In United States dollars, constant 1970 prices)



Source: United Nations, Statistical Yearbook for Asia and the Pacific, New York, various issues: World Bank, World Tables 1980, Washington, D.C.

113. The trends in capital stock and primary energy consumption are illustrated in figure XX. In general, the increase in capital stock since the 1970s is accompanied by an increase in the consumption of energy, with the notable exception of Japan. The highest rates of increase in capital stock are in the South-East Asian countries. If economic development continues, there will be increasing demand for energy throughout the region.

114. It can be seen from figure XXI that food production per capita is rising in spite of considerable population growth. Increases in food production have been accomplished through the expansion of croplands and the intensification of agriculture through the use of chemical inputs. There are indications that per capita food production may be expected to decline owing to inappropriate soil and water management techniques. Figure XXI summarizes the results of model simulations for food production in selected countries of the region. It shows that per capita food production can be maintained in most cases up to the year 2000 or later. However, reduction in land quality may occur, causing a sudden decline in output at the turn of the century unless concerted land conservation and reclamation measures are undertaken.

115. The efforts for enhancing production may further increase the use of agricultural inputs, particularly chemicals. Fertilizer inputs have increased considerably in many countries of the region in recent years. The countries of South-East Asia had a ten-fold increase over the last 30 years.

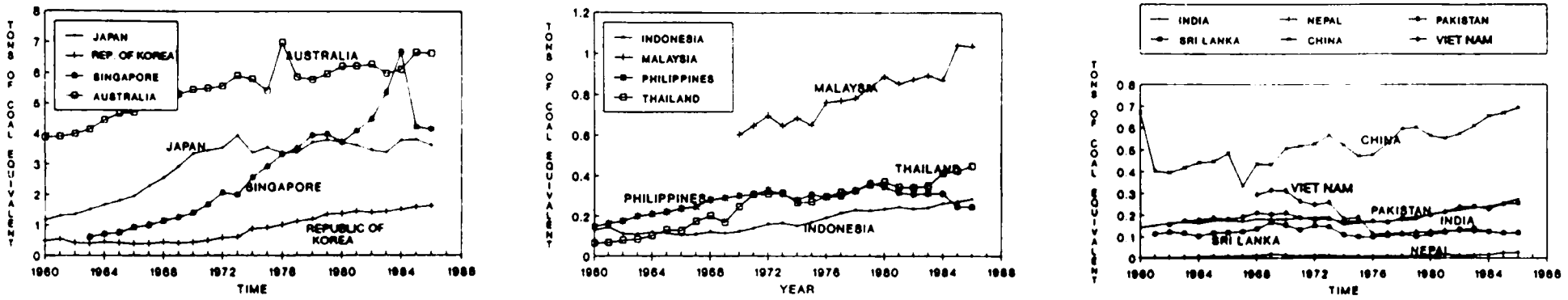
Natural resources and the environment

116. This section examines the rates at which resources are being consumed, the likely future trends and their environmental impact in the region. Tropical deforestation in the 1970s took place at the rate of 2 million ha per year (1.8 million ha for closed forests). According to preliminary estimates of FAO, the recent net deforestation rates are much higher (approximately 5 million ha per year). The effects of deforestation will depend on the complex interrelationship between the forest and the ecology of the surrounding area. Nevertheless, the removal of tropical forest would certainly have a disastrous impact on bio-diversity.

117. Deforestation, along with increasing inputs of water and chemicals, is likely to continue the process of land degradation. However, no systematic statistical data exist to show the future degradation of soil quality or the rates of desertification in the region as a whole.

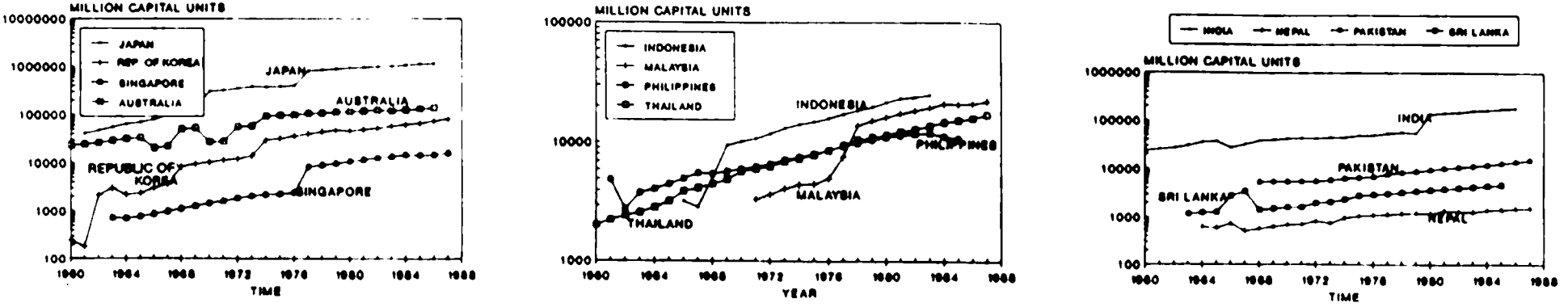
Figure XX. Trends in energy consumption and capital stock in selected countries of the ESCAP region

PRIMARY ENERGY CONSUMPTION PER CAPITA



Source: United Nations, World Energy Statistics 1950-1974; Statistical Yearbook for Asia and the Pacific 1984; Statistical Yearbook (1983/1984, 1985/1986).

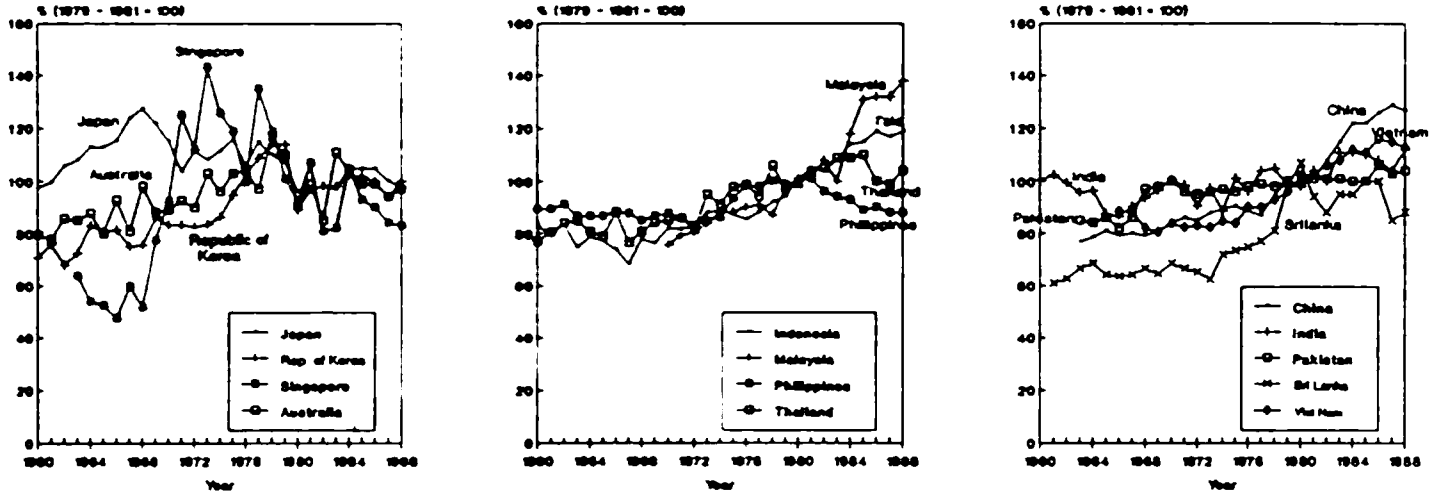
CAPITAL STOCK



Source: United nations, Statistical Yearbook for Asia and the Pacific (1970-1988).

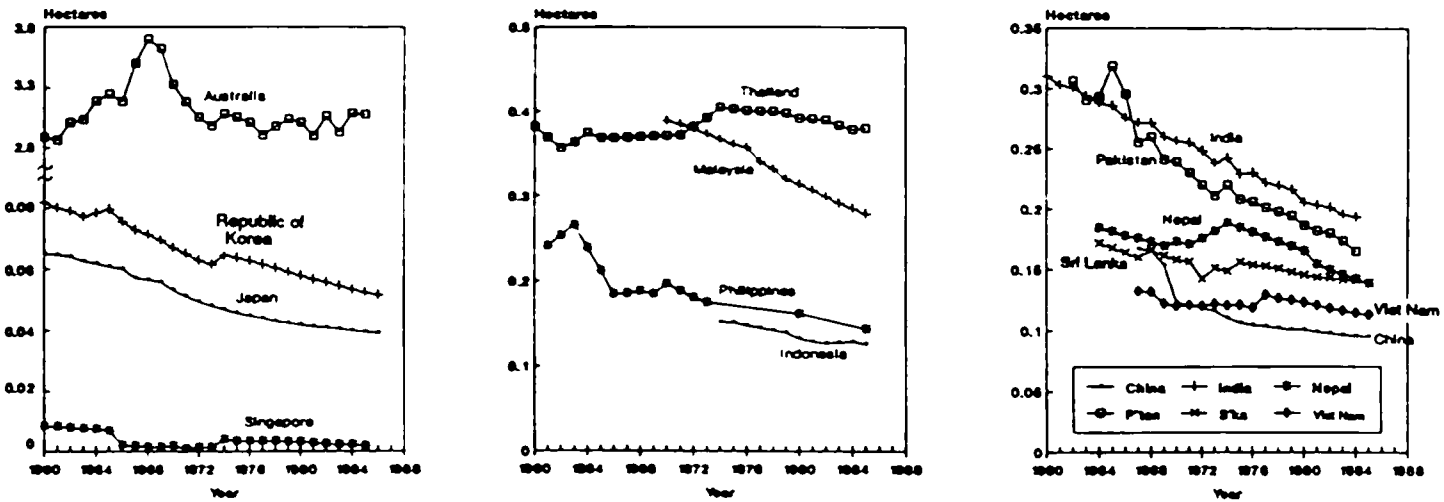
Figure XXI. Trends in food production and agricultural land per capita in selected countries of the ESCAP region

INDEX OF PER CAPITA FOOD PRODUCTION



Source: FAO, Quarterly Bulletin of Statistics, New York, vol. 2, 1989; United Nations, Statistical Yearbook for Asia and the Pacific, various issues.

AGRICULTURAL LAND PER CAPITA



Source: United Nations, Statistical Yearbook for Asia and the Pacific, various issues.

118. Fisheries constitute an extremely important food resource and a number of countries in the region have a high dependency on marine products for their protein needs. The fish catch in almost all countries of the region has risen exponentially in the past 30 years and disregard of sustainable yields has already resulted in the decline of some species.

119. The regional share of proven energy reserves of gas and oil is very low in relation to stocks worldwide. Coal utilization is expected to increase in all countries of the region. Dependence on coal/solid fuel has been increasing (figure XXII) and will continue to increase. The coal reserves will be able to meet the demand but at the cost of environmental pollution and contributing to global warming.

120. In 1980, around 40 per cent of energy consumption in the region was in the form of fuelwood. Because of the increasing population and the already extensive deforestation, a rural energy deficit is predicted. Current projections show that the total population affected by the fuelwood deficit will have doubled from 832 million to 1,671 million between 1980 and 2000 in Asia.

121. The status of air and water pollution has been discussed in part II of this report. The data set for air pollution are of low quality. However, an attempt has been made to project atmospheric pollution and the results are shown in figure XXIII. As could be expected, air pollution is projected to increase rapidly in the industrializing countries of the region.

122. The simulations for solid waste in figure XXIV show that accumulated non-biodegradable solid waste will rise significantly in all sample countries in the next decade if current patterns of disposal continue.

B. Regional implications of global problems

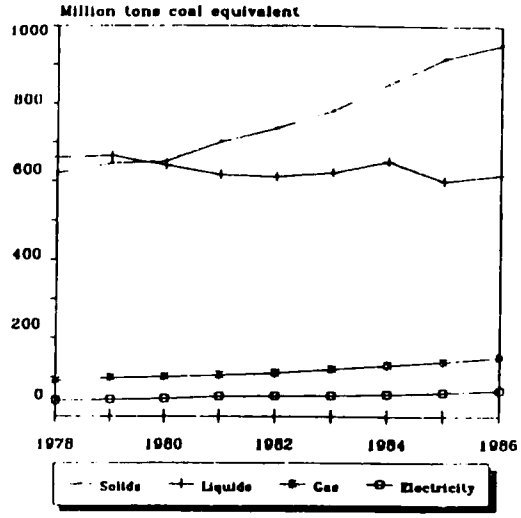
123. Major global problems which have serious implications for the Asian and Pacific region include (a) the greenhouse effect, (b) ozone depletion, and (c) loss of biodiversity.

The greenhouse effect

124. The earth's atmosphere can be regarded as a greenhouse. With certain gases, like carbon dioxide, chlorofluorocarbons (CFCs), methane, nitrous oxide and ozone, the atmosphere traps the heat from the sun, very much like glass in a typical greenhouse. At the same time, the earth loses heat to chilly outer space continuously. The net result of these mechanisms

/Figure XXII.

Figure XXII. Consumption pattern of commercial primary energy in the ESCAP region



Source: ESCAP, Regional Energy Policy and Planning Issues, 1989, reviewed at the fifteenth session of the Committee on Natural Resources and Energy, 9-13 October 1989, p. 10.

Figure XXIII. Simulated air pollution levels in selected cities of the ESCAP region

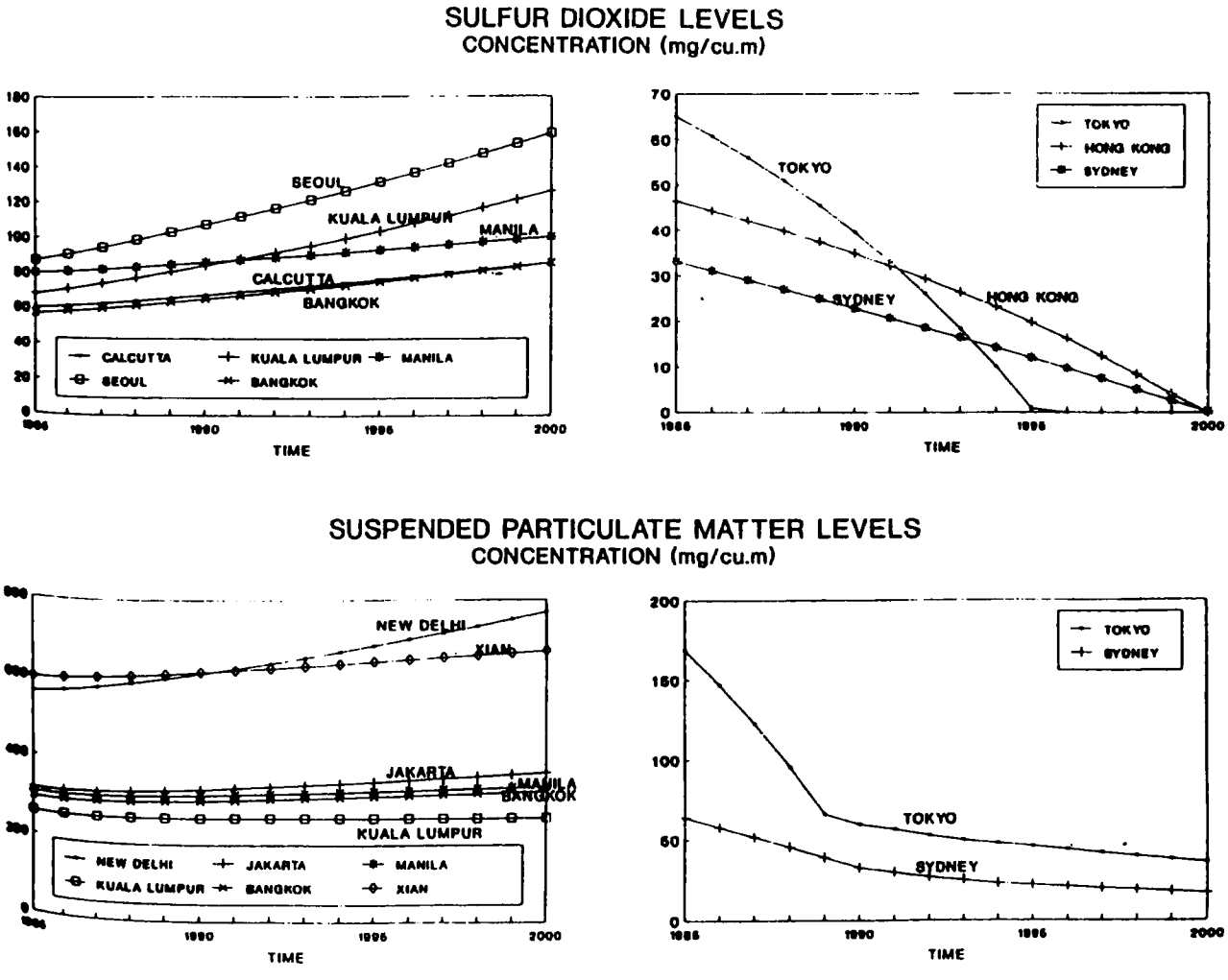


Figure XXIV. Simulated solid waste projections for selected countries of the ESCAP region

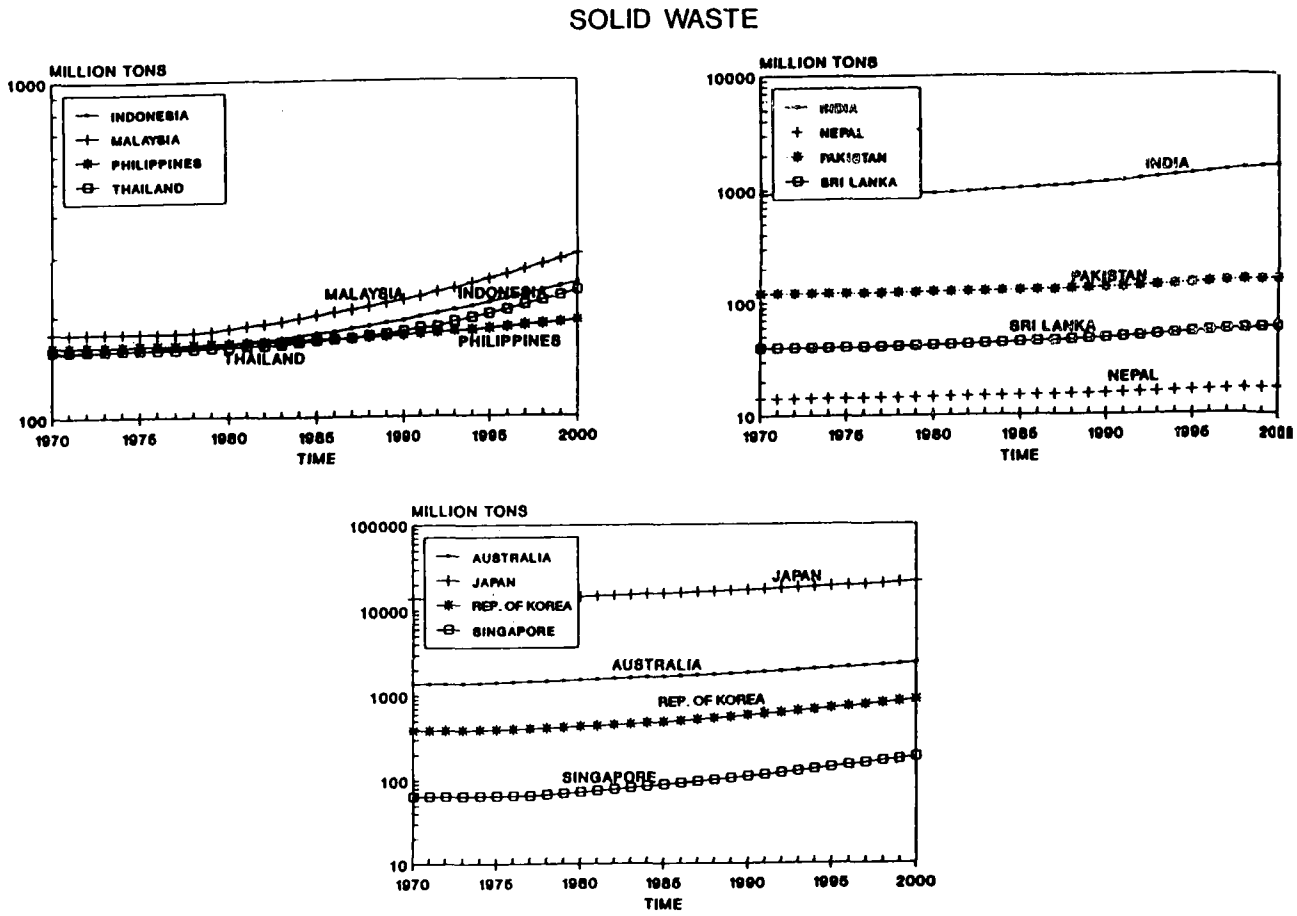
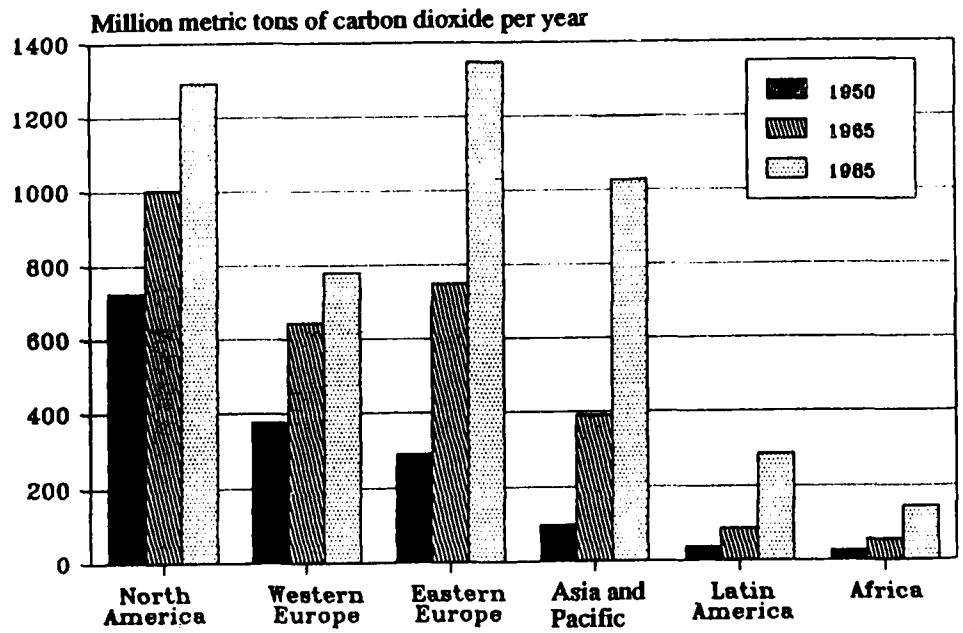


Figure XXV. Increased carbon dioxide contribution to greenhouse warming by ESCAP and other regions of the world

(Industrial emissions only)



Source: World Resources, 1988-89 (World Resources Institute, Washington, 1988), p. 336.

with mean annual temperatures greater than 20-25°C, the projected temperature increase may be slight. Yet locally (for example, in mountainous and in some northern areas) the relative temperature rise may have greater significance. More important may be the altered patterns of precipitation and the general increase of evapotranspiration because of elevated air temperatures. A dramatic change in net precipitation, for example, can affect greatly the success or failure of agricultural harvests, and river flow. Secondary impacts, such as storm frequency and severity, may be important, particularly in areas that are prone to typhoons (such as south China and the Philippines), cyclones (for example, Fiji and other Pacific islands) and resultant coastal flooding (such as Bangladesh).

130. Low-lying land, such as densely populated river deltas (for example, the Ganges, Irrawaddy, Mekong, Pearl and Yangtze) or coral atoll islands (for example, Maldives and many Pacific islands), may be flooded, particularly if natural defences are altered. For example, channelling or damming river flow may prevent deltas from keeping pace with local sea-level rise, thus leading to inundation. Similarly, coral reef growth could keep pace with the projected rate of sea-level rise for the next 40 years, but many Asian reefs are increasingly polluted or destroyed by siltation.

131. For many other coastal areas, increased salinization of ground water and the need to modify sewage outflows will require considerable anticipatory planning and effort, as well as curative planning. Low-lying urban centres will be particularly affected.

Ozone layer depletion

132. The stratospheric ozone layer acts as the sole umbrella that shields the earth from the most dangerous ultraviolet radiation, known to cause cancer and cataracts, and to depress the human immune system. Ozone and the gases that consume it, such as chlorofluorocarbons (CFCs) and halons, are also greenhouse gases. It is expected that human-induced changes in the atmospheric concentrations of these gases will contribute to a change in the global climate. In this respect, studies show that the alleviation of the greenhouse effect caused by the thinning of the ozone layer will be negligible compared with the damage done by the increased concentrations of CFCs and halons.

133. The implications of the depletion of the ozone layer are wide-ranging, damaging and costly. Human health, agriculture, synthetic materials and possibly fisheries are all expected to be negatively affected. It is

estimated that each 1 per cent drop in ozone will result in 4 to 6 per cent more cases of squamous and basal cell carcinoma. The data base is at present too small to make projections for the region. However, it appears that the greatest effect of ozone depletion will be in higher latitude countries.

Loss of biodiversity

134. Loss of biodiversity is another critical global problem. The existence of biodiversity is a symbol of ecological balance and serves humanity in a variety of ways. The utility of diverse species is increasing, not only as a source material, but also as a new genetic resource which can contribute to the improvement of breeds and to the development of biotechnology. Currently, half of the world's prescribed medicines have their origin in wildlife species, and the annual economic value of this industry is estimated to be $US 40 billion worldwide. The utilization of plant genes has increased agricultural productivity and enabled many ESCAP countries to meet the food needs of the burgeoning population. Only an infinitesimal number of the wildlife species found in nature have been utilized in the agricultural field, and many more useful species will be discovered as man learns more about the environment. Saving biological diversity is therefore a national, regional and international obligation.

135. The key areas of concern in the ESCAP region are the tropical forests where species diversity and endemism are usually high. The need for economic growth to alleviate poverty, the existence of unsustainable trades to pay for external debts, and habitat destruction due to urban expansion and the advance of agricultural frontiers are the main causes of the destruction of biological diversity, as well as of germ plasm resources of value to medicine and agriculture. Tropical forest species show a limited ability to adapt and survive in an altered habitat and they are thus especially vulnerable to habitat change.

C. Environmental challenges in the 1990s: A synthesis

The challenges

136. The most formidable challenge for the region in the present and coming decades is to halt environmental degradation and to embark on a regime of "green" industrialization and development based on national self-reliance and regional co-operation.

/137.

137. The critical requirements for the various ecosystems may be listed as:

(a) In land ecosystems, to rehabilitate degraded land, arrest further net deforestation and degradation of land quality while at the same time assuring food security, fuelwood supply and protecting the traditional rights of subsistence farmers and shifting cultivators;

(b) In inland waters, to meet the increasing demand for water and sanitation in the context of diminishing supplies and increasing threats to water quality;

(c) In marine and coastal ecosystems, to establish regional management regimes for the oceans and integrated national coastal zone management systems;

(d) In urban ecosystems, to break the vicious cycle of growth of primate and megacities and to create effective institutions to deal with the existing problems of urban shelter, sanitation, water and power supplies, public safety and pollution;

(e) In rural ecosystems, to increase the pace of rural development while at the same time preventing further deforestation, reducing the use of agrochemicals, discouraging the shift to fossil fuels and promoting renewable energy resources.

138. In terms of the regional implications of global problems and regional-global interaction for sustainable development, the crucial challenges to the region are the following:

(a) The formulation of a regional action programme to deal with threats of global climate change;

(b) The preservation of the heritage of genes, species, biological communities, habitats and ecosystems;

(c) The amelioration of aspects of international economic relationships that foster the overexploitation of natural resources in the developing countries, such as the deteriorating terms of trade, the financial burden of debt servicing and net outflow of financial resources;

(d) The assurance of food security for all countries in ways that are consistent with sustainable development;

(e) The assurance of energy security for all countries in ways that are consistent with sustainable development.

Underlying factors

139. The major environmental problems in developing countries of the ESCAP region are part of a vicious cycle of cause and effect. Cross-sectoral interaction is implicit in this system of cause and effect. For example, sectors as disparate as international trade and water development are linked. Thus, roundwood removal for export to pay debts may cause erosion and siltation of dams. There are similar linkages between political institutions and deforestation, between industry and agriculture and in general between environment and development. The policies for environmentally sound and sustainable development will involve the integration of environmental principles into the economy, including agriculture, industry, trade and technology.

140. Environmental impacts also migrate in scale. Some sources that are local could have a national, regional or global impact or vice versa (figure XXVI). Thus, the costs of amelioration also expand in scale. For example, a local air pollution problem resulting from burning fossil fuel could contribute to the greenhouse effect. As opposed to this, international indebtedness could force a country into removal of wood for export, promoting deforestation at the local level with all its adverse consequences. It is therefore important to pay special attention to the scale or level transfer mechanisms in policy formulation.

Policy imperatives

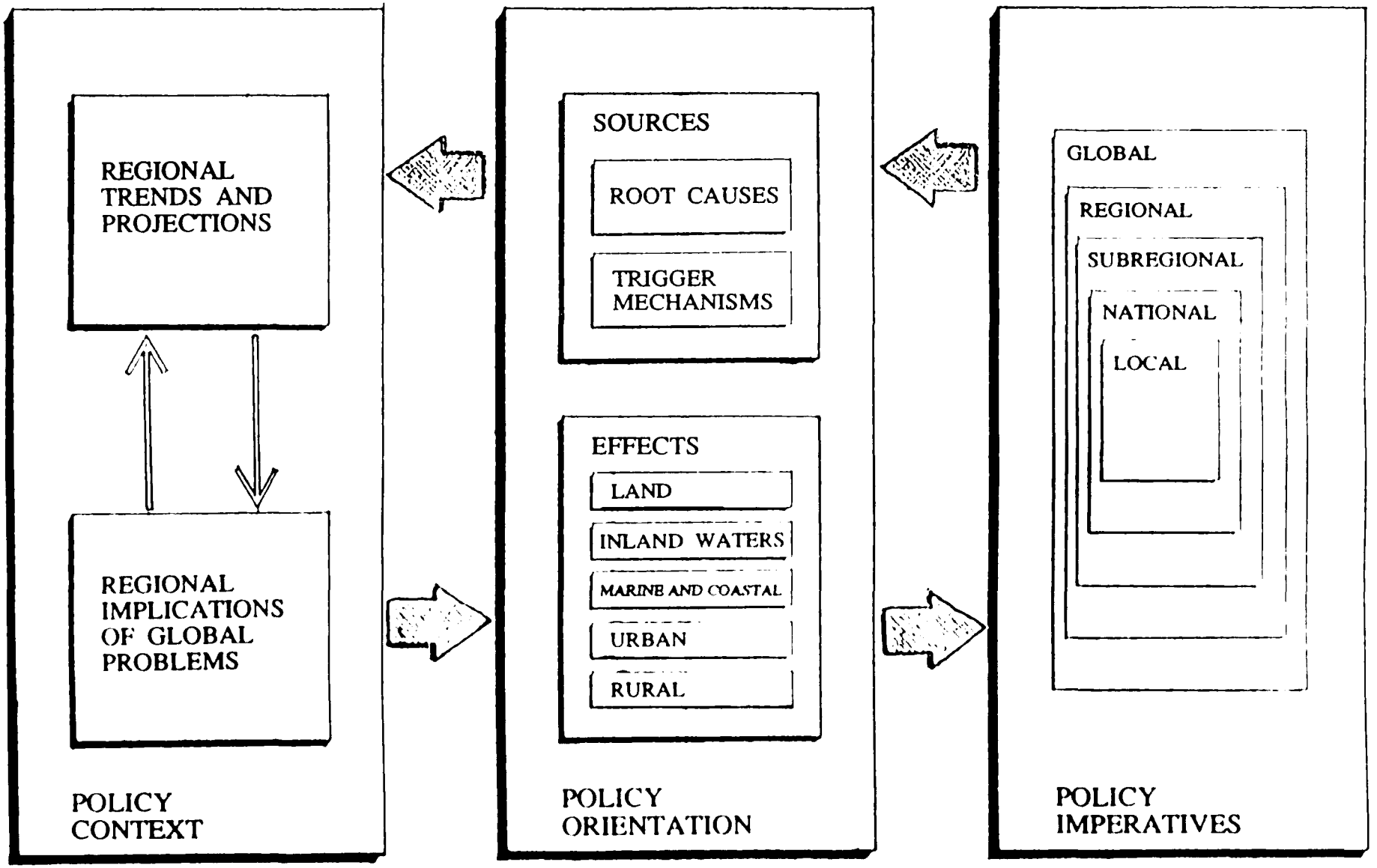
141. The strategy required to deal with environmental problems has two facets (a) source-oriented and (b) effect-oriented.

142. The source-oriented elements of environmental strategy involve long-term preventive measures including fundamental changes in policies by:

(a) Focusing on the root causes, of environmental degradation such as the lack of broad-based access to natural resources, unsustainable chemical-based agriculture, underpricing of natural resources, rapid population growth, rural poverty and unsustainable terms of trade and development assistance;

(b) Reforming environmental administration through strengthening institutions and legislation dealing with environmental protection and sustainable development, human resources development through establishing training networks, and the development and adoption of regional and global legal instruments;

/Figure XXVI.


REGIONAL TRENDS AND PROJECTIONS
REGIONAL IMPLICATIONS OF GLOBAL PROBLEMS
POLICY CONTEXT
SOURCES
ROOT CAUSES
TRIGGER MECHANISMS
EFFECTS
LAND
INLAND WATERS
MARINE AND COASTAL
URBAN
RURAL
POLICY ORIENTATION
GLOBAL
REGIONAL
SUBREGIONAL
NATIONAL
LOCAL
POLICY IMPERATIVES

(c) Promoting environmental awareness by developing communication packages on environmentally sound and sustainable development with the involvement of all forms of mass media and non-governmental organizations;

(d) Supporting appropriate environmental technologies, such as sustainable agricultural techniques, pollution control systems for small-scale and medium-scale industries, as well as clean processing technologies;

(e) Strengthening of environmental planning through the use of geographic information systems, the training of human resources for policy analysis, natural resources accounting and environmental impact assessment.

143. The effect-oriented or short-term curative measures will deal with the serious effects of unsustainable development through reforestation, the establishment of protected areas, rehabilitation of degraded ecosystems, integrated coastal zone management, urban renewal, cleaning of rivers, development of waste management systems, etc.

144. These tentative ideas on policy imperatives suggested by the state of the environment in the region are based on the analysis of the dominant causative factors. A comprehensive set of strategies and action programmes has to be formulated, following the guidelines contained in this synthesis, and implemented at the national, subregional and regional levels to meet the regional environmental challenges in the 1990s.

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